

## Urban Sustainability Programs: Case Studies

David J. Hess, editor

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## Amsterdam: The Cycling City

By Lauren Bolhack, Alycia Bouchard, Hannah Duckworth, Morgan Goddard, and Sarah Sams

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The city of Amsterdam is the capital of the Netherlands and has a population of over 820,000 people, making it the most populous city in the Netherlands. Industry in Amsterdam is mostly dominated by retail in the form of small shops and businesses, the booming red light district, and the tourism industry that affects many neighborhoods (iAmsterdam 2013a). The Amstel River divides the city and flows into its many canals, which are signature landmarks of the city. Current environmental issues include water pollution in the canals, acid rain, the transition to renewable energy sources for power generation, using more local and organic foods, and the greening of businesses and homes since Amsterdam is an old city (WWF 2012).

Many cities have formal sustainability plans laying out regulations and guidelines to put the city on a path to sustainability. Amsterdam has no formal plan; however, there are still many initiatives to make the city more sustainable across a range of sectors. Among the many initiatives, Amsterdam's use of bikes for transportation and creation of incredibly bike-friendly infrastructure is arguably the most outstanding.

This paper will analyze Amsterdam's various initiatives and plans for sustainability in more detail. First, we will review initiatives across a wide range of areas. Next, we will review the city's impressive efforts in greening transportation through the bicycle system. The conclusion will summarize and evaluate Amsterdam's effectiveness and discuss its potential portability of their programs to other cities.

### Sustainability Practices

Amsterdam is an international leader in sustainability and climate mitigation. The city does not exactly have a mitigation plan, but through networks of eco-friendly people, businesses, and public sectors it has a coordinated network of sustainability initiatives. Some of the strongest practices are in transportation, whereas green spaces are not as strongly emphasized. What Amsterdam lacks in some areas it makes up for in others, all the while continuing to develop as a green city focused on mitigating the effects of greenhouse gases.

With respect to green buildings, the Dutch Green Building Council developed a sustainability label called BREEAM-NL based on the English BREEAM methodology and similar to the LEED system in the U.S. (DGBC 2013). BREEAM-NL has nine categories of evaluation: management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, and pollution (DGBC 2013). Amsterdam has some models of sustainability in the building sector such as the Sportplaza and the Amsterdam Public Library (OBA). The latter is "constructed primarily using renewable materials" and has solar panels on the roof (iAmsterdam 2013b). For saving energy in existing buildings, the city council is going to launch a program that insulates the existing housing stock more efficiently and develops instruments to help homeowners' associations implement energy-saving measures. For new buildings, starting in 2015 all building projects in Amsterdam will be climate neutral, meaning "all energy such as

heating, cooling, water, and electricity should come from sources near the building without the use of fossil fuels” (iAmsterdam 2013b).

The city’s business sector also has developed initiatives related to sustainability. Throughout the city, a major focus for businesses is the triple-bottom line of economic, environmental, and social accounting. The city is addressing major business sectors such as the tourist industry. For example, Amsterdam has created a green hotel program in which hotels are labeled by a Green Key logo to indicate that they meet the “highest standards for sustainability” (iAmsterdam 2013c). As of 2013, forty-five percent of beds in Amsterdam have the label (Amsterdam 2013b). In addition, the city promotes sustainability through the Green Business Club, which is a local initiative that provides opportunities for learning and collaborating about sustainability for Amsterdam’s businesses. The club acts as a support for other facets of a sustainable society through the greening of buildings, the use of renewable energy sources, and the recycling and reuse of waste materials.

Green spaces not only provide environmental benefits to the city, but they also are great ways to engage the community. However, Amsterdam has few initiatives in this area in comparison with some other cities. This failure is likely due to a lack of necessity for the expansion of such spaces, because the city currently has over thirty green spaces (Amsterdam.info 2013b). Instead of making space for more green spaces, Amsterdam is focusing on protecting the existing green spaces from destruction as the city experiences an increase in urban development. Most of these spaces contain playgrounds and/or athletic facilities, which promote community involvement and interaction. One park in particular that succeeds in community engagement is Vondelpark, the largest park in Amsterdam and the host to an estimated ten million visitors each year (Amsterdam.info 2013b).

With respect to the transition to green energy, the city plans to cut forty percent of its carbon-dioxide emissions (from burning coal) by 2025 by pursuing three tracks simultaneously to establish a sustainable energy supply (Amsterdam City Council 2012). These three tracks will be energy savings in existing buildings, climate-neutral new-build, and sustainable electricity and sustainable heating and cooling (by means of thermal storage). The two initiatives for buildings are discussed above. For sustainable electricity, the state is working with the Sustainable Energy Production Stimulation Scheme, which will make the installation of wind turbines cost-effective. There are plans to expand and update the wind farms in north Amsterdam and to install many more solar panels by 2018. For sustainable heating and cooling, the city council is encouraging the use of district heating and cooling systems, which involves businesses and/or homes being connected to the same source. Also, Amsterdam is looking to switch from using geothermal storage for their cooling systems and using cold water from deep lakes around the city that can also be interlinked via collective networks (Amsterdam City Council 2012).

There are five main types of public transportation—the train, tram, the metro, buses and the ferry—which can take people to every district and neighborhood in the city. Amsterdam has convenient and straightforward ways to commute using the different types of transportation, making the use of public transportation much more desirable and quicker to the citizens of Amsterdam than owning their own private cars (iAmsterdam 2013h). Citizens who take public transportation can get discount cards that can be used on any form of public transportation in the city, which further incentivizes citizens to use public transportation.

In addition to encouraging people to use public transportation, Amsterdam has also made a giant push in the last decade for sustainable, electric vehicles. To encourage the transition to electric transport and to make it more attractive and convenient for residents to make the switch to electric vehicles, Amsterdam has started implementing electronic charging stations throughout the city. Electric transport cuts down significantly on carbon dioxide emissions and leaves a much smaller carbon footprint than traditional transportation. Amsterdam has plans to invest largely in the research and development of battery technology and electronic car assembly. The transition will create many new

economic opportunities to build up these emerging industries. The city government plans to have at least 10,000 electric cars on the streets by 2015. Although electric cars are currently more expensive than regular vehicles, their prices should decrease as the demand in the market increases. The main goal is to be completely shifted to electric transport by 2040. Windmills, solar panels, and biomass plants will power these electric vehicles. Even the canals, which are a mode of transportation around the city, will be filled with electric boats. The long-term goal is to make fossil fuels completely obsolete when traveling in the city (Amsterdam.nl 2009).

Another greening action Amsterdam has taken is to make Schiphol International Airport the world's first "bioport" by 2017. Sky NRG and KLM, both leaders of the Dutch airline industry, have taken great measures to invest in research of aviation biofuels. The longest commercial flight to run on biofuels, using a fuel similar to cooking oil, occurred in June, 2012, from Schiphol to Rio de Janeiro (iAmsterdam 2012d). Schiphol has also implemented an electronic taxi service, which builds on the electronic transportation goals, as a luxury service for workers on business trips who need to cover a smaller distance within a 100 mile radius of Amsterdam (iAmsterdam 2012e).

With respect to food, the city is very dense and confined, which is great when it comes to transportation, but urban farming is also more difficult to support. Urban farming also struggles with funding and community support. In order to overcome these issues, projects must have political support, be economically sustainable, or both. Some community gardens have garnered support through education and community-enrichment, and there are other projects to ensure that Amsterdam has access to local, sustainable food. The first food market was established in the city in 1783, and today there are twelve outdoor markets, open daily, and several others that are open one to two days a week (Amsterdam.info 2013a). There are also networks of people who commit to buying locally in order to promote agriculture in the city, like VersVoko (Farming the City 2013). The city is also home to farm-to-cafeteria projects and food co-ops. Amsterdam currently has existing urban agriculture and it is expanding as it gathers community and political support.

Because Amsterdam has little room for landfills, all urban waste is sent directly to Amsterdam's Waste and Energy Company (AEB), which contains one of the world's most efficient incinerators. AEB has excellent environmental qualifications and is also a leader in turning waste into products and energy. "The waste-fired power plant has an electrical efficiency of 30%, 8% higher than the average waste-to-energy plant...The AEB can produce sustainable energy because 48% of the waste consists of biomass. Energy released from biomass qualifies for CO2 neutral certification" (iAmsterdam 2013f). Approximately 1.4 million tons of waste are brought to the AEB each year, which is the equivalent of 600 trucks and 1 freight train each day. The AEB has become a model for municipalities because it is a more practical and sustainable way to dealing with waste than destroying habitats to create more landfills. In addition, the AEB also promotes recycling by turning bottom ash, or the waste that is not incinerated, into a new product. Currently, bottom ash from the AEB is used to produce artificial sand and granulates, but the company hopes to develop new ways to convert bottom ash into higher quality materials (Afval Energie Bedrijf 2013).

Auto Recycling Netherlands (ARN) is the largest car recycling facility in the Netherlands (iAmsterdam 2013g). This recycling company is currently responsible for recycling at least 85% of the vehicle weight; however, by 2015 this standard will be raised to 95% under the laws of the European End-of-Life Vehicle Directive (ARN 2013). In addition, Amsterdam has smaller scale goals to improve the recycling of packaging materials, as well as to encourage responsible recycling of "scrapped products within the municipal organisation" (Sustainability Programme 2011).

In summary, Amsterdam is currently a leader in sustainability across a wide range of areas and has many initiatives to improve those areas that are lacking. While being weaker in green spaces, Amsterdam has strong programs when it comes to recycling, electric vehicles, and green buildings.

### Best Practice: Bicycling

Amsterdam is a world leader in “bicycle-friendly” (iAmsterdam 2013c) cities and has earned the nickname “Bike City.” With over 400 kilometers of cycling pathways that circulate throughout the city, biking is viewed as the superior mode of transportation to many citizens of the city (iAmsterdam 2013a). Pete Jordan, author of *In the City of Bikes: The Story of the Amsterdam Cyclist*, explains that to the Dutch “bicycles were as natural as air or water,” because they have become such a staple in the culture in Amsterdam (Tobar 2013). Cycling’s popularity began in the 1970s after an automobile-oriented period during the middle decades of the twentieth century (BBC 2013). Before World War II, biking was a primary mode of transportation, but after the war the city used the destruction of bike paths as the basis of a rebuilding program that focused on expanding roadways. This expansion was continued in the subsequent years, nearly eliminating biking from the city (Goodyear 2012). However, the increase in automobiles led to an increase in car-related deaths, which outraged citizens (BBC 2013). In 1971, “more than 3,000 people were killed by motor vehicles, 450 of them children” (BBC 2013). The movement Stop de Kindermoord gained momentum and encouraged a focus on the improvement of cycling, rather than car, infrastructure (BBC 2013). The Middle East oil crisis of 1973 also helped to spur the transition. These developments led to an infrastructure overhaul in order to expand bike paths and limit roadways. Today, children are familiar with bikes at a very young age in Amsterdam, as many babies travel in seats on “bakfiets” or cargo bikes (BBC 2013). Additionally, cycling proficiency lessons are “a compulsory part of the Dutch school curriculum” (BBC 2013). Youth cannot drive until the age of 18, making biking an appealing option (ibid.).

Bicycling is particularly popular in Amsterdam due to the city's relatively small size, dense population, and flat terrain. However, the city's street designs also play a large role in the attractiveness of biking in Amsterdam. Historically, the streets in Amsterdam's city center were built before the era of automobiles, and consequently they are narrow, winding, and not very welcoming for cars (iAmsterdam 2013a). There are several additional factors that keep automobiles out of Amsterdam: freeways and highways do not protrude into or through city limits; many streets in the city are closed off to cars; and the streets that are car-tolerant are one-way, which complicates navigation throughout the city. Furthermore, the city has implemented numerous signs and traffic lights to provide safety and order to the four hundred kilometers of cycling pathways (iAmsterdam 2013a). Together these factors yield one of the world's leading bicycle transportation system.

Amsterdam has made many architectural changes in order to accommodate the overwhelming number of bikes in the city. Some of these changes involve the addition of easy-to-use bike racks throughout the city as well as the construction of multi-story bicycle parking lots. One in particular, which is located next to Amsterdam Central Station, is a three-story bicycle parking lot that can hold up to 2,500 bicycles (Wikimapia 2011). In addition, the city streets are bicycle-friendly with bike lanes wide enough for two cyclists to bike comfortably side-by-side (Christine 2010). The wide lanes also make bicycling safer by providing a buffer from automotive traffic. Because of the large amount of bike lanes, there is not a lot of cross-traffic between bikes and vehicles, increasing the safety of the bikers.

Currently, there are more bikes than people in the city, and the transition to heavy bicycle use has generated new problems. With the average citizen owning 1.5 bikes, one could argue there is too much biking (Peach 2011). Consequently, bike racks are frequently overcrowded, especially when roughly 60% of the bikes on bike racks have been abandoned (Peach 2011). While bicycling leads to fewer carbon emissions and an overall healthier lifestyle for the population of the city, this becomes impractical when the roads are impassible and bike racks are unavailable due to overcrowding. This also creates a visual pollution issue. With the overwhelming amount of bikes, the beauty of the city could possibly be hidden behind racks and racks of bicycles. To combat this issue, Amsterdam is trying to raise awareness for the unused bicycles through art installations and promotion of the recycling and disposal

of bikes once they are beyond repair (Peach 2011). While Amsterdam serves as a model of biking, it also provides some insight into the potential problems of a widespread bicycling system.

Because of the compact structure of the city, there are not many parking spaces available, so having a bike is more convenient than having a car for most people (Peach 2011). There are only an estimated 80,000 parking spots available in the city, most of which are in parking garages or street parking paid for by meters (iAmsterdam 2013a). To regulate the use of the limited number of parking spots in the city, the Cition, which is under the jurisdiction of the city government, enforces the strict compliance of parking violation rules (iAmsterdam 2013a). The Cition frequently gives tickets for insufficient funds at parking meters and tows cars for keeping a car parked in the spot when the meter has run out. More often than not, these violations of the parking rules are a result of tourists visiting Amsterdam (iAmsterdam 2013a). Another big disadvantage of owning a car in the city is that the expenses involved in owning a car are much greater than the expenses involved in owning a bicycle.

In summary, Amsterdam provides a model of an automobile-oriented city that has made a substantial transition toward heavy reliance on bicycling. Amsterdam's unique topography and historical architecture create "the perfect storm" for a transition from cars to bicycles, and the city certainly warrants praise for this green and sustainable initiative. The changes have brought, however, their own problems, such as lack of capacity for bike racks and lack of opportunities for automobile parking. Thus, the city provides an interesting experience for other cities that are contemplating an increase in bicycling as part of their sustainability initiatives.

## Conclusion

Amsterdam is famous for its focus on biking practices and its commitment to sustainability. Although the city's best practice is quite obviously its emphasis and promotion of biking, the city excels in its other sustainability practices as well. As discussed earlier in the paper, each core area of sustainability is addressed in varying degrees. Amsterdam is especially strong in the areas of waste management, green buildings, and transportation. The areas that are less prevalent are all being improved and are still advanced compared with many cities throughout the world.

Amsterdam's best practice, its elaborate biking system, has several positive implications. In addition to promoting a healthier lifestyle, the ubiquitous bike system also helps diminish the distinction between classes while reducing the city's carbon footprint. However, this system is not without drawbacks. Not only is Amsterdam trying to manage the overwhelming amount of bikes in the city and the deficiency of the bike racks and bike storage areas, but the city is also combatting a spike in bike theft. Although few in number, these weaknesses can interfere with the overall effectiveness of Amsterdam's biking system.

The best practice of biking in Amsterdam is a portable practice for the most part. Every city already has lanes for automobiles, so adding bike lanes would be easy for most cities. Adding bike racks is also easy and inexpensive. However, the development of bike lanes would be harder to implement in dense cities because the expansion of roads to allow for bike lanes would be very difficult if the city is already developed. Furthermore, Amsterdam's cool climate, flat terrain, and relatively high density make it ideal for bicycling. In cities with harsher climates, uneven terrain, and low density, bicycling is less likely to be as effective. But overall, it would be easy to implement bike lanes and bike racks in most cities and would prove a very portable practice.

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## Barcelona's Sustainability Plan and Solar Programs

By Timour Kamran

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Barcelona is one of the largest cities in the European Union and the capital of Catalonia. Located on the coast of the Mediterranean Sea, it has a population of about 1.6 million, making it the sixth most populous city in the European Union.<sup>1</sup> Despite the sheer number of people within the administrative limits of the urban area, Barcelona still manages to have a strong sustainability program and one of the lowest levels of CO<sub>2</sub> emissions per capita in the world. As the city council's Agenda 21 program states, "Fostering a compact, dense, and complex urban structure is key in achieving such low emissions."<sup>2</sup> This same dense urban structure makes for strong programs in many sustainability initiatives. In addition, the city's strong Catalan identity and culture create an atmosphere in which a combination of competitive feelings towards a greening Europe and a willing populace ensure environmental concerns are taken seriously and acted upon accordingly by the city government.

The city's plan for sustainable energy, the *Plan for Energy Improvement in Barcelona*, or PMEB, is clear and provides for a solid blueprint for how to move forward with green initiatives. The PMEB was only intended for the years 2002-2010, but its initiatives and vision are still relevant to the city today. The city's innovative programs and clear, accessible plan make it a portable model for other cities to follow. Barcelona's plan for sustainability is strong and portable, except in the areas of social justice and public health; moreover, the city council's thermal solar initiatives are notable enough to serve as a model for other cities. In this report, I will address the City Council's plan for sustainability; following this will be a discussion of the city's best practice, its solar thermal energy program and the city's Solar Thermal Ordinance.

### Barcelona's Sustainability Plan

The PMEB names transportation as an important component of the city's overall sustainability plan. A focus on human-powered transportation sets the tone for both the plan and the programs that grew out of it. This focus makes sense because of the density and flat geography of many of the popular districts within the city. The city council also details plans to improve the efficiency of traffic control and its municipal fleet and to promote car sharing among its residents. A significant part of the city council's implementation of these goals has to do with public relations. The PMEB summary states that "the project places particular importance on public awareness campaigns" of its transportation initiative concerning the promotion of hybrid vehicles; similar language is used concerning the rest of the plan as well. Implementation of the PMEB in the field of transportation has been successful and could easily be modeled by other city governments attempting to soften the environmental impact of the urban residents' commute.<sup>3</sup>

Barcelona's transportation department promotes the use of bicycles among both residents and tourists visiting the city. One way in which residents can take advantage of the many bike-friendly aspects of the city is through a municipal bicycle rental system called *Bicing*. Users of *Bicing* pay a thirty-euro annual fee that entitles them to use of any of the 418 rental stations located around the city. The first thirty minutes – adequate time to reach any point in the city – are free. After that intended time limit expires, the user is charged a penalty fee for every hour the bicycle is not returned.<sup>4</sup> This service makes transportation around the city quick, cheap, and sustainable. In 2009, only four years after the

inception of *Bicing*, there were 190,000 subscribers to the program.<sup>2</sup> The city is able to make the program affordable because of an impressive dedication to sustainable transportation; 100% of the surplus from fees collected from on-street parking is used to finance *Bicing*.<sup>5</sup> These statistics are a testament to the practicality and affordability of the system for users, and also of the city's dedication to sustainable transportation.

The city has also implemented measures that are intended to make commuting by bicycle safer. In 2009 the city had 156 kilometers of one and two-way bike lanes ranging from 1.5 to 2.2 meters in width, with plans to expand to 200 km. The bikes are protected from car lanes by rubber speed bump-like strips, and all areas in which bike and car lanes intersect are painted red in order to remind drivers to be cautious.<sup>6</sup> These safety measures, combined with the promotion of cycling as a form of transport on the city's web site and through ad campaigns, combine to make cycling a strong element of Barcelona's sustainability program.

Pedestrian transportation is the other form of human-powered transportation promoted by the PMEB.<sup>3</sup> One case study on Barcelona's parking program states that for the last decade (about the same time frame of the PMEB), Barcelona has been removing parking in order to make way for more pedestrian streets. Many districts in the city, such as the historic city center, have been made completely off-limits to motorized vehicles.<sup>5</sup> Famous areas such as Las Ramblas have also been made pedestrian only. In addition to this, the traffic model mentioned previously has been used to manage traffic in such a way that pedestrians have an easier time walking around the city – for example, the “walk” signs at intersections have been lengthened.<sup>7</sup> In addition to this, the city is in the midst of a strong advertising program with which it hopes to improve and maintain public support for pedestrian initiatives. This is detailed in the PMEB, and is typical of a Barcelona sustainability program.<sup>3</sup>

In addition to the promotion of cycling and pedestrian transportation, the PMEB also describes plans to use the computer simulation of the traffic in the city to measure the environmental impact and efficiency of traffic regulation in the city with regards to vehicular transportation. The council goes on to state that the information from this model will be used to coordinate variables such as traffic signals in order to maximize the sustainability of motorized traffic in the city. It seems, however, from the rest of the plan that making private transportation sustainable is not as important to the city council as cutting back on the amount of cars on the road. The focus on reducing vehicles makes sense considering Barcelona's problems with congestion, which are only natural in a city as dense as it is.<sup>8</sup>

The city council is also interested in improving the efficiency of its own municipal fleet of vehicles and that of the private vehicles in the city as well according to its stated goals in the PMEB. The web site states that vehicles such as street cleaners and garbage trucks are powered by more environmentally friendly energy. The “Innovation” section of the city's web site tells of a program called “LIVE,” or the “Logistics for Implementation of the Electric Vehicle.” This program assessed what was necessary to increase the number of hybrid or electric vehicles on the streets of the city, with regards to both private and municipal transportation. Another way the sustainability of private transportation is being improved is through the city's car-sharing program. The transportation section of the city's website promotes car sharing and states the benefits of the program. These initiatives show that Barcelona, while invested heavily in human-powered transportation, has not necessarily left motorized vehicles behind.<sup>1</sup>

Barcelona's energy renewability and conservation is its strongest practice, and within this program, its Solar Thermal Ordinance is arguably the strongest part. The first important part of the city council's plan for energy conservation is its strong retrofit program. The PMEB lists several forms of retrofitting that the city could subsidize and states that any of these plans could be made material with laws or regulations. It recommends sealing window frames and glazing windows in order to improve heat insulation and draft proof homes. In addition, the council states that insulation in existing buildings must be improved, and new building standards regarding insulation must be made in order to reduce

the amount of energy spent on maintaining the temperature of buildings.<sup>3</sup> According to one U.S. Department of Energy's booklet, insulation has been proven to be one of the most effective forms of reducing energy use, so this initiative is one that should have a great deal of impact on the sustainability of buildings in the city.<sup>9</sup> The PMEB goes on to recommend such energy-saving techniques as replacing old, inefficient incandescent bulbs with fluorescent ones and promoting what the city calls "rational energy use," which seems to be such easy tactics as switching the lights off when one leaves a room. As usual for Barcelona, these initiatives are accompanied by a corresponding ad campaign. The council states the public awareness campaign should "make the general public aware of the benefits arising" from these energy saving techniques.<sup>3</sup> Finally with regards to home retrofits, the city council planned to review energy standards in new and refurbished dwellings in order to find criteria for new bylaws that could improve energy savings even further.<sup>3</sup>

Another way in which energy use is being improved in Barcelona is through the sustainable production of energy. This is accomplished chiefly through photovoltaic solar, thermal solar, and the use of biogas produced from compost. Thermal solar and the Solar Thermal Ordinance will be discussed later in the "best practice" section of this report, so PV solar and biogas will be discussed in this section.

The city of Barcelona has several solar structures within the city limits, and many buildings have PV solar panels on them as well. One structure that blurs the line between functional sustainability and art is the *Pergola Solar del Forum* in the Forum 2004 district of Barcelona. With a surface area of 10,500 m<sup>2</sup>, it is the largest such structure in Europe. It produces energy for the public sector in the city, and reduces the city's yearly carbon emissions by 440 tons as a result.<sup>10</sup> This combination of art and function serves to demonstrate the approach Barcelona takes to sustainability, which is one of cultural significance and pride as opposed to only seeing the greening of the city as a way to garner some publicity and increase tourism. The city also has plans to further increase the amount of PV solar used in the city; buildings with over 3,500 square meters of floor space are required to get 10% of their energy from solar power. In addition, the city plans to build even more solar structures within the Forum 2004 district. Some of these, such as the second pergola on top of the sailing school, have already been completed and are supplying a considerable amount of power to the surrounding city.<sup>11</sup>

Urban Development is another strong element of Barcelona's sustainability program. The 22@ and Forum 2004 districts of the city are excellent examples of the sort of urban renewal the city of Barcelona is interested in. The 22@ district is a former historic cotton district and was renovated into a "knowledge center." According to [sustainablecitiescollective.com](http://sustainablecitiescollective.com), "The innovation district already had 114,000 m<sup>2</sup> of new green space and 7,000 companies, businesses and shops, half of which moved to the district after 2000." The same district has increased its residency by 23% and now has 90,000 people working in it. The 22@ district is focused on creating a living and working space in which international business – a large part of the overall business scene in Barcelona – can participate locally and add to the community with contributions to both the energy and social sides of the city.<sup>13</sup> The difference between the ghost town that the area used to be and the progressive urban mecca that it has become is vast.

The other case of urban renewal in the city is that of the Forum 2004 district, located on the coastline of the city. The district is recognized for two reasons: a symbol of Barcelona's sustainable intentions and also a real-life model of those ideals. The pergolas mentioned in the renewable energy section of this report are both located in the Forum 2004 district. In addition to the production of clean energy, the area is also a model for energy conservation. It makes use of a central thermal system powered by the steam generated in the nearby Sant Adrià waste treatment plant. This thermal system reduces the amount of energy needed in the area by 32%, which is the equivalent of 1,850 tons of oil per year.<sup>11</sup> These urban development programs, while not as strong as those of the 22@ district, are still symbolically and statistically strong and represent Barcelona's desire to be among those cities in the top tier of sustainability.

The final element of Barcelona's sustainability program is waste management. As mentioned earlier, the city has built two Ecoparks that process a large portion of the city's waste. The Ecoparc de Barcelona has the mission of making "use of organic and undifferentiated waste," for composting and conversion into fuel.<sup>14</sup> Another way in which the city is moving the social and scientific sides of waste management forward is the installation of new selective recycling bins on the streets of Barcelona. These bins are more advanced and also more numerous than the previous ones, which serves to promote their goal of increasing the percentage of waste that is actually recycled. The storage area of these bins are also oftentimes located underground, which has myriad of benefits such as odor reduction, a less obtrusive design, and a larger capacity that leads to less emissions because of less trips made by garbage trucks. The new bins also address a justice issue, as they are much easier for handicapped people to open than the old ones were; this accessibility also makes it easier to empty the bins.<sup>1</sup>

Another form of waste management mentioned in the PMEB is biogas, which can be produced from organic waste compost. This compost is processed by the city's municipal waste services, which have sustainable merits of its own. For example in 2001, the Ecoparks built by the city began to process a significant percentage of Barcelona's total waste. Of this waste, 40% is turned into either biogas or compost. This biogas goes on the power many municipal and public transportation vehicles, performing multiple purposes in the process. By processing the waste that was going to be landfilled, it is being saved from being dumped and left to rot. In addition, it reduces the amount of fuel that would be needed by the municipal fleet thus reducing the demand for petroleum-based fuels.<sup>12</sup>

The weaknesses of Barcelona's plan lie in its omission of the remedying of social justice and public health issues that face the city. There is little mention, if any, of either in the PMEB. Most of the food growing operations in the city, which could possibly remedy food shortages in low-income areas, are guerilla gardens. That is to say, there are some community gardens, such as Can Masdeu (a famous *pirata* garden, or pirate garden); however, there is little endorsed by the city besides a few rooftop gardens that could never supply enough food to feed a significant portion of the low-income population of the city.<sup>15</sup> Public health, another important issue in most cities, is overlooked in the PMEB as well. The addition of more programs in these fields would certainly benefit Barcelona's population. It would also make Barcelona not only one of the greenest but also one of the most just cities in the world.

#### Best Practice: Solar Thermal Energy

The "best practice" of Barcelona is undoubtedly its thermal solar program. It is the capstone of the entire PMEB and the strongest energy program put forward by the city. One case study of Barcelona's sustainability initiatives states, "The Solar Thermal Ordinance of Barcelona is the legal instrument that has transformed the city into a solar energy mega power."<sup>16</sup> This initiative was made law by the city's *Solar Thermal Ordinance*. The law itself demonstrates a great deal of commitment to sustainability; it requires businesses to use "the best technology available" to produce 60% of energy used to heat water in buildings and building complexes that require more than 292 mega joules of power to do so per year. The ordinance also requires that all buildings built before the enactment of the law that are undergoing major remodeling or retrofitting must comply with the law.<sup>17</sup> In addition to this, the law is only getting stronger; in fact, the city council is currently in the process of revising the plan in order to lower the threshold of application and increase the amount of buildings that would fall under the OST. The city council formed the Barcelona Solar Energy Bureau in order to monitor this law and rewrite it based on their findings.

Barcelona's location and weather patterns also make the OST an extremely strong program. The average January temperature is fifty degrees, and the average July temperature is 78 degrees. This mild weather makes for a city that does not need a great deal of energy to change the temperature of their homes. These conditions make up for Barcelona's decidedly average amount of sunlight (2,800 hours

per year). The fact that the program is as successful as it is with so little sunlight suggests that if put into place in a sunnier city – such as many of the western desert cities in the US – the success of solar thermal energy could be tremendous. The program’s portability is a central aspect of why it is a “best practice” among all of the other initiatives in the city.

Unsurprisingly, another component of the OST’s success is the awareness campaigns run throughout the city.<sup>16</sup> The web site of the Barcelona Solar Energy Bureau states that the Solar Energy Agency has published a solar energy guide using layman’s language and graphics in order to keep the public informed on the goings-on of the OST.<sup>11</sup> In addition to this, children in Barcelona are educated at a young age about why solar energy and sustainability is important. By doing so, the city prepares a generation of young people that are already ready to deal with the challenges that the program will face in the future. In addition to this academic perspective given to the children, there are demonstration projects at work in which schools are outfitted with thermal solar panels, giving children a first-hand look at clean energy.<sup>16</sup> More of these demonstration projects include the solar thermal projects on sports stadiums and Olympic swimming pools in the city.<sup>2</sup>

In 2007, Barcelona won the “MagagEnergy Local Action Award” for its efforts in sustainability, especially solar thermal. According to the committee that gave out the award, the city had installed a total of 14,018 square meters of solar panels by 2007. The city had also saved 11,222-megawatt hours per year and reduced carbon dioxide emissions by 1,973 tons per year. These figures are impressive and testify to the fact that solar thermal and the OST are Barcelona’s best practices.<sup>18</sup>

Barcelona’s sustainability initiatives are stronger than its official plan first suggests. As an individual program, thermal solar program is arguably its best practice; however, new developments in photovoltaic solar panels may soon make thermal solar panels obsolete. If Barcelona’s thermal solar program is not phased into a PV-centered system, some of the city’s other notable green practices may need to be perfected in order to maintain Barcelona’s status as one of the top-tier sustainable cities in the world.

## Conclusion

An important strength of Barcelona’s sustainability is the multitude of above-average (as opposed to one strong and few if any weak to moderate strength) programs. Transportation, renewable energy, urban development, and waste management are all at a point where more focus from the city government could make them candidates to be a “best practice.” As it stands, however, Barcelona is a city with an above-average sustainability program that has a few omissions.

The city’s weaknesses lie mostly in the field of justice and health, along with the attainability of the goals set forth by the council. There is little mention of any social justice goals in the PEIB, and the city’s various web sites and publications that deal with sustainability do not do much more. In addition to this, some visions given to the public by the city government – especially from those in more politically competitive positions such as mayor – are extravagant and unlikely. Various programs have faults, but these are the only two areas with a serious lack of focus. For the city to move into the elite group of cities that are inspiring further innovation in the field of sustainability, the government must revamp their outdated plan from 2002 to deal with the present day’s problems, address health and justice issues, and learn to balance what is reasonable in the short term with what is possible in the long.

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Berkeley, California:  
Sustainability and Transportation in America's Greenest College Town

By Ryan Zauk

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As one of the greenest and most liberal cities in the United States, Berkeley has a multitude of green initiatives to make this college town as sustainable as possible and serve as a role model for American cities. A small city of 112,000 residents in Alameda County, Berkeley is home to the University of California-Berkeley, which brings jobs, capital, research and development, and fresh ideas and people to the area. Most of Berkeley lies on a rolling plain that rises from sea level to the base of the Berkeley hills. From there, the land rises dramatically and goes into the Berkeley mountains. Berkeley has a Mediterranean climate with dry summers and wet winters. The green initiatives of the town are spearheaded and run mostly by the green-minded students of the university who pursue many degrees in environmental science, sustainable chemistry, and sustainability practice. The town's liberal politics (one of the most progressive in the nation) blossomed in the 1960's, as the city and university became a hotbed for anti-war protests and environmental activity. This wide breadth of movements shaped the town and attracted many of the progressive thinkers that inhabit the city today.

Berkeley has become quite sustainable through a variety of methods in the past half-century. The city has made great strides in areas such as transportation, local finance, sustainable food and building efficiency, along with the changeover to more renewable resources. Its strongest practice is sustainable pedestrian transportation, including a wide array of bicycle initiatives across the city. The city has adopted many ideals from the "new urbanism" movement and radically redesigned the city to fit a more sustainable lifestyle. These initiatives are put into action by the local government and citizens of all ages, along with the dedicated students of UC-Berkeley. There are numerous student organizations on campus dedicated to various areas of sustainability both on and off campus that bring both fresh ideas and manpower to the green movement.

This paper will delve into the various initiatives and plans that Berkeley utilizes to remain as sustainable as possible. The following section will outline the city's specific plans, goals, and methods for its various green plans in detail. After the analysis of the plans, I will discuss Berkeley's "best practice" out of all of their initiatives, which is bicycle and pedestrian transportation. A thorough analysis of the strengths, weaknesses, and effectiveness of Berkeley's designs will be provided and the paper will conclude with an overview of Berkeley how other college towns can model themselves after Berkeley.

#### An Overview of the City's Initiatives

The city of Berkeley has a single, comprehensive climate plan, "The Climate Action Plan," under which all major sustainability initiatives are gathered. The Climate Action Plan is divided into five main areas: Sustainable Transportation and Land Use, Building Energy Use, Waste Reduction and Recycling, Community Outreach and Empowerment, and Adapting to a Changing Climate. Although some areas of sustainability initiatives are unaccounted for in Berkeley's plan, such as local finance for green businesses and sustainable food practices, there are projects run by both private businesses and U.C. Berkeley for food, finance, and other areas. ("Berkeley Climate Action Plan," 2011). Through the combination of "The Climate Action Plan" and the various public and private initiatives, Berkeley has developed strong sustainable initiatives in transportation, recycling and reuse centers, finance, building

and energy efficiency, and food, and the city has become a nationwide leader and role model for green cities. The following section will describe the various projects that make the city so sustainable, beginning with its largest initiative, transportation.

One of Berkeley's strongest modifications to the city is the emphasis on creating a more sustainable and efficient transportation system in urban planning, which is run by the "Sustainable Transportation and Land Use" section of the Climate Action Plan (City of Berkeley 2012). To understand Berkeley, one must begin with its first and largest initiative, bicycle transportation. Berkeley began by adopting strategies from new urbanism, such as a more localized and easily accessible town that does not require automobile use. The town constructed wider sidewalks on main streets along with a large bicycle lane on every street that is easily accessible. Berkeley then cracked down on safety, lowering speed limits and placing vigilant police on street corners to monitor safe transportation so that citizens would be encouraged to use bicycles. Building upon infrastructure, Berkeley created its unique "bicycle boulevards," bicycle-only streets that take riders to major locations throughout the city such as malls, schools, and town centers. The boulevards now cross the city and facilitate the safe use of bicycling throughout the city ("What is a bicycle boulevard?" 2011). There are bicycle stands on many corners for riders to safely leave their bikes without fear of theft. To make sure these initiatives last, the town has begun bicycle education in both public and private schools, preaching bicycle usage and safety to all children throughout Berkeley. The radical changes in personal transportation have led Berkeley to be dubbed the "safest place to bike and ride in California" ("Bicycle and Pedestrian Safety in Berkeley," 2011).

Another leading transportation initiative for Berkeley has been the change to its public transportation through bus-rapid transit and the BART (Bay Area Rapid Transit), along with car sharing. The bus system in Berkeley is run by the Alameda Contra Costa Transit System, which shares a fleet of 689 energy efficient buses with nearby areas. The bus fleet consists of CNG and electric powered buses, along with zero-emission buses. The vehicles work on a very efficient system complete with bus lanes and traffic monitoring so that idling, a huge cause of pollution, is stifled. The rail system for the city, the BART, is rather similar to the bus system. The BART uses energy efficient trains, some solar powered, to transport passengers efficiently and without burning fossil fuels. The trains also include bicycle racks on each car so that passengers riding bicycles can bring them along to ride. This combination of buses, bicycles, and the BART renders automobile transportation almost unnecessary ("BART," 2011). However, those interested in automobiles can still use the "car-sharing" program. This program places "pods," or hubs of cars, in certain areas of the town where people can use energy-efficient automobiles for a period of time and then simply drop it off at any other pod in the city after completion. The city has a large Zip-car infrastructure as well, and a city car share system in which families can share a car with another family. This system makes certain that car usage is limited to necessity only, making the city more sustainable ("Car Sharing," 2010). The aforementioned transportation renovations have greatly changed the way Berkeley functions as a city, and is the principal reason that they are one of the most sustainable cities in America.

Moving away from transportation, Berkeley has initiatives in the financial area for green efforts as well as building and energy reform, which will be covered in this section. These initiatives fall under the "Community Outreach and Empowerment" and "Adapting to a Changing Climate" sections of the Climate Action Plan. For financial support, the "Berkeley First" program allows homeowners who are interested in solar additions to their to apply for financing. If accepted (and most are), homeowners are given financing for rooftop solar. The city will finance up to \$40,000 worth of installations, along with tax credits and rebates to help cut costs. Through this system, Berkeley has made solar usage quite cheap and easy for all citizens to have, which is a key reason why solar energy use is rising in the area ("Berkeley First," 2011). Another financial system put in place for energy efficiency is the utilization of ME2 grants for both home and business owners. These ME2 grants are funded by the United States

Department of Energy but are run through Berkeley's city government. Much like the Berkeley First program, citizens apply for these grants for home energy efficiency improvements. To help plan for applicants in the previous two programs, Berkeley has created a "SolarMap" under the SmartSolar program, which is an interactive map that shows the solar capabilities of every few acres of land in Berkeley. It takes into account geographic location, average sunlight exposure, surrounding area, and the building itself. This map also allows for citizens to check if their homes could be vastly improved through solar energy technology, with an easy link provided to contact a government official ("Money for energy efficiency," 2011).

Another initiative of Berkeley's is its "buy local" and "local first" movement, which promotes both local finance and sustainability through advocating for citizens to purchase from local businesses. As described by its website, this program consists of a "collaborative of merchant associations and individual small business owners in Berkeley" ("Buy local first") The group educates "about the cultural, environmental, community and economic benefits of shopping at locally owned businesses" through marketing campaigns and community events ("Buy local first"). This program, started in 2007, realized the importance of the prosperity of local businesses, citing benefits such as keeping money in the economy, more local jobs, a more green business district, and maintaining local identity. Employees that are members of union in local businesses enjoy greater salaries and benefits than those of supercenters such as Wal-Mart, and often provide better services. The campaign has enjoyed great success, with a 2008 survey stating that 58% of people buy "local first" ("Buy local studies").

In terms of water systems and green spaces, Berkeley has solar and rain technologies available for installation under the "Building Energy Use" and "Adapting to a Changing Climate" sections of the plan. For rain, Berkeley already has rain barrels and permeable pavements in place throughout the city, but it also offers home installation on a smaller scale for water conservation. For structural improvements, many homes install drip irrigation, apply mulch, install "greywater" and rainwater catchment systems, and choose drought-tolerant plants that are native to the area. (Clunies-Ross, 2012). Any citizen can purchase rain barrels to catch rain and save up to 100 gallons of water per barrel. For larger homes or structures, Berkeley has rain cisterns in place, which require permits and zoning certificates from the city government ("Rainwater harvesting," 2011). High-efficiency toilet and showers are standard in many homes along with water-saving clothes and dishwashers. According to data provided by the East Bay Municipal Utility District (EBMUD), the Berkeley community reduced total water consumption 20 percent between 2000 and 2010 and nearly 40 percent since 1975.

Recycling and Reuse has also been an integral part of Berkeley and is included in the "Waste Reduction and Recycling" section of the climate plan. Berkeley offers standard curbside pickup for all homes, along with an abundance of recycling bins attached to trash bins across the city. Citizens are rather diligent in this area, and usually they separate their trash into the separate categories. The city also has reuse centers for many different things such as old appliances, computers, raw materials, and other goods. The stores will take these various objects from you and they will either then be recycled or re-purchased by others in the town. There is also a website called StopWaste.org that has dedicated itself to a cleaner and more recycle-friendly Berkeley. Stopwaste collects data on Berkeley's progress in this department, and has calculated that in the past few years Berkeley has diverted an impressive 75% of waste from landfills in the county. Perhaps the largest aspect of recycle and reuse in Berkeley is the "UrbanOre" Ecopark. This reuse center, which vows to "end the age of waste," is a haven where people can drop off almost anything that is unwanted, from old doors to house appliances. The reuse center has been extremely successful, netting \$2.5 million in profit in 2011 and selling to many local contractors, saving the contracting businesses a great deal of money. (Pellissier, 2010)

Although sustainable food practice is not its greatest initiative, the city has made great strides in recent years toward greener food. The city's first new food co-op in over twenty years, the Berkeley Student Food Cooperative, was 100% created, funded, and run by students at U.C. Berkeley. The co-op

vows to “carry fresh, local, healthy, environmentally sustainable, and ethically produced food at affordable prices” (Henry, 2010). Berkeley also has community gardens, aimed at growing healthy, local foods and reducing “food miles,” because the average mileage on food for Berkeley is 1,500 miles. Leaders of the gardens claim that “A typical Berkeley garden, intensively farmed, can easily produce enough fruit and vegetables for five families – or more – about 48 weeks a year,” and is certainly cheaper and more sustainable than shopping at chain grocery stores and restaurants (Hahn, 2012). A center of sustainable food networks in Berkeley is the “Chez Panisse” restaurant, run by food activist Alice Waters. The restaurant prides itself on using only local, natural, and organic fresh food and produce that are selected by Waters and her staff. The restaurant is a landmark in the city, having inspired many other restaurants of its kind, while earning recognition as one of the top 100 restaurants in the world by Restaurant Magazine. The restaurant supports local businesses and slashing food miles and shipping and storage costs for food (Air, 2011).

Perhaps the most vital aspect of the city’s future has been unmentioned so far, but lies in the city’s University, UC-Berkeley. The students of UC-Berkeley bring fresh ideas and energy to the city and provide it with jobs. There are a great deal of student organizations on campus that are dedicated to making the campus and surrounding city more sustainable. Students use car sharing and Zip-Car systems to save energy, and they either walk or ride bicycles to get around campus. The campus uses locally grown foods, the only of its kind in America, and has sustainable food truck fairs everywhere to promote the use of food trucks. All students live in energy efficient dorms that recycle and reuse water and energy. The students do a great deal of community service in the city, and many go on in careers in sustainability after achieving degrees. For graduate studies, University of California at Berkeley has a division for the Haas School of Finance called the Finance Center for Responsible Business. This center awards degrees in either sustainable finance or sustainable product and solutions and is one of the best in the nation in its field. Pupils in the school must create projects that are student run and designed, with aid from esteemed faculty. If the projects are useful and practical, the city will fully fund the project and implement them. The University of California at Berkeley is the centerpiece of the city, and helps pave the way for future sustainable initiatives.

In conclusion, Berkeley has become one of the greenest cities in America through its implementation of the Climate Action Plan. Berkeley has reshaped almost every aspect of its city to fit its vision for a safe-haven from pollution and the unsustainable living conditions that are omnipresent in the world today. The city has become much like the sustainable, people-friendly cities across Europe that put our industrial parks and concrete jungles to shame. Through citywide dedication, a devoted university, and an efficient government body with these plans in mind, Berkeley serves as the role model for all cities looking to join the green movement.

### Bicycling Initiatives

As one can infer from the previous section, Berkeley has an abundance of initiatives that all contribute to its high sustainability. Out of the various initiatives, it is clear that Berkeley’s initiatives are especially strong in transportation, recycling and reuse, and local finance for energy efficient buildings. However, the city’s finest and strongest practice falls under the umbrella of transportation, more specifically its bicycle infrastructure and citywide accommodations for bicycle usage. Through extensive planning and dedication by both the city government and U.C. Berkeley, the city has been named the most bicycle friendly city in America. The section will discuss additional initiatives in bicycle transportation that were not previously discussed, as well as the portability of this city’s methods.

In Berkeley’s Climate Action Plan, the “Sustainable Transportation and Land Use” section is the most developed of the five areas. The new urbanism ideals have taken over the city structure and the ubiquity of the bicycle has been the catalyst. More specifically, the city government has created a subdivision of this plan called the Bicycle Subcommittee of Transportation, which holds its public

monthly meetings to propose, discuss, and agree upon all bicycle issues in Berkeley. These meetings have generated many successful initiatives, most notably the plan for a bicycle bridge that spans all of I-80 in West Berkeley. This bridge plan was discussed at these public meetings and approved thanks to great public support. This bridge allows people to engage in mass transportation via bicycles instead of driving automobiles in a safe and efficient manner ("The West Berkeley Gateway, 2012).

Private groups have also sprung up such as the Bicycle-Friendly Berkeley coalition, which promotes bicycle usage in all areas of the city. With this group's help, "bicycle-businesses" have begun to sprout up, in which businesses have bicyclists deliver food, packaging, and run errands across the city. Although they are still small, an expansion of this business idea is in the making and would drastically increase sustainability. Businesses cut costs by using bicyclists instead of large, gas-guzzling trucks with many employees in nonlocal businesses (Riviera, 2011). From a financial standpoint, businesses save money, and much more of their expenses stay within the city and go straight into the pockets of local businesses. It is obvious that this will decrease car usage and therefore produce less smog and pollution while alleviating road congestion.

In addition to the initiatives led by city government, U.C. Berkeley has been expanding bicycle usage both on and around its campus. The university's bicycle organization, BicyCal, is a co-op that works closely with the administration to make riding bicycles easy and accessible. Every aspect of two-wheeled transportation has been analyzed by this organization, ranging from licensing to bike rack installation. Structurally, they have implemented "dismount zones," where riders must dismount to prevent crashes with students and over-congestion. They have put in public bicycle storage in areas like the college sports complex, so students and citizens can ride their cycles there. In 2010 alone, BicyCal installed 650 new parking spots around campus for bicycles. There are student maintenance workers available to come to dorms and repair one's bicycle, and also to teach students how to repair or ride bicycles. Volunteers for the organization can earn credits that can amount to objects such as a free helmet or bicycle. Another great idea that the campus has put into place is bicycle fleets that are stationed around campus for students so they can rent a bike for an hour to get to class, or for the whole day (Cockrell, 2010). The student organization also has fundraisers each year that support local businesses by having them sponsor events or bike-a-thons, which is always good for a sustainable economy. The progress has been impressive, as the university cut gallons of gas used in commutes by over 1 million gallons. Likewise, the amount of faculty commuting by car has declined by 3% in the past ten years. ("Transportation overview," 2012)

Given the above information, it is easy to see the extent and effects of the city's bicycle initiatives. Five times as many people commute by bicycle than in any other place in all of the Bay Area, which is a testament to how convenient and accessible areas are in Berkeley via bike. Safety, another enormous concern of the city's plans, has also witnessed impressive results in recent years. According to California's bureau of transportation, Berkeley is the safest place with a population over 60,000 in the whole state to walk and bike in. ("Bicycling in Berkeley," 2012) Bicycle usage has clearly affected every aspect of the town, from bike lanes on the roads to bike businesses, and locally sponsored cycling events. It has fostered involvement on UC Berkeley's campus, and has greatly discouraged the usage of cabs and cars because bicycles are so convenient. With such a safe, simple, and accessible infrastructure, Berkeley residents would be foolish to not hop on their cycles and ride.

## Conclusion

Berkeley, with the help of its active citizens and a dedicated government, has transformed itself into a leading community for sustainability. This paper has discussed the city of Berkeley as a whole, its array of diverse green initiatives, and its best practice. Under initiatives outlined in the Climate Action Plan and from the University of California at Berkeley, the city has made progress in many areas of urban sustainability, including transportation, building energy use, waste reduction and recycling, water and

infrastructure, local finance, and sustainable food. The plan has been constantly revised and amended as the city of Berkeley progresses each year to become a greener city.

After an analysis of each area, it is clear that Berkeley's enhancements to bicycle transportation and pedestrian transport are its greatest sustainable practice. The various changes in city infrastructure and bicycle education, along with U.C. Berkeley's BicyCal organization, has made Berkeley a national leader in bicycle transportation. The city has achieved high ratings for bicycle safety and transport, and it has slashed automobile usage to make this city a role model for others. Although it will be difficult for metropolises like New York City or Los Angeles to adopt these urban structural changes, smaller cities and college towns can certainly switch over to human powered transport, especially with the help of motivated students. As long as Berkeley continues its progress and its citizens are motivated to maintain a green community, the city will remain one of the most sustainable cities in America.

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## Environmental Policy and Energy Initiatives in Berlin

by Stephen Kornblum

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As the capital of Germany, a country which has invested heavily in sustainability, Berlin is among the most environmentally conscious cities in the world. Despite the fact that it is located near neither a coastline nor in an area that receives a significant amount of sun or wind, Berlin has been able to decrease its use of fossil fuels while relying more heavily on renewable energy. The 3.5 million residents of the city enjoy the clean air as well as the ample parks and forests in and around city.

The Berlin city government is in the process of enacting an ambitious policy goal of becoming "climate neutral" by the year 2050, and it has also established the more proximate goal of reducing CO<sub>2</sub> emissions to 40% of 1990 levels by 2020. To achieve this goal, Berlin has invested in a number of different initiatives in many different fields. The public transportation network is extremely extensive and is one of the most environmentally friendly in Europe. The recycling and waste disposal services are also notably efficient. Berlin also has a long history of citizen-owned gardening zones as well as parks and forests. But the field that the city excels in is clean energy and related research.

This paper will cover Berlin's major environmental policies and initiatives in detail as well as its plans for the future. An overview of each area of note will describe how exactly the city plans to act as well as what is already in place. It will also place extra focus on the best specific policies which show the most promise and will produce the most benefit for the city and its population in the long and short term. The following section will discuss in more detail the city's clean energy initiatives, and the conclusion will evaluate the city's energy practices and assess their potential for adoption by other cities.

### Overview of Sustainability Initiatives

This overview begins with a look at Berlin's overall goals in regard to the environmentally conscious development in the city. It continues with a look at the green spaces in Berlin, energy use and alternative power sources, transportation, food and gardens, waste and recycling, and green businesses. Green buildings are not mentioned in a specific section because many buildings in Berlin could be called "green," and no individual structure stands out.

Berlin and Germany as a whole have vowed to cut carbon-dioxide emissions to 40% of 1990 levels by 2020 (City of Berlin 2013a). Berlin itself has the goal of becoming a "climate neutral" city by 2050, which means that all emissions are offset. The Berlin city government also promotes energy efficiency measures at every opportunity and believes that by setting an example it can motivate private citizens and companies to do the same. As such, all public buildings are constructed and run with the goal of saving as much energy as possible (City of Berlin 2013b). This policy is also mirrored in all publicly run institutions, from the public transit service to the recycling sector. There is no single area which is focused on for improvement that can be called the main achievement of the policy because it affects such a broad range of institutions and has enjoyed success in many of them.

The city of Berlin has many green spaces within and around it. Many, if not most of these spaces have been around for hundreds of years, such as the Tiergarten in central Berlin. Other green spaces exist in the form of forests on the edges of the city, like the Grönwald area. The forests contain many lakes as well as footpaths, and they are popular with joggers, bicyclists, and dog walkers. Small green

spaces less than 40 square meters are also commonly found in many neighborhoods and often named after historical figures. Berlin is also home to a world-class botanical garden and two zoos (City of Berlin 2013d). A more recent development is the repurposing of the former historic Tempelhof airport into a park. Residents are able to walk along the old runways and green spaces on the former airport grounds which are being allowed to return to a semi-natural state (City of Berlin 2013e).

With respect to energy, power plants in Berlin are being switched from coal or lignite to natural gas, which is a much cleaner fossil-fuel (Vattenfall AB 2012a). General plant and electrical grid efficiency is also being increased, which further reduces carbon-dioxide emissions. Older houses and buildings are being added to the district heating grid, which means they no longer need to burn heating oil or other fossil fuels for on-site heating. As a result, the number of coal furnaces in individual buildings in Berlin sank from 400,000 in 2005 to 60,000 today (City of Berlin 2013b). Berlin itself is home to many cutting edge research facilities concerned with alternative energy and solar power in particular. The research and energy policies are being put into practice more and more. In 2005 alone 47,000 square meters of solar thermal collector panels were installed in Berlin. The roofs of publicly owned buildings are available for investors to build miniature solar power plants on. The excess energy produced can be sold back into the grid at a subsidized price (City of Berlin 2013b). Power plants that run on old wood were recently constructed with emission-reducing technology. An additional power plant that uses heat from organic garbage was also built (Vattenfall AB 2012e).

Public transportation in Berlin is very efficient and is used by most of the population. The company Berliner Verkehrsbetriebe (BVG) runs all of the public transit in and around Berlin. The buses run by this company are diesel-powered but were "the first to meet Europe's strictest EEV (Enhanced Environmentally Friendly Vehicle) standard," which entailed strong particulate traps on the exhaust (Berliner Verkehrsbetriebe 2013a). There are also dedicated bus lanes as well as bus stoplights to make the network more efficient. The extensive BVG rail and streetcar networks all run on electricity. The rails for these vehicles are also designed to produce as little noise as possible when the trains run over them. The BVG also works to reduce waste in related areas, such as saving water while washing the buses and reusing the track ballast when relaying rails. The next step the BVG will take in the future is to have all the buses run on hydrogen fuel-cell technology and remove all emissions completely (Berliner Verkehrsbetriebe 2013b). Berlin also has a huge network of bicycle lanes that are used extensively by many Berliners every day. Traffic in the center of the city is limited to cars with low emissions. Owners must also pay to have their car emissions inspected and to be issued a permit to do so. This lowers air and noise pollution in the most densely population part of Berlin (City of Berlin 2010).

Berlin also supports local food through the "Schrebergarten" system, which divides large plots of land and assigns them to individuals or families to grow crops for non-commercial purposes and to be improved as the owner sees fit. The plots are not community gardens in the sense that all gardeners are responsible for all lots; the individual owner works only on their own lot, but the ownership of a lot gives the owner a say in the management of the entire garden community as a whole. In Berlin there are 833 garden complexes, and they are protected by federal law. There is also an organic farm in the center of the city which people can visit and from which they can buy local produce. Local produce is easy to come by for those who do not wish to grow it themselves. Most neighborhoods host farmers' markets on at least two days a week. Farmers often make deals with store owners to sell their goods in the city on a permanent basis. Value is placed on organically grown food to the extent that several chain stores which stock only environmentally friendly and organically grown products have appeared and prospered (City of Berlin 2013c).

Berlin has many small local recycling centers throughout the city. Residents can bring whatever they would like to dump to any center and dispose of it for free by sorting it and placing it in the correct dumpster. Color-coded garbage cans are provided to residents so that they can separate plastic and metal packaging to be recycled, as well as paper. The waste that does not fit into those categories, such

as organic garbage, is placed in yet another trash can. The organic garbage is brought to a collection plant where the methane from the decaying matter is collected and used to fuel the garbage trucks. Burnable trash such as old wood is brought to a plant where it is incinerated to generate steam, which is then sent to a power plant to generate electricity (Berlin Stadtreinigung 2013a). The incinerator itself is very efficient and has low emissions. Recycling plants separate metals and other recoverable resources from the other trash and turn the rest into fuel. Methane is also captured from old landfills where it is used to fuel power plants (Berlin Stadtreinigung 2013b).

Once a year Berlin hosts a "Green Week" event during which green businesses in the agricultural, horticultural, and food industries are invited to display their products and innovations to the population of Berlin in the massive city convention center. It is the largest event of its type in the world and had over 400,000 visitors in 2013 alone (Messe Berlin GmbH 2013). Berlin has multiple business associations, some of which specialize towards helping foreign investment or biotech industries. The Berlin chamber of commerce also has a large role in this. Berlin is also a hotspot for international investors or those who wish to engage in research into alternative energy sources; especially solar energy (Industrie- und Handelskammer zu Berlin 2013a).

All of these green initiatives add up to and are included in Berlin's current green policy. Some of them are already very old, like the parks and gardens, and are taken for granted by the Berliners. But many of them are new and potentially risky for the city government in terms of budget constraints. But the measures enjoy the support of the citizens and are only the start of the plan to make Berlin a climate-neutral city.

#### The Green Energy Transition in Berlin

The best and most impressive environmental practice of the city of Berlin involve power generation. The initiatives include the modernization of older power plants as well as the construction of new ones that are designed to be as efficient as possible. Power plants powered by refuse-derived fuel are also included in this practice, but the most important aspect is the research that Berlin is conducting into alternative energy sources.

Like many other cities, Berlin generates a sizable amount of its electricity using coal-fired power plants. These have been recognized as detrimental to the environment and the people of Berlin due to the large amount of carbon dioxide and black soot produced by burning coal. The three coal-fired power plants in Berlin run by Vattenfall all also produce hot water for heating in addition to coal (Vattenfall AB 2010). All of these plants utilize Carbon Capture and Storage (CCS) technology and have been rebuilt to increase efficiency (Vattenfall AB 2013). The coal plant in Klingenberg is the largest of its type in Berlin and is fueled by lignite, which is a relatively inefficient form of coal in terms of energy output relative to emissions produced. So to meet the requirement to reduce Berlin's emissions by 2020, Vattenfall will invest 700 million Euros to completely convert the plant to run on natural gas by 2016, which does not produce nearly as much in way of emissions. The part of the plant that is powered by coal will be entirely decommissioned. To supplement the electricity and hot water output of the main Klingenberg plant, two biomass plants will be built in 2017 and 2019 (Vattenfall AB 2012a).

Berlin also has several natural gas fueled power plants already running. The power plant in Mitte is located in the center of the city. It supplies 390,000 residences with power and generates the most power of any plant in the city. When it began operation in 1997, it was one of the most modern natural gas plants in the entire world (Vattenfall AB 2012c). It has been upgraded over the years to increase efficiency and keep up with the demands of a growing city, and today it can burn natural gas with an efficiency of 90%. An additional, smaller natural gas plant in Lichterfelde was built in 1970 and initially was fueled by heavy oil. By 1997 it had been completely converted to natural gas which significantly decreased emissions (Vattenfall AB 2012d).

There are also a few biomass fueled power plants in and around Berlin. The plant in Berlin-Neukölln run by RWE burns discarded wood as fuel (RWE Innogy 2013). Using wood as an alternative to coal reduces carbon dioxide and soot emissions by a large amount, so the plant is an improvement on coal. The use of wood as fuel also reduces the amount of wood that is buried in landfills and frees up that space for other materials. A different biomass fueled power plant operated by Vattenfall is located a few kilometers outside the city in Rüdersdorf. It is a waste-to-energy plant that specifically is fueled by refuse-derived fuel created from Berlin's garbage (Vattenfall AB 2012e). The plant uses many modern techniques to reduce carbon dioxide emissions as well as other chemical byproducts that can be formed as a result of burning garbage.

Berlin does not have much in the way of actual solar or wind energy power generation installations in or around the city. This is mainly because wind turbines are more effective when situated in open areas away from cities. Distributed solar generation is more compatible with urban spaces, and by 2011 there was a combined surface area of over 80,000 square meters of installed rooftop photovoltaics (City of Berlin 2013b). To accelerate the growth in this field, Berlin started the Solar Roof Initiative which allows investors to place solar panels on the roofs of city-owned buildings. The investors can then sell the electricity to the grid at a subsidized price (City of Berlin 2013f). One hundred and twenty different solar installations have been constructed on roofs around Berlin through this initiative. A "Solar Atlas" has also been created for the city to allow potential investors or private home owners to determine where a solar installation would be most effective to make the process even easier (Berlin Business Location Center 2013). Berlin is also a major center for research into alternative energy, especially in the field of photovoltaics. Over 40,000 experts are employed in various companies and institutions for the express purpose of furthering alternative energy technologies of all kinds (Industrie- und Handelskammer zu Berlin 2013b).

Berlin has also invested heavily in energy efficient generation techniques as a way to lower carbon-dioxide emissions. By using the heat generated as byproduct during electricity generation to heat water, they can use up to 90% of the potential energy within fossil fuels (Kraft-Wärme-Kopplung Modellstadt Berlin 2013). The water can be easily transported to houses across the city to be used for heating and hot water. This allows residents in older buildings to completely remove their own hot water boilers and central heating units. Berlin is home to over 150 individual companies dedicated solely to energy efficiency. They consult with private and public industries and companies to help them find the optimal solution for their energy needs and then act as contractors to implement the changes. The list of areas where buildings can have their efficiency increased includes the heating and electrical systems, as well as the operation of machinery inside the building in the case of factories (Berliner Energieagentur 2010).

## Conclusion

Berlin has already made many great strides towards its goal of achieving the creation of a carbon-neutral city and a place where sustainability as well as respect for the environment are high priorities at all times. The transportation and waste management systems alone are a model for cities around the world, not to mention the parks and gardens. But the energy sector is the field in which Berlin has undertaken the most significant changes. Their plans for the future are even more ambitious, and it remains to be seen how successful they will be at their long-term goals of implementation. But if things continue in the same direction they are moving right now, Berlin will certainly become a model of urban sustainability efforts.

The innovations in Berlin's energy sector would not be particularly difficult to replicate in other cities. Solar and clean fossil-fuel technology are not difficult to export, but the limiting factor is the price. These technologies may even be more effective, and cost efficient, in areas of the world with high levels of sunlight and air quality problems associated with fossil fuels. The price of natural gas also varies from

region to region, potentially making natural gas a relatively cheap alternative power source. But then again, not every city can afford to invest so heavily in new generation plants, especially in developing countries.

One issue with Berlin's plan for the future is that it may be too ambitious. Without focusing on any one or two fields, city legislators run the risk of running out of funding for existing projects. The energy services in particular are very expensive to update and construct. Research into alternative energies is also somewhat risky as relying on potential clean technologies of the future is far from a sure bet. But they have made a good start and at the moment their diversified strategy may be the best starting point.

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## Bogotá's TransMilenio System

By Spencer Ciesla, Charlie Ewing, Zack Jaworski, Chong Lim, and Breana Moore

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Located at a high altitude in central Colombia, Bogotá is characterized as a subtropical highland with an average temperature of 57 degrees Fahrenheit. The city experiences a dry and wet season; however, the weather can be very erratic. Home to over 7 million people, the city is both the nation's capital and the country's largest city, and it ranks in the top 30 largest cities in the world. The city has extremes in wealth and poverty, with over 32% of the population living in poverty, defined by the World Bank as living on less than \$2 a day. It is the country's center in almost all areas, including industry, culture, and education (Bogotá 2012). The city is also known for its high number of colleges and universities, earning the name the Athens of South America. However, Bogotá has also been recognized as one of the most violent and dangerous cities in the world. Although the local government has been making strong efforts to increase the efficiency and safety of the city, the high level of poverty also creates conditions for ongoing urban problems and crime.

In response to the population growth and high level of industrialization, the local government has attempted to become greener and more environmentally efficient in their daily operations. For example, the city government has made efforts to create parks and recreational areas, to green its buildings, and to developing recycling, and it has also established many community gardens to provide a more localized source for more organic and fresh food. However, the most significant and impressive improvement the city government has made for the city is the implementation beginning in 2000 of TransMilenio, the public transportation service of the city. The transit system is widely recognized as one of the most efficient in the world.

In the following section, Bogotá's programs for sustainability will be discussed in more detail. The different practices Bogotá has put in place will be evaluated to lay out the importance and support that each practice is gaining. Then, after discussing all the sustainability areas Bogotá is involved in, the next section will discuss the city's best practice, which we argue is the bus rapid transit. The conclusion will evaluate the city's sustainability programs and discuss their potential portability to other cities.

### An Overview of Sustainability Programs

Bogotá has made many strides to increase its sustainability through initiatives that are government funded or based on public-private partnerships. Although there is no general sustainability plan, there are initiatives in green buildings, parks and green spaces, and the transportation system. With respect to green spaces, vertical ecosystems have been built on a few buildings throughout the city in order to boost the air quality and energy efficiency of the buildings. Architects literally took plants and had them planted on the sides of certain buildings, such as the B3 Hotel Virray, creating a structure completely covered in vegetation. The plants insulate the building more than a standard concrete or brick wall, thus reducing the amount of electricity the building must consume to heat or cool it. Other buildings like the Doctorate's Building at the University of Colombia are using solar-powered technology to reduce the amount of electricity they must consume. The roof has solar panels that convert the sun's energy into electricity for ventilation systems and for other items that require electricity to run properly.

The Doctorate's Building also contains a rainwater capture system that will allow the building to use rainwater for a multitude of purposes instead of using the city's fresh water supply. Other buildings are implementing better lighting plans that allow for natural light to illuminate rooms instead of requiring electricity to light the same areas. The Timayui Kindergarten building uses shotcrete, a new building material, in order to reduce the amount of materials used in building a structure and also the amount of time wasted to use other more complex materials. It is also naturally ventilated, so air conditioning is hardly ever needed in order to keep the building's inner portion cool enough for the young children and teachers who work inside. Many buildings in Colombia are also using locally harvested woods to create structures instead of depleting the forests of their trees in an effort to save the environment and promote better air quality.

The city has also invested in green spaces such as parks and recreational areas. Many of these parks are public and are used to stage concerts and other events, like kite flying. There is also a National Park, which has trails and other family friendly activities. Another site for recreation is the Botanical Garden, where plants from all over Colombia are brought in. Most neighborhoods have family parks as well. These include sporting areas like soccer fields. Away from the excitement, the Parque del Chicó has gardens and ponds. Improvements to these areas and many others were done under Mayor Enrique Penalosa. During his three-year term as mayor, over 100,000 trees were planted around the city and hundreds of kilometers of sidewalks were built or reconstructed. In addition, over 300 kilometers of bicycle paths known as "ciclorutas" were built, and on Sundays main streets are closed to automotive traffic under the "Ciclovías" program. Finally, the building or restoration of more than 1,200 parks occurred.

TransMilenio, the city's transportation system, helps to transport millions of people while avoiding the traffic gridlocks of the city of 7 million people. TransMilenio provides buses, trains, tram, and subways as various types of transportation (Bogotá 2012). Although the buses run on diesel, they are said to be very clean in comparison with the previous system of thousands of privately owned and highly polluting mini buses. Under the leadership of Enrique Pensola, who was Bogotá's previous mayor, TransMilenio went from an idea to existence in fewer than three years (New York Times 2012). Pensola has also allowed prior private bus owners to buy new buses from the government and retrain their drivers. In fact, Pensola now advises other cities on how to start BRT programs of their own.

In contrast with transportation, until recently there were very few efforts to encourage recycling and waste management, and the city lacked a recycling plant. However, in December of 2007, an announcement was made that a large recycling effort would be put into effect for the city. The goal of the program was to recycle 30 percent of the daily 5,800 tons of waste that goes to the landfill outside the city each day. The program called for homeowners to use three separate disposal bins for their waste. A clear bag is used to discard recyclables, like paper and glass. A dark bag is used for organic waste and all other trash goes into another bag. Around the city, there are bins marked for different types of waste. Those include ones labeled for organics, plastics, and papers. The problem with this effort is that there is not a company or service that collects the waste. This leads to bins filling to the top with waste and most of the time, the label on the can is disregarded and waste gets thrown into the wrong bin. The poor who collect the waste and use it as income mostly do the recycling around the city. These scavengers travel around the city collecting the recyclables and carry the waste on a cart. While this sounds beneficial, trash bags are ripped open and waste gets tossed around on the street. While Bogotá has tried to make strides in improving their recycling programs, there are still many problems. The city still remains one of the most polluted in South America.

With respect to food, the city has become slightly more localized in order to reduce importing products from long distances. The effort that stands out the most is their implementation of community gardens throughout urbanized sectors of the city. These community gardens are government-funded and civilian-run gardens that provide organic and local options for people looking for a fresher fruits and

vegetables that are usually grown with organic fertilizer and mainly transported by walking or wheeling in carts. In efforts to increase the impact of the community gardens, the city of Bogotá has trained over 40,000 residents to be capable of successfully and properly running the gardens (Levenston 2008). In addition to the food sustainability efforts, the community gardens also provide needed jobs to the city and its residents.

Even though Bogotá remains one of the most polluted cities in South America, the city has come a long way. From growing plants on the sides of buildings to its green spaces, transportation, and food initiatives, Bogotá has demonstrated that it can act as a model for other countries, especially in less developed countries, where financial resources tend to be more limited. However, there is still much more to improve in many sustainability areas, such as recycling and waste management within the city. Bogotá's strengths are definitely its transportation system and the greening of buildings.

### The TransMilenio System

Although Bogotá has strong sustainability initiatives in green businesses, recycling and reuse, and green buildings, the TransMilenio system has far surpassed all others and has become the model for all other cities to follow. The initiatives and construction of TransMilenio in Bogotá have set a global standard. This section will review the greening of this aspect of Bogotá's transportation with a discussion of the TransMilenio infrastructure and the current initiatives surrounding the system. It will also discuss the current progress in transportation and outline the problems and the future of initiatives in this area.

TransMilenio includes buses, trains, trams, and subways that are coordinated from a control center that holds the system's dispatchers, who are in contact constantly with the drivers. In its beginning in 2000, Transmilenio served as transportation to approximately 800,000 Bogotáns, and within six years the ridership had risen to over one million daily. As of 2012, the Transmilenio bus public transit system is used by 1.6 million riders every single day, and the number continues to rise. By increasing the number of people who now choose to ride the public transit instead of commute around the city in their personal vehicles, the public bus system has already helped reduce a large portion of the city's emissions problem.

The hallmark of the system is bus rapid transit (BRT), which has easily accessible stations that connect to walking bridges and bike pathways. Much like above-ground subway stations, the BRT stations consist of turnstiles and waiting areas for various bus routes (New York Times 2012). There is a separate lane for the rapid buses, walking bridges for passengers as mentioned, and bike storages within the walking bridges (New York Times 2012). Traffic has been affected through "signalization": for instance, when a rapid bus approaches a green light, the green light is sustained seconds longer for the bus to go through. This feature allows for a smoother run of traffic for others cars and quickens the ride for rapid transit riders that vary in age, economic status, and demographics. Due to the accessibility, timeliness, low cost, and energy efficiency of the TransMilenio, it is a model for countries and cities throughout the world.

TransMilenio has also engaged in the ongoing greening of the vehicle technology. Selective catalytic reduction technology is used to increase the efficiency of the catalytic conversion system in all of the engines of the new bi-articulated buses that being put into service (Nova Bus Inc. 2012). The new technology reduces emissions and improves air quality, which is a growing concern of the city's population. The new buses will also exceed the emissions standards that are required by all vehicles in the city of Bogotá.

The Transmilenio system has recently made adjustments and advancements to expand the capacity, and the system has plans of further expanding in the near future. There are currently 11 routes that pass through a total of 115 bus stations located throughout the city. All of the stations have signs approximating the time until the next bus comes; however, there is usually a bus already at each station.

Currently, there are 25 stations that are under construction and several new routes running through downtown. Also, because of confusion that passengers had regarding routes and stations, TransMilenio created an interactive guide for passengers that clarifies and explains those areas. Future plans for expanding the routes include building 388 kilometers that will make a network of routes that branch out to a multitude of areas. This is projected to cost \$3.3 billion and is projected to take at least five years to complete (TransMilenio 2012). New buses have also been recently added to the TransMilenio bus rapid transit system. The original buses were able to seat up to 160 passengers, and in 2007 a new, larger bus design was proposed that increases the passenger capacity to 270. The bus has three sections and two articulators (a rotating center connector used to improve turning).

Bogotá has also set forth future plans to enhance the efficiency of the TransMilenio system. TransMilenio will be entering its Phase 3 of construction and enhancement of the system. The phase consists of four months of preconstruction, 18-22 months of core construction, and 60 months of maintenance. The deliberately planned out Phase 3 calls for an additional three main terminals and three feeding areas to be constructed for the TransMilenio system (Bogotá 2012). The system is said to enhance the efficiency of the TransMilenio by transporting 1,960,047 riders a day, which is much higher than the peak of 1,761,123 passengers carried this September. The enhancement will also decrease waiting time to about eleven minutes; therefore, a bus will be expected to arrive every eleven minutes and speed the movement of traffic (TransMilenio.gov 2012). The additional terminals will also provide more access to the airport, which is also to be expanded, and provide a cleaner atmosphere in Bogotá by pushing for fewer cars to be on the road.

Although the TransMilenio has only been in existence for a short time, many experts agree that its method of handling public transportation is one of the best in the world. Handling millions of customers daily is no small feat, and the choice to revamp completely the public transportation aspect of the city has been a historical change. The quality of life has improved significantly with the creation of the TransMilenio, which utilizes diverse transportation technologies and reduces greenhouse gases. The system has shown how a city can completely change its public transportation quality over a few years. Bogotá has become a greener and better city thanks to the revamping of its public transportation.

## Conclusion

Although Bogotá has other sustainability efforts like green spaces, recycling and reuse, food, and green buildings, the public transportation system is the most successful and most well known. Green spaces in Bogotá are used for public events, and in the last three years over 100,000 trees have been planted. Also, the building and restoration of over 1,200 parks have occurred. Recycling in the city of Bogotá is not very effective, and this sector does not receive much attention. Efforts have been made but they have not been effective due to the lack of a recycling company to collect the waste. Food sustainability efforts in Bogotá include community gardens, which are run by over 40,000 trained citizens. These gardens reduce the amount of food that needs to be imported, therefore minimizing the food miles problem. Buildings are being greened through the use of rooftop and side-wall gardens. The public transportation system in place in Bogotá, the TransMilenio, is the most effective sustainability effort in the city and is one of the best of its kind in the world.

Although the TransMilenio public system is one of the best in the world, several problems remain. On the positive side, the system is able to transport effectively over 1.6 million passengers daily, and its routes cover most of the city, and there are hundreds of buses that run throughout the city, resulting in little to no waiting time. However, the system faces two major problems: the cost of a trip and personal security. One trip costs \$1, which is one-third of the average daily income in Bogotá. Furthermore, in terms of security, there have been numerous pickpockets recorded.

Notwithstanding the challenges, the Transmilenio system has very unique qualities and is a very portable system, therefore making it very effective. The separate lanes that are specifically constructed for the busses are much less expensive than light rail, but have many of the benefits of urban rail, such as allowing the buses to stay out of normal traffic in order to reduce the likelihood that they will become caught in congestion. The system is very portable because it is an inexpensive system to build and implement, it is easy to expand with a growing population. It is more flexible than a rail-based system, so it can respond to urban design changes, and buses can leave the dedicated lanes at the outer portions of the city where congestion is lower. However, the cost of riding buses is relatively high for the working class.

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## Sustainability and Green Space in Chicago

By Emily Heald

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Despite Chicago's efforts to develop greening initiatives, its programs are significantly behind those of the greenest cities in the world. Though they cover many areas, the city's three main plans remain in early development. This lack of progress could be due in part to Chicago's history as an industrial city. Steel production defined the southeast side of the city until the industry closed in 1992. The city's reliance on industry could have prevented the creation of strong sustainability initiatives, because those initiatives may have opposed the interests of Chicago industry.

In recent years, Chicago has placed more emphasis on sustainability. While the previous mayor, Richard M. Daley was in office, he made green initiatives a priority. In fact, he announced that he wished to turn Chicago into one of the greenest cities in the world. As a result, Chicago has developed several comprehensive sustainability plans. The city has received much attention for its innovative ideas for increasing the amount of green space. Chicago has a well-developed park system and has created countless rooftop gardens on city buildings. Thus, though Chicago's efforts to be sustainable seem to be significantly behind the greenest cities of the world, Chicago does have unique green-space initiatives that some of the most innovative sustainable cities lack.

In the following pages, I will first describe the basic goals of Chicago's three plans, and then I will note their strengths and weakness. I will then layout Chicago's green-space and green rooftop initiatives, which I believe to be Chicago's best practice. In conclusion, I will look at what lies ahead for Chicago; are the city's ideas portable and realistic to implement in other cities?

### Assessment of Plans and Programs

Chicago has several sustainability plans that cover many important areas. One plan, "Eat Local, Live Healthy," centers on promoting local agriculture. Another, focusing on urban design, is titled, "Adding Green to Urban Design." The third is Chicago's general plan, titled "Chicago Climate Action Plan." The "Eat Local, Live Healthy" plan outlines the city's problems relating to agriculture, and it mentions possible methods of fixing those problems. However, it lacks an in-depth explanation on how exactly the mentioned problems will be solved. In comparison, the Climate Action Plan is comprehensive, covering many areas including energy, transportation, and waste. It also contains useful statistics, but, like the local food plan, it lacks specific methods of carrying out initiatives and metrics. Thus, the urban design plan seems to be Chicago's most developed plan. The "Adding Green to Urban Design" plan explains why a plan is necessary, what the exact urban design goals are, and how the goals will be carried out. It lists specific actions the city plans to take as well as the estimated dates of completion. Therefore, though Chicago's three sustainability plans are comprehensive, "Adding Green to Urban Design" is the most specific and the only well-developed plan.

Chicago encourages local agriculture in the "Eat Local, Live Healthy" plan. The plan aims to increase the supply of locally grown food; increase both food production and composting in city neighborhoods; make Chicago the home of local, all-natural, organic processing; and make local food more accessible. Though the plan explains ways in which these goals could be achieved, it does not lay out the specific measures Chicago is taking to carry out the outlined goals. For example, the plan mentions that one of Chicago's goals is to increase the supply of locally grown produce. To achieve this

goal, the plan explains that Illinois farmland must be preserved. It suggests that “area governments and officials must assess their commitment to farmland preservation [...] the assessment should include the potential for farmers to replace a portion of corn and soybean production with fruits, vegetables, livestock and poultry” (City of Chicago, 2007). The plan gives no further description of the assessments; it neither requires them, nor does it provide dates of completion. If this plan were to contain metrics and more detail, it could be of better use to the city.

In comparison, Chicago’s Climate Action Plan is comprehensive, but it tends to be vague. The *Chicago Reader* calls it an “ambitious-if-toothless” plan (“Mayor Daley Continues,” 2011). It provides the foundation for a good plan, yet it needs more to be more specific. The plan contains sections on green buildings, clean and renewable energy, transportation, and waste. While not given a section, green jobs are briefly addressed throughout the plan (City of Chicago, 2009).

In the building section, the plan suggests that Chicago try to retrofit 400,000 buildings by 2020 in order to make the city’s buildings more sustainable. This is a commendable goal, but the plan does not offer any detail about how the city will go about retrofitting so many buildings. The plan does offer good statistics; for example, it explains, “Reducing energy consumption and emissions by an average of 30 percent in 9,200 buildings by 2020 could produce reductions of 1.3 MMTCO<sub>2</sub>e” (City of Chicago, 2009). However, it does not mention how to go about reducing consumption other than through retrofitting. Thus, though on the right track, the proposed solutions suggested by the plan should contain more substance.

The Climate Action Plan’s section on greening Chicago’s energy also needs to be more specific. The city’s goal is to “use large-scale renewable sources to reduce electricity emissions by 20 percent, enough to replace four coal-fired power plants” (City of Chicago, 2009). It does not further describe how the city is going to achieve this goal. The city has begun to install solar panels on many public buildings, though, and more than twenty percent of the electricity used in city buildings and thirty percent used in Chicago Park District facilities was purchased from green power in 2007 (City of Chicago, 2009). Thus, the city has made improvements, yet the energy initiatives in the Climate Action Plan are not as innovative as those of other cities.

Chicago recognizes that through greening its urban design, it can greatly reduce the amount of waste the city produces. The urban design plan is split in to three focused sections: improving water usage and conserving local bodies of water, improving air quality, and creating adequate green-space. The plan outlines the basic changes to urban design that can help carry out these goals, lists specific initiatives, and finally lists estimated dates of completion for those initiatives.

Chicago plans to retrofit its urban design in order to better use water.

As a result of Chicago’s location on Lake Michigan and the Chicago River, proper water usage is extremely important. The city has the additional responsibility of keeping these bodies of water clean. The steps the city has taken to reduce water consumption and prevent pollution have benefitted the Chicago River greatly already. For example, the plan describes the problems Chicago has with its sewage system. Too much water is being sent to the sewage system, thus during rainstorms it often floods, sending dirty water into local bodies of water. To solve this problem, the city has been building a Tunnel and Reservoir Program (TARP). TARP is a system of deep rock tunnels and surface reservoirs that store runoff and sewage temporarily during storms, thus prevents flooding. Chicago’s urban design plan is much more developed, and as described, it offers specific solutions to identified problems (City of Chicago, 2008).

As most cities do, Chicago faces air-quality issues. Therefore, the plan aims to make the city even more pedestrian and bike friendly to reduce air pollution. It also wants to encourage taking public transportation instead of cars. The plan lists specific methods of encouraging pedestrians. For example, it will “improve pedestrian amenities,” and to do so it will “coordinate with the Senior Services Area Agency on Aging to improve bench program; Improve pedestrian crossing design; expand countdown

traffic lights” (City of Chicago, 2008). The plan explains that the Department of Transportation will be in charge of this initiative and it is to be completed by August, 2010.

Finally, the urban design plan focuses extensively on green-space. It aims to increase the amount and improve the quality of green-space in Chicago. One specific initiative is to “update parking garage landscape requirements and develop special-use green design guidelines” (City of Chicago, 2008). This initiative was to be carried out by the Department of Zoning and Planning by December, 2009. This plan offers both specific actions that will be taken as well as metrics, which the other two plans do not provide

In conclusion, “Adding Green to Urban Design” is Chicago’s strongest sustainability plan. Both “Eat Local, Live Healthy” and the Chicago Climate Action Plan need specific, developed initiatives to be more useful. Altogether, Chicago’s plans are able to address local food issues, energy, buildings, transportation, urban design, waste, and green-space; the plans are fairly comprehensive. Even so, many of those areas need to be addressed in much more detail. Green jobs and local business are barely mentioned. Within the urban design plan, the green-space section seems to be the strongest. Thus, I have determined Chicago’s best practice to be its policies on green-space, and even more specifically, its focus on green rooftops.

### Green Space

Since the construction of a roof-top garden on top of the city hall building in 2001, Chicago’s green-space initiatives have received attention. Richard M. Daley, mayor from 1989 until May 2011, made greening the city a priority. He placed a huge amount of emphasis on green-space initiatives. The success of the city hall rooftop garden led to the Green Roof Grants Program. The government began to create incentives for those who retrofit or build buildings with green rooftops. Today, Chicago claims to have over 7 million square feet of green rooftops around the city; more than any other city combined (City of Chicago, 2010-11). However, many believe that Chicago’s green-roof programs still contain room for growth. Thus, though the city’s green-space initiatives are strong and developed, there is room for improvement.

The city’s general green-space initiatives are impressive. Between 1989 and 2002, Mayor Daley planted 300,000 trees. As of 2002, Chicago spent ten million dollars a year on new trees, flowers, and shrubbery (“Green Machine,” 2006). The mayor also expanded parkland by about 1,300 acres from 1998 to 2010. He created Millennium Park, a 24.5-acre park built on underground parking garages and commuter rail lines (City of Chicago, 2010-11). He also created the CityScape program, which converts unused open space or vacant lots to parkland and community gardens (Danish Architecture Centre, 2008). Despite these advances, Chicago still has many park deserts. According to the *Chicago Tribune*, “Chicago falls far short of providing the parks and natural areas to support its population of 2.7 million,” and many people don’t have access to nearby green space (“Mayor Daley Continues,” 2011). Though many effective programs have been established, Chicago must continue to expand its green space.

The most successful aspect of Chicago’s green-space programs is the effort to encourage green rooftops. Germany’s advanced rooftop garden programs first inspired Mayor Daley to create a garden on top of city hall. The city hall rooftop garden was completed in 2001. It is 20,300 square feet in size, and the garden contains 20,000 plants. This rooftop was very successful; “compared to an adjacent normal roof, City Hall’s green roof was nearly 100 degrees lower, and contributed to \$5,000 in annual energy cost reduction, in addition to improving air quality and reducing storm water runoff” (City of Chicago, 2010-11). The garden absorbs about seventy-five percent of the rainwater that falls on it, which reduces the amount of water sent to the sewage system. Thus, the risk for flooding has decreased. It also acts as an insulator, so it reduces the energy needed for air conditioning by about thirty percent (World Clean Energy Awards).

As a result of the success of the city hall green roof, the Green Roof Grant Program was introduced. The program uses “vast awareness and education campaigns to show that green roofs have a number of benefits, both for individual building owners and the surrounding Chicago community” (World Clean Energy Awards). The program is causing rooftop gardens to become mainstream. The program emphasizes that though they may be more expensive, green roofs last significantly longer than normal ones, and that they will lead to huge energy savings (Paulson, 2006).

The project will give up to \$100,000 in matching funds to developers who seek to retrofit buildings with rooftop gardens. It also provides \$5,000 grants to smaller, residential projects. Furthermore, the city expedites requests for permits through a green permitting process. Finally, the project requires green rooftops on new, city-financed buildings. Though the greening process began with city buildings, it has successfully spread throughout the city. The Apple store, Target, Wal-Mart, and even a McDonalds have green roofs (Paulson, 2006).

Many critics of Chicago’s efforts exist, however. They are quick to point out that though the statistics sound impressive, Chicago’s 500 green roofs make up less than one-tenth of a percent of the city’s half-million buildings. Many cities, especially in Europe, are way ahead. For example, in Germany, fifteen to twenty percent of roofs are green. In addition, not all of these roofs live up to certain standards. Most gardens are not as large or effective as the one on city hall. A rooftop does not have to be beautiful or large to comply with city standards (Kamin, 2010).

The types of buildings the gardens are constructed on create further inequalities among gardens. For example, as said in the *Chicago Reader*, “Putting a green roof atop McDonald’s,” an “emblem of the energy-wasting car culture, [is] like sticking a piece of lettuce atop a bacon double cheeseburger and calling it healthy” (Kamin, 2010). In contrast, a restaurant called Uncommon Ground has a rooftop garden that grows a variety of vegetables that are used in the food they serve. However, this type of garden, which promotes local agriculture and organic food, is less prevalent. Many of the rooftops are not part of daily life. They do not receive visitors, nor are local crops grown on them. To further advance their rooftop garden programs, Chicago could tie more of the gardens to local agriculture. Thus, though the city’s programs are already progressive, the quality of rooftop gardens could be improved (Kamin, 2010).

Despite all criticisms, however, Chicago’s green rooftop initiatives are very strong. They are practical, easy to implement, and very successful. Among many other benefits, the rooftops reduce the urban heat island effect, decrease the amount of water sent to the sewage system, and significantly reduce energy costs. The government incentives have successfully promoted green rooftops. The strategies used to promote green rooftops are simple. The Green Roof Grant Program incentives encourage retrofitting buildings to include gardens as much as they encourage constructing gardens on new buildings. Retrofitting incentives have allowed the program to become much more effective. Other cities can easily follow in Chicago’s footsteps and create successful green roof initiatives.

## Conclusion

Overall, Chicago’s sustainability initiatives are well behind that of most cities. The three plans are comprehensive, yet the “Adding Green to Urban Design” plan is the only one that goes into detail. The “Eat Local, Live Healthy” and the “Chicago Climate Action Plan” outline what Chicago should do, rather than really explain what the city will do.

If these plans were further developed, they could become useful for the future. Both the local food plan and the general plan address important issues, yet they fail to develop concrete solutions. If specific initiatives and dates of completion were added to these plans, they could be comprehensive and useful. They could help Chicago make significant advances towards becoming more sustainable.

Chicago has been successful with its green-space initiatives. The actions Mayor Daley took to carry out green-space initiatives were both simple and practical. He made expanding Chicago’s park

system a priority. He also encouraged rooftop gardens. Green rooftops are easy to implement, save money, and yield significant results. By offering the proper initiatives, any city could easily create a program like that of Chicago. Furthermore, rooftop gardens are practical for individuals to implement. For example, as covered on NBC Nightly News, one Virginia couple was inspired enough by Chicago's success to create a rooftop garden on their home. In the first month with their new roof, they saved twenty-five dollars on their air conditioning bill. That adds up to about three hundred dollars saved per year (Tibbles, 2006). Chicago's ideas are portable, and many cities and individuals are following its lead. Ultimately, if Chicago begins to place as much emphasis on other areas of sustainability as it does on green space, for example on creating green jobs, and using cleaner, renewable energy sources, the city could in fact become very sustainable.

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## Greening the Built Environment in Dallas

By Sahil Batra, Robert Cross, Nathanael Gabler, Amber Gerdes, Sydney Pedigo, Yi Zeng

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The eighth largest city in the U.S., Dallas has a population of 1.2 million. It grew to that size largely during the area of automobile transportation, and consequently it has relatively low density and high dependence on automobiles. The climate is also "humid subtropical" and includes intense summer heat that is magnified by the urban heat island effect. In one year Dallas had 56 days of consecutive triple-digit temperatures that led to twelve deaths (Watson, 2011). The heat requires high levels of air conditioning, and it promotes blackouts and exacerbates water shortages. In response the city has had to buy energy from Mexico's Federal Electricity Commission, and it plans to expand its water sources to include two more reservoirs beyond its existing system of five reservoirs (Slater, 2011). Prompted by the shortage of resources, Dallas has developed into an environmentally conscious city.

Among the sustainability efforts in the city, Dallas was the first to enforce the International Green Construction Code as mandatory, and it has successfully lowered water consumption while increasing its recycling participation, alternative fuel and energy consumption, and LEED certified buildings (Dallas Economic Development, 2013). In addition, there are efforts to increase efficiency in transportation, energy conservation, and recycling. The strongest practice is the development of green spaces and buildings, an area of sustainability initiatives that has received substantial funding and attention.

This paper will first provide a summary of sustainability plans and initiatives in various areas, including green buildings and spaces, food, recycling and waste, transportation, green businesses, and energy. Next, we will focus on green spaces and buildings, the sustainability area where Dallas has shown the greatest leadership. The conclusion will evaluate the city's best practice and assess its value as a model for other cities.

### Overview of Sustainability Programs and Efforts

Environmental sustainability and complete use of materials are important concerns that Dallas is making a focused effort to address. Among the categories of environmental sustainability are the issues of green buildings and green spaces, sustainable food practices, recycling and waste functionality, transportation practices, green business, and sustainable energy. Dallas has created plans to address each of these categories and has implemented many practices already that will help lead the city into a more environmentally friendly future. One of the major efforts being made, though by no means is it the only effort, is the Dallas Sustainability Plan, which addresses each of these issues in-depth and with real, achievable, and measurable goals. The plan was finalized in August, 2012, and is one of the more recent sustainability initiatives of the city council (Dallas City Hall, 2013). This plan's goals span categories of air quality, land use, water quality, materials management, and energy, with several different proposed methods of accomplishing each.

Buildings are responsible for 48% of all energy consumption in the U.S. annually (City of Dallas, 2007). In order to counteract this impact, Dallas is implementing changes in its building certifications

and contracts that involve greener, more sustainable, and more energy efficient techniques. These techniques will utilize greener energy processes such as city-produced solar power and purchased green credits from cities that utilize wind and hydropower, as well as many other methods. It is the hope of the city council that implementation of these newer techniques will lead Dallas to becoming one of the greenest cities in Texas. Leadership in Energy and Environmental Design (LEED) certification is a major mechanism for implementing green building practices. In order to gain this certification, buildings must adhere to certain qualifications, including limited or nonexistent non-green energy use and greener building practices. Dallas intends to gain LEED certification for its buildings by using high performance building enclosures as well as by downsizing some less efficient air conditioning and heating systems (City of Dallas, 2007). All public buildings over 10,000 square feet were required to attain LEED Silver Certification after 2003 and LEED Gold Certification after 2006 (City of Dallas, 2007). Achieving certification of these levels, the third and second highest ratings possible, will increase the efficiency of the buildings in question over other buildings of similar size that do not meet LEED silver or gold certification status.

Energy usage by buildings cannot, however, be solely defined by how efficiently buildings use the energy given. In order to increase the sustainability of Dallas buildings, the city is also attempting to increase the level of solar installations (City of Dallas, 2012). The change could allow the city to produce its own green energy and not have to pay another plant or operator to purchase the energy, and this locally produced energy could keep the city from purchasing or using non-green energy. Furthermore, the city began purchasing at least 40% of its energy from renewable sources in 2008 (City of Dallas, 2012). Through this program, the city can continue to be environmentally conscious even if it cannot produce all the energy it requires.

With respect to food, there are a number of efforts, ranging from development of more community gardens to development of a farmers' market that has been going strong for 60 years. DFW Community Gardens and Gardeners in Community Development are the leading organizations for community gardening in the area, and the latter is also a major contributor to local neighborhood greening efforts. Community gardens not only provide nutritious and pesticide-free local food to the areas where they are located, but they also support community building and the encouragement of sustainable food initiatives in the city in general (DFW Community Gardens 2011). This element of local food systems in Dallas is a rapidly growing part of daily life for many citizens because there are now more than 50 community gardens in the greater Dallas-Fort Worth area, most of which developed over the last few years. Another important development is "Greenling," an online order-based form of community-supported agriculture that provides customers with organic, locally grown produce from sustainable farms, delivered to their door (Greenling 2013). One of the best known local food organizations is the Dallas Farmer's Market, which has been an essential part of the downtown Dallas area for 60 years and is one of the biggest public markets for local food in all of the U.S. (Dallas Farmers Market 2013). There is a wide variety of foods available for purchase at the Dallas Farmer's Market, and even with its commitment to encouraging consumers to "buy local," the market still attracts farmers from up to 150 miles away, as they come to sell their fresh, organic produce. Finally, local organic food is also used by Dallas restaurants in their recipes, such as by Bolsa, which uses local goat cheese and tomatoes in its flatbreads (CBS DFW 2011).

Recycling, reuse, and waste management have been integral components of the Dallas Sustainability Plan. The city of Dallas and surrounding inner suburbs offer various types of waste collection and reuse as well as recycling programs. However, some services are only available to residents of specific cities or select areas within the county (Collin County, 2013). The city developed an e-cycling program that allows its residents to access recycling options online (Visit Dallas, 2013), and it also launched the "Too Good to Throw Away" Recycling Program in the beginning of 2007. The goals of this program were to offer single-stream recycling that collects recyclable material from the residents

and to turn the recyclable trash into reusable treasures (Dallas City Hall, 2006). There has been steady increase in recycling participation among the residents: from 20,000 tons of materials in the fiscal year 2006-2007 to nearly 30,000 tons in the FY 2007-2008 (Green Dallas 2008). During the 2009-2010 fiscal year, the City of Dallas collected 40,000 tons of recyclable products, which were recycled at Green Star in Garland and generated \$2.3 million for the city (Gillett, 2011). The recycling volume peaked last fiscal year as the city collected more than 51,000 tons of recyclables.

Transportation has been a more difficult area for sustainability initiatives because residents of Dallas rely heavily on cars for transportation. Several programs to provide alternate methods of transport or reduced use of cars have been initiated, and the sustainability plan developed by the Transportation and Environment Committee of Dallas has also started to reform transportation in order to improve air quality. The plan aims to increase alternative commuter options and to reduce emissions from industry due to idling vehicles (Dallas City Hall, 2012). The city will also encourage greater use of bicycles and mass transit. The Dallas Bikeway System Master Plan and the City of Dallas Trail Master Plan have established the goal of a system of 230 miles of trails open for biking or hiking that connect to the bus system in convenient places. The Dallas bus system has also seen a shift towards sustainability, with 41% of the fleet—2,000 buses in all—operating on alternative fuels and plans to incorporate electric vehicles into the system (Green Dallas, 2013). However, the Flyer Fryer outdoes the bus fleet as possibly the most energy-efficient bus driving around Dallas. The school bus runs on cooking oil donated from restaurants or residents and converted into a biodiesel fuel. Not only does it use an alternate form of fuel and save the school district \$400,000, but it also impresses on students' minds the importance of energy conservation (Montagne, 2009).

Although there has been a push to use public transit, the use of vehicles is still the most widespread method of transportation. HOV lanes are the traditional means of consolidating traffic; however, when these lanes started taking up much needed highway space, a new tolling system was developed that encourages carpooling. Still in the construction phase, the tolling system is designed to allow cars with more than one passenger to pay half the regular toll rate, only during peak traffic hours, and it would replace the use of HOV lanes on Interstate 30 (Dickinson, 2013). Carpooling is also made more accessible by vanpooling services such as DART, TRE, and DCTA, which allow people to rent a van to carpool at affordable rates (Dallas City Hall, 2013). There is an increase in electric vehicle charging stations that makes ownership of an electric vehicle more plausible, and there are plans to build more charging stations at conveniently accessible locations. The company Ecotality with the U.S. Department of Energy has set in place the EV Project, agreeing to donate \$25 to the Texas Tree Foundation for every electric vehicle test driven at certain dealerships, and they have set up 17 Blink charging stations throughout the city (Caceres, 2012). TXU Energy is encouraging the move to electric vehicles by negotiating with the City of Dallas to build 6 more charging stations around the district (Green Dallas, 2013). North Texas Green and Go Partnership helps connects customers to taxis that offer green cabs, hybrid or electric vehicles instead of diesel-based, upon request (North Texas Green and Go, 2013). These methods all encourage the use of electric vehicles by making them more accessible and reasonable to the public.

Despite all the programs geared toward sustainability of resources, Dallas has spent more of its budget for transportation on fixing highways than on encouraging alternate methods of transport (Texas Department of Transportation, 2013). One such project, the Horseshoe Project, will use \$818 million to create smoother roads, more efficient routes, and more lanes. Although the project will help to limit waste due to idling vehicles, it shows that to date the main focus of transportation changes in the city is on increasing the efficiency with which gasoline is used instead of leading a full transition away from petroleum-dependent transportation. Although Dallas has not made steps to completely transition away from automotive transportation, it is working to increase community involvement by facilitating bike, bus, and electric vehicle programs.

Although there is no formal plan for the greening of businesses in the Dallas, the Dallas area has begun to embrace the idea of greening of businesses. Companies in the city see investments in sustainability “as a way to recruit and retain good employees, build a reputation as a corporate citizen, and save money on energy and water usage” (Dallas News, 2013). The web site Green Source DFW provides a comprehensive source of news and issues relating to green businesses in the Dallas-Fort Worth area, and it also promotes other sustainability practices. Green Source DFW also has numerous links to other green sites related to the Dallas area (Green Source DFW, 2013).

Two interesting cases of green business in the city are the State and Allan Lounge and the Fairmont Hotel. The former is the only restaurant in Dallas to be a “Certified Green Restaurant” by the Green Restaurant Association. In 2009 the State & Allan recycled 67,604 tons of materials. The restaurant also ran a program connecting local community gardens with the lounge by exchanging restaurant foods scraps to be used as compost for fresh vegetables (State & Allen, 2013). The Fairmont Hotel undertook a \$10 million renovation with the goal of reducing the carbon footprint of the hotel. By the front entrance, where 36,000 vehicles pass each year, they have planted local plants to convert emissions from the cars to oxygen. On the roof of the building there is also a 3,000 square foot garden that provides vegetables for the restaurant in the hotel (Dallas News, 2013).

The main contributor to Dallas’s green energy initiative is the city’s commitment to purchase forty percent of the city’s electricity from renewable resources. Currently, Dallas is among one of the top purchasers of green energy and is ranked fourth on the EPA’s “Top 20 Local Government Partner List” (City of Dallas 2013). This energy is purchased in the form of Renewable Energy Credits of up to 40% of the city’s annual usage. The credits are a way to guarantee to the businesses that produce the renewable energy that there will be someone to buy it. This makes it less risky for renewable energy producers to continue to produce it (City of Dallas 2013). In addition to purchasing renewable energy, the city continues to explore new technologies and methods to lower the city’s carbon footprint. One of these methods is Dallas Water Utilities began operating a Cogeneration Facility in 2011 to burn methane produced during the wastewater treatment process for the production of electricity. That year this facility produced around 26 million kWh of renewable energy, which reduced carbon dioxide emissions by around 34,000 tons (City of Dallas, 2013). In general, the city’s primary goal with regards to energy are to continue to explore new technologies, “keep Dallas on pace to reduce energy use by 5 percent per year over 2007 levels, maintain a 40 percent level of renewable energy purchase and help it become one of the greenest cities in the nation” (Stowers 2013).

### Green Spaces and Green Buildings

Although Dallas has been making strides in all forms of environmental and sustainable development, two areas stand out as the city’s best practices: green spaces and green buildings. Green spaces are essential to the general greening and environmental awareness of urban Dallas. Additionally, they can also help with temperature control in the city, and they serve as community gathering centers that encourage all generations to support the environment and come together to enjoy a break from all the buildings and other urban features that constantly surround them. By also working on green building practices, Dallas is emphasizing the reduction of wasteful resource and energy use in building construction and also the building’s post-construction processes, such as for commercial purposes.

Since 2000 there have been various efforts to add to the green spaces in Dallas. In 2004 the Downtown Parks Master Plan focused on reducing (and hopefully reversing) the urban heat island effect, which results in “[increasing] temperatures and [is] created by the construction of heat retaining structures such as roads, dark colored roofs and clear-cut areas” (Green Dallas, 2013). This plan very effectively accomplished the goal with the development of three major parks, the last of which opened in 2010: Woodall Rodgers Park, the Belo Garden, and the Main Street Garden. Another park, Klyde Warren, is a 5.2 acre urban green space located in the heart of Dallas (Klyde Warren Park, 2012). It is

very effective in serving as a community gathering location and as a source of relief from the heat of the city center. After its opening in 2012, the park quickly attracted large crowds, in addition to proving to be a success in expanding the green space inside the city.

Dallas also hosts two programs that assist in the maintenance of the quality of the parks. The city provides 1875 training hours per year to educate city employees about the methods of keeping the city's green spaces in their best possible shape throughout the year. Another training program, "It's My Park Day," has Dallas area citizens "adopt" a park that they enjoy visiting for a day of community service in which they "participate in beautification, recycling and clean-up projects that included litter and debris pickup, graffiti removal, weeding, mulching, and plantings" (Green Dallas, 2013). Although it is only a biannual event, occurring in March and September, it has a significant impact on preserving the green spaces which Dallas is making such a large effort to emphasize in their sustainability efforts. These maintenance programs are effective in that they take care of the parks and other green spaces in and around the city, but they also remind the citizens of the importance of their own efforts in conserving their local green spaces.

The universities have played a unique and exemplary role for the city in greening the built environment. The major universities in the Dallas area—Southern Methodist University (SMU), University of Texas at Dallas (UTD), and University of North Texas (UNT)—recognized the importance of integrating the campus into the community and creating more green spaces for the students and the neighborhood. UTD worked with PWP Landscape Architecture to develop a multi-phase campus enhancement project. The project aims to transform the campus into a bike and pedestrian-friendly environment by "cut[ting] the pavement by half" and by incorporating more green spaces for a more park-like campus environment (U.T. Dallas, 2013). Phase I of the project added a series of public spaces, pocket parks, walkways, and water features to the central portion of the campus. Phase II of the project began in December 2013, and it will continue the greening of the campus (Landscape Architecture Foundation, 2013). The university also received \$1 million donations to sustain the 5,000 newly planted trees and native plants, fountains, etc. Unlike the growing UTD, SMU is known for its beautiful landscape. In addition to a planned tennis complex, a 2-acre pocket park will be built to provide green space that serves both the university and the neighboring community (Repko, 2013).

Universities also play essential roles in urban development, especially in the greening of architectures. The government and university create alliances to transform the built environment and construct more sustainable buildings on college campuses. UTD's new Student Services Building was awarded LEED Platinum status in 2011. The building showcases environment-friendly and innovative features, such as solar thermal water heating and the use of greywater in low-flow water fixtures (U.D. Dallas, 2013). In addition to renovating the old buildings to meet sustainability standards, new SMU buildings are also built to meet the standards established by the U.S. Green Building Council's LEED program. The university also encourages the students to conserve energy by putting energy consumption of each building on campus on display at SMU's Building Dashboard website (SMU Sustainability, 2013).

As mentioned earlier, green building initiatives constitute the other best practice in the city of Dallas. The main green buildings goal is to have every new municipal building that is over 10,000 square feet receive a silver LEED rating when it is built (Visit Dallas, 2013). This is an important step to creating more environmentally friendly buildings that use less energy, are more sustainable, conserve water, utilize resources well, and are less wasteful in general. All of these concerns were driving forces behind the Dallas Green Building Program, which was one of the first programs of its kind, and it has already led to success with LEED buildings. In fact, the city already has achieved a number of buildings with both gold and silver ratings and even a few structures with Platinum ratings (Green Dallas, 2013). Every effort and push towards creating greener buildings and greener residential construction has been an

important step in terms of establishing a precedent for the significance of green building initiatives in Dallas, as it remains at the front of the pack for large cities in this category.

In summary, Dallas's built environment has improved significantly over the past few years because of its efforts to create more green space as well as to meet the LEED standards in the design and construction of new buildings. City Forestry programs are currently in place to promote tree planting projects and to transform the undeveloped areas into pedestrian-friendly parks. Dallas has also completed a number of green facilities since the adaptation of Green Building Program in 2003 (Green Dallas, 2013). In recognition of the city's sustainability efforts, Dallas is named as one of the greenest cities in the U.S.

## Conclusion

In summary, Dallas has made progress with its sustainability efforts, but there are both strengths and weaknesses. Unlike some cities, Dallas does have a sustainability plan, and it is fairly comprehensive. Some cities have a very narrow focus when it comes to sustainability, but in Dallas essentially every aspect of sustainability is included in the plan to green Dallas. The one sustainability aspect that is not included in that plan, the green businesses, is thus one of Dallas' weaker practices. The green businesses that exist in the Dallas area very good, but there is no general initiative in the city to develop the plan. Likewise, the city is heavily reliant on automotive transportation, and the public transportation system, when used, relies mainly on fossil fuels. Nevertheless, there is a plan in place to attempt to green the Dallas public transportation system.

The strengths of Dallas' sustainability efforts lie in the realms of green buildings and green spaces, which help Dallas become a greener city, as well as a better place to live in general. The number of new parks that have been added is impressive, as is the effort to develop energy-efficient buildings. Because Dallas is such a sprawling city, it is easier for them to create more green spaces in their city than places such as Boston or Paris, which are much more densely populated. However, this emphasis on green spaces could be replicated in other fast-growing cities such as Atlanta or Charlotte. Unlike the green spaces, which are easier to implement in faster-growing areas with low building density, Dallas' attention to green buildings could easily be duplicated in any city in the world that is willing to devote the resources to developing these green buildings.

For Dallas to become an even more sustainable city, it will have to emphasize the importance of green businesses, as well as implement and carry out plans to help green transportation within the city. In the end, it all comes down to the Dallas citizens. For this to be an increasingly sustainable area, the citizens in Dallas are going to have to support and encourage action that reflects the intent of the Sustainability Plan. The citizens will need to do things such as use more public transportation, buy more local food, and attempt to consume less non-renewable energy. The sustainability of a city is only as effective as the desire of the citizens to live in a sustainable city.

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## Transportation Practices in Denver's Sustainability Initiatives

By Partha Reddy

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Sustainability initiatives around the world maintain common interests; they increase efficiency and promote a healthier living environment. Often times, however, the social climate is not supportive of such practices. In contrast, the government of Denver has a strong backing from its people, and policy is directly affected by this positive social environment. Therefore Denver has the right tools to become a leader in sustainability practices. The City of Denver's sustainability efforts are channeled through the Greenprint Denver plan. The former mayor of Denver, John Hickenlooper, created this overarching city sustainability program in 2006, and the effects and accomplishments are being tracked through this current year. The strength of Denver's Greenprint plan is the ability to encompass organization and singular governance, yet the lack of innovation and use of newer technologies and ideas to promote sustainability prevents Denver from being the leader. Denver is establishing itself with the promotion of energy, land use, transportation, waste, and community integration initiatives.

In this next part of the discussion, Denver's major energy initiatives, land use, waste management programs, and food programs will be discussed. From there, a full analysis of Denver's best sustainability practice, a multi-modal transportation system that includes a biking program, a mass transportation system and a city fleet will be investigated. To conclude the critique, there will be a retrospective examination of the practicality and portability of the Greenprint Denver plan.

### Practices of Greenprint Denver

Energy initiatives in Denver are focused on solar energy and greening the city fleet. Solar energy is an important aspect of the Denver sustainability initiative, especially because Denver has the fifth greatest solar potential in the United States, with over three hundred sunny days on the calendar. Solar initiatives are funded extensively by the government, and over the past five years, major construction projects and buildings contain massive solar arrays. The Denver International Airport, the Museum of Nature and Science, the Colorado Convention Center, and multiple public schools are homes to these arrays. The public display of these impressive energy creators funnels public opinion towards solar energies. The greening of the Denver fleet is labeled the Green Fleet. Hybrid, fully electric, biodiesel, and CNG vehicles compose the government's fleet. The idea behind this program is that energy independence and conservations starts from the top down. This practice ties in with the transportation initiatives of Denver, which will be discussed later. (Greenprint Denver)

The Greenprint Denver plan also focuses on capitalizing on Denver's beautiful landscape. Denver has included 9 of 10 sustainable zoning code categories from a recent EPA report to ensure on a logistical level that it is up to date. Furthermore, the Mile High Million program is working to incorporate one million new trees in metropolitan Denver area by the year 2025. An additional greening initiative is Tree by Tree. Unlike Mile High Million that promotes city planning organization, Tree by Tree is completely focused on community integration. By using neighborhoods, schools, and other community oriented staples of society, the Greenprint Denver plan is pushing its land use policies to the individual basis. In this manner, politicians and their constituencies are on the same political and social

level, which greatly enhances the probability of widespread agreement on legislation. (City of Denver 2009)

The City of Denver has made vast improvements in both waste management systems and food initiatives in the past few years. Denver prides itself on being a sustainable city, but has struggled with massive amounts of landfill and dealing with recycling and compost. The GreenPrint Denver plan issued in 2006 has dealt with these issues and the effects will be examined later. Additionally, food programs have been addressed with the highest of effort through organizations such as a Denver Urban Gardens and Grow Local Colorado.

Landfills, while not the most threatening environmental effect, play a large role in Denver's initiatives. In fact, the Rocky Mountains have the highest landfilling rate in the country at eighty eight percent of waste (City of Denver 2009). The Greenprint Denver plan, not only offers some of the basic rebuttals to landfilling like recycling and composting, but also gives innovative and practical techniques like minimizing junk mail and precycling. Junk mail actually accounts for the destruction of about one hundred million trees, and increasing awareness can significantly reduce landfill mass and environmental spill over. Precycle in theory is quite easy: select materials and objects for purchase that are recyclable. By simply taking five extra seconds at the supermarket, an individual can significantly decrease waste going to landfills.

Recycling in Denver, while not a novel idea, is highly organized and very effective. Denver's public recycling is run through Denver Recycles. The organization has created a "Go Purple" initiative that uses a unique and popular purple design of recycling bins and containers to motivate a city-wide push. One can easily check their household's availability on Denver Recycle's website (City of Denver 2011). Accessibility and organization is key, and Denver has established both of these. Coupled with this recycling initiative is Denver Composts, an equivalent organization that uses green bins and containers to promote and create easy composting practices. Composting is essential for Denver to complete its sustainability efforts since approximately fifty eight percent of the material dumped in landfills is organic. (City of Denver 2009) If composting on an individual basis is desired, one can simply visit [www.dug.org](http://www.dug.org) to sign up for free lessons. (City of Denver 2011, Denver Urban Gardens 2010)

Food programs in Denver revolve around community gardens and food banks. Two types of programs exist in Denver, one with private organization and another public. Grow Local Colorado is a private initiative that offers a meeting place for individuals who would like to be matched in a community garden or a food bank philanthropy. The organization offers seven food banks and six community gardens that are encompassed by Grow Local Colorado. Although the organization partners up with the Denver Parks and Recreation Department, it remains a totally volunteer based project that fails to envelop the whole city. DUG, Denver Urban Gardens, on the other hand, is the supplement to the local initiatives that creates overall organization and a situated program. DUG takes the community garden initiative to a wider population and has government affiliation to provide substantial benefits. (Denver Urban Gardens)

Even though Denver lacks in innovative sustainable practices of waste management and local food initiatives, the overall organization and widespread use of the techniques that the city has instituted is a success story in itself. Denver's waste management programs are all sustained under the government eye. Additionally, food programs are maintained more thoroughly through DUG and Denver's government although a strong local presence is still felt. This encompassing efficiency allows Denver's government to create impressive sustainability measures.

## Transportation

Denver prides itself on its long-lasting transportation initiatives, which are the city's most effective area of greening. In fact, Denver has shown a dedication to greening the city's governmental fleet of vehicles since 1993. This early determination has put Denver on the required path towards

transportation success. Using the former Mayor John Hickenlooper's GreenPrint Denver plan, Denver has continued to show its leadership of clean and efficient transportation by pursuing green government vehicles, enabling bike use, and creating an overarching mass-transit system.

The Green Fleet is one of Denver's proudest achievements. Perhaps this early determination to green the government has propelled Denver's overall environmental sustainability initiative: "Since the early 1990s, Denver has been on the cutting edge of environmentally-conscious urban technology, and has remained committed to ensuring that the city is as "green" as a city can be. Nowhere is this commitment more apparent than in Denver's Green Fleet" (Visit Denver 2011). The introduction of greener technologies over time to the Denver government has had a positive effect on the citizens of Denver, who are encouraged by the initiatives of their leaders and government programs. Hickenlooper himself can be seen driving a Ford Escape hybrid SUV (City of Denver 2009). Although most vehicles use a B20 biodiesel, the breakdown of all vehicles still includes hybrids, propane, electric, and CNG energies (Visit Denver 2011). This is most likely a realization of the different layers of energy initiatives in Denver's long history of greening its fleet.

Denver's bicycle program has been a large success in the last five years. Operating under Denver Bike Sharing's non-profit charitable organization, B-Cycle is a comprehensive urban biking share system. At the request of Hickenlooper, B-Cycle still operates independent of the government. The government actively encourages the use of bicycles in the city of Denver: "The Bicycle Commuter Act of 2008 allows for up to \$20 in taxfree benefits per month for employees who bicycle to work" (DenverBikeSharing). According to {bike-sharing.blogspot.com}, Denver was the first American city to create such an expansive bike sharing program within the United States. New York and Boston are both operating with a bike share system opening in 2012. Denver is embracing this change and is promoting the use of bikes: "The city now has 62 miles of trail, 43 miles of bike lanes; 21 miles of sharrow (an on-street bike route); 400 miles of signed bike routes"... and will have "50 stations and 475 bikes in system by October 15" (City of Denver 2009).

The final piece to Denver's transportation solution is FasTracks. This light rail mixed with commuter rail transportation system is a few years under way. Unfortunately, the program is working with a cost overrun of about two billion dollars. With about 119 miles of new rail added to Denver's existing rail, FasTracks is likely to transform the city's transportation system. Because Denver has a problem with sustaining a dense city in terms of population, a commuter rail will surely solve these woes, if not ameliorate them (City of Denver 2009).

Now that Major Hickenlooper is out of office, the citizens of Denver must look to new leadership for energy innovations. James Mejia, a candidate for the mayor position in Denver, provides insight on the sustainability programs of Denver in an article in the *Huffington Post*. His focus stays on the transportation practices mentioned and his plan, if elected, is to capitalize on these major successes in the city (Mejia2011).

By promoting a bike share program, light rail, and the Green Fleet, Denver clearly uses a multi-modal transportation system. In fact, this is one of the goals that is laid out in the GreenPrint Denver plan to promote lasting sustainability. The ability to give an option of clean transportation is unique in Denver and a recent but important trend in sustainability talks.

## Conclusion

The GreenPrint Denver plan has had lasting success for the past five years. The plan builds upon the strengths of Denver as a city and has achieved many of the goals it has set out to achieve, whether it is achieving LEED certifications for buildings or drastically improving air quality. The ability to have a highly organized government that overlooks all aspects of the greening process has led to a highly efficient green machine. Transportation systems have been far and away the most effective initiatives,

yet Denver's highly centralized waste management programs, solar energies, and food programs are all laudable.

Despite all the successful attributes the GreenPrint Denver plan can claim, the plan is in its final year of creating initiatives. While some projects are still in the works like the FasTracks network and a few solar arrays, many of the projects have been long accomplished. Denver Recycles and Denver Composts, the Denver B-Cycle program, and the Denver Green Fleet are all programs that have been thoroughly integrated. There is room for improvement of these initiatives, however, Denver must act soon and reinvigorate the city to capitalize on this recent success. With a social climate that promotes sustainability, Denver can easily remain a leader in sustainability. The citizens of Denver are staunch supporters of the initiatives that the local government is trying to promote (Mejia 2011).

Even though Denver is a unique city with inherent characteristics, its similarities to other Rocky Mountain cities cannot be avoided. Issues such as correcting waste and public transportation remain common in many cities in the area. Thus the "Balanced Energy Capital of the West" has a plan that can be transplanted with editing into other city's sustainability legislation. Denver's transportation model can be quite easily used in many other cities that are lagging in the sustainability policy area. (Weathersbee 2008)

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## Green Businesses in Ithaca

By Beau Baldwin, Jamie Braunstein, Alma Farooque, Daniel Rubin, Henry Strohm

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The city of Ithaca is located in central New York within the Finger Lakes Region, and it has a growing population of just over 30,000 people. The city and the surrounding area contain scenic treasures such as rolling hills, forests, deep gorges, and waterfalls. Located at the southern tip of Cayuga Lake, Ithaca's lake helps temper the summer's heat. Ithaca is most known for being home to two large schools, Ithaca College and Cornell University, which attempt to improve the sustainability of the city with their own campus sustainability programs. Because the city is focused on these two colleges, it is in many ways a typical American college town. For example, the city contains businesses such as bookstores, art house cinemas, craft stores, and numerous local restaurants, while residents also strongly support the Ithaca Farmers Market. Even with much success for various sustainability initiatives, Ithaca still faces challenges. For instance, about 44 percent of the residents of the city live under the federal poverty rate, and there is a housing shortage in the city (Pereitsvaig, May 2012).

Ithaca is one of the strongest cities in the nation when it comes to sustainability efforts, in large part because of the support the city receives from the students at its two colleges. Although Ithaca already contains many parks, the city has worked to increase green spaces and community gardens. Ithaca also seeks to make improvements in green buildings by developing LEED-certified local buildings, energy efficiency, and renewable energy. Also, Ithaca's strong public transit system offers college students and residents a good alternative to personal vehicles. Ithaca has also made a conscious effort to develop local food networks and to establish institutions that will help recycle waste. Although the city of Ithaca is very strong in all of these areas of sustainability, we will focus on its local and green business initiatives. Local First Ithaca, the Downtown Ithaca Alliance program, and the local currency Ithaca Hours are all very effective in maintaining and developing the local economy by keeping money within the community.

This study will begin with an overview of Ithaca's sustainability plans and its programs and initiatives in several areas, including green spaces, green buildings and energy, public transit, local food, and recycling. Then it will focus in detail on analyzing the green and local business programs. The conclusion will assess the business programs and their potential portability to other cities.

### Overview of Sustainability Programs and Efforts

The town of Ithaca has developed a sustainability planning process called Sustainability Goals for the Town of Ithaca, which of five foci: a greenhouse gas emissions inventory, climate action planning, comprehensive planning, resolutions, and public education and engagement (Town of Ithaca, 2013a). Although the plan is very broad, it includes specific goals within the areas of green spaces, green buildings, energy efficiency, transportation, food, recycling and waste, and green businesses associations.

In coordination with the town's general sustainability plan, various committees, organizations, and companies have developed specific goals and initiatives to solve a variety of environmental issues. For example, a major goal in the area of greenhouse gases is to reduce carbon dioxide emissions from government operations by 30% by 2020 and 80% by 2050. Major initiatives include greening Ithaca's bus fleet, the TCAT (Tompkins Consolidated Area Transit), and increasing pedestrian and bicycle traffic.

Ithaca's green spaces and parks are plentiful and mostly connected by the Cayuga Waterfall Trail, and preservation of clean water and gorges is very important. Furthermore, Ithaca promotes local agriculture through its large farmers' markets, which attract thousands every day. In terms of energy efficiency, Ithaca is working towards implementing solar energy systems on a larger scale (Town of Ithaca, 2013a).

Ithaca's green spaces are mainly focused on its water resources, with special attention given to the city's famously beautiful gorges and the lake. A main goal for the city is to finish the Cayuga Waterfront Trail, a foot and bike path that connects Ithaca's downtown with the city's green spaces on the waterfront. The intention of this path was to increase the preservation of the waterfront by creating pedestrian traffic in green spaces and raising citizen accountability for keeping the space clean. In addition, the trail connects important commercial areas, including the Farmer's Market. The trail is currently through two phases of construction, and is on pace to be completed by October 2013 (Sustainable Tompkins, 2012). Also, Ithaca is working to implement community gardens throughout the city in order to promote local food and a tighter-knit community. For example, Project Growing Hope is a membership organization, which attempts to further community food self-sufficiency through a project called Ithaca Community Gardens. Members are allowed to maintain their own garden plot, use the garden tools, manure, and compost, as well as take part in and organize educational workshops and social events (Ithaca Community Gardens 2013). Project Growing Hope has successfully plotted over 150 community gardens throughout the city.

The greening of buildings has not always been the most prominent area of urban sustainability policy in Ithaca; however, the Ithaca Green Building Alliance (2013) has helped to make the issue more prominent. The non-profit organization strives to foster a sustainable environment and community via an emphasis on the development, construction, and design of local buildings. Every year this organization hosts the Green Building Open House in Ithaca, attracting visitors to a number of Ithaca's finest green buildings (Ithaca Green Building Alliance, 2013). The open house showcases both commercial and residential buildings, many of which are LEED-certified, and fosters sustainable living in Ithaca by spreading awareness of green building opportunities.

Ithaca is also home to three ecovillages that assumed basic sustainable design concepts in their constructions (Amanda Coen, 2011). These ecovillages offer community supported agriculture (CSA) vegetable and berry farms, office spaces for cottage industry, and community gardens and a variety of natural areas. The designers have planned for over 80% of the 175 acres to remain green space. The ecovillages also offer residents common dinners several times per week. Residents volunteer about 2-3 hours per week to maintain their ecovillages through outdoor maintenance, finances, governance, and more (EcoVillage at Ithaca, 2013).

Although it may not be Ithaca's best practice, energy efficiency is one of the city's strongest initiatives. In 2007 the city signed a fifteen-year Energy Savings Performance Contract (ESPC) with a company named Johnson Controls, Inc. This contract identified and implemented a variety of energy conservation measures, such as lighting upgrades, automatic temperature controls, and high-efficiency furnaces, at facilities owned by city without any extra expense. Only six years into the contract, it is estimated that Ithaca has saved over \$500,000 in energy costs, over two million kilowatt hours of electricity, and approximately 1500 metric tons of carbon dioxide (Town of Ithaca, 2012a). Other energy efficient projects in Ithaca include replacing all city-owned traffic lights with LED bulbs and the use of Warm-Mix Asphalt Technology, called Low-Emission Asphalt. As a college town, energy efficiency has also improved on campuses. For example, Cornell joined the Building Energy Conservation Program, which is an aggressive campaign that works to reduce energy consumption across campus mainly through behavior change (Cornell University, 2013).

In addition to energy efficiency initiatives, the city has also developed its renewable energy sources. For example, the city installed a geothermal heating and cooling system at the Ithaca Youth

Bureau building and solar thermal hot water systems in the Cass Park main building and the Streets and Facilities building. In 2012, Ithaca joined EPA's Green Power Partnership program, obligating the town to continue to look for and support renewable energy sources (Town of Ithaca, 2012b). Ithaca also plans to purchase 100% of its electricity consumption from renewable energy sources by signing a different contract with Integrys Energy Services of New York, Inc. By purchasing these Green-e Energy certified renewable energy certificates for all of its electricity use, Ithaca will offset approximately 5,000 metric tons of carbon dioxide emissions annually (Environmental Leader, December 2011). Solarize Tompkins is a group-buying solar energy program that makes it easier for homeowners and businesses to install solar panels by working to reduce the costs and other existing barriers to these solar installations (Town of Ithaca, 2013b).

Ithaca has recently concentrated on the goal of greening public transportation. As a small college town, everything in Ithaca was built to be within walking or biking distance of Cornell University, Ithaca College, or downtown Ithaca. Many of the efforts toward greening transportation have focused on implementing safer bicycle paths and pedestrian walkways alongside major roads. This has been a focus of the city for more than a decade, and there is now a whole grid of "shared roadways" aimed at supporting bicyclists, and there is also a large network of foot-trails in heavily traveled areas. However, because the colleges are located on hills, it is also convenient for students, staff, and faculty to have access to public transportation. Ithaca has made major steps towards greening its bus fleet by buying over a dozen hybrid vehicles and purchasing small amounts (17 tons) of biodiesel fuel for public and private use. City officials will increase the amount of biofuel purchased in future years if it proves to aid greatly in the greening of the city (Town of Ithaca, 2012c).

One of Ithaca's most prominent initiatives is its local food, and the centerpiece of local food in Ithaca is the city's farmers' market. Opened in 1973, it has come a long way in the Ithaca community with 150 vendors located within 30 miles and around 5,000 visitors per day (Ithaca Farmers Market, 2013). Many of Ithaca's restaurants purchase food from the farmers market, as it is an unparalleled source of fresh, locally grown food (Bickell, 2010). A central part of the community, the market is open eleven months out of the year, allowing it to foster effectively the city's local agriculture and bolster its local economy (Town of Ithaca, 2012d). Furthermore, the market tends to Ithaca's sustainability goals by decreasing non-local food based carbon emissions and food transportation fees and by assuming a zero waste program, in which the market manages and reuses its unused materials and turns all of its garbage into compost for the community's use (Ithaca Farmers Market, 2013).

With respect to waste and recycling, the Finger Lakes ReUse center offers an extensive reuse and refurbishing program as well as deconstruction services. This deconstruction program is especially remarkable in that it prevents 70-90% of old building materials from going to landfills. The ReUse center also accepts donations of old furniture, appliances, building materials, miscellaneous household items, and computers and electronics for sustainable reuse, remanufacturing, and resale. Furthermore, it provides low-cost tech support and repair, and it offers the community employment opportunities, while also being a nonprofit business itself (Finger Lakes ReUse, 2013). For city-wide recycling, Tompkins County Recycling and Solid Waste provides curbside recycling and a drop-off Recycling and Solid Waste Center that also accepts food scraps for compost, hazardous waste, and large-scale waste items (Tompkins County Solid Waste, 2013).

In summary, Ithaca has seen a dramatic improvement in its sustainability initiatives. For a small city of 30,000 people, it has an impressive array of urban sustainability programs.

#### Local and Green Business Associations

Although Ithaca has an extremely well planned out green initiative, the local and green business associations are its most well-known sustainability initiative. There are multiple organizations that promote the importance of local businesses and their sustainability efforts. Local businesses are

extremely important in a sustainable society because they build a sense of community and encourage people to interact. The local economy is a key factor in a sustainable urban society, and local businesses increase the amount of money that recirculates within the community. Local initiatives in Ithaca, such as Local First Ithaca, Ithaca Hours, and the Downtown Ithaca Alliance attempt to develop the local economy, while many local green businesses strive for sustainability in their manufacturing and products.

Local First Ithaca works to bring people, businesses, and organizations together in order to create a successful local economy. Local First Ithaca is an example of an inclusive network of independent, locally-owned businesses and services, farmers, non-profits, and community members. Additionally, the organization is a network affiliate of BALLE, the Business Alliance for Local Living Economies. BALLE works to increase the need for local owned businesses and services and also to promote a more just and sustainable society. It offers effective models for campaigns and programs that educate communities about the economic, social and environmental benefits of supporting local and independently owned businesses. Local First Ithaca collaborates with existing local groups that are working towards similar goals to multiply its impact. For example, it supports local businesses through group promotion, market development, and sustainable business practices. LFI also provides a voice for small businesses to influence the governmental issues that affect them directly by advocating for policies at the local, state, and national level. Finally, LFI keeps more money within the community by offering events and other programs that build the local economic capacity and sense of community (Local First Ithaca, 2013).

Another important sector of green businesses in Ithaca is Ithaca Hours. Ithaca Hours is a local currency system that promotes local economic strength and community self-reliance in ways that support economic and social justice, ecology, community participation and human aspirations in and around Ithaca, New York. Ithaca Hours began to develop this form of legal currency in the town of Ithaca in 1991, and twenty years later there were over \$100,000 worth of Hours in circulation. Ithaca Hours has created a currency that is different than dollars, because it helps spending to recirculate in the community. By joining, Ithaca Hours converts your money into money that you spend with local businesses. Thus, the money stays in the town for the initial consumer to earn back and build the local economy. This is money based on sharing not scarcity, and there are hundreds of places and people in the neighborhood of Ithaca who want to do business with this form of currency. Ithaca HOURS are accepted just the same as US dollars at the Ithaca-area merchants and service providers. However, unlike US dollars, when people spend HOURS they know the money stay in the local community, keep circulating, and maybe even end up right back in their pockets. In order to keep money local, some local employers and employees have agreed to pay or receive partial wages in Ithaca Hours. In addition to LFI, Ithaca Hours builds community pride and connections, for over 900 participants publicly accept Ithaca Hours for goods and services (Ithaca Hours, 2006).

A related initiative is the Downtown Ithaca Business Improvement District, also known as the Downtown Ithaca Alliance, a non-profit organization that strives to revitalize, develop, promote, and manage downtown Ithaca. The organization attempts to preserve and develop the central downtown core as the region's main center for banking and finance, business and professional offices, government and community services, downtown residences, and as a retail destination highlighted by specialty shops, restaurants, arts and entertainment. The Downtown Ithaca Alliance serves people who live and work downtown, city and county residents, college communities, area visitors and tourists (Downtown Ithaca, 2013).

Apart from the initiatives that attempt to develop the local economy by keeping money within the community, Ithaca also supports numerous green businesses. For example, a local company called Sunbeam Candles offers natural beeswax, soy wax, and aromatherapy candles. The shop only uses renewable energy and is entirely powered by solar and wind energy. The company also ships packages

“carbon neutral” and takes part in an extensive recycling program (Sunbeam Candles, 2013). Another local business, Home Green Home, sells furniture and bedding products that are all 100% organic (Home Green Home, 2013). Both of these companies are Green America certified, showing that the businesses are being used to promote positive social change and are environmentally responsible. E2E Materials is a green manufacturing company that produces all types of household products. All of their manufacturing and products are petroleum-free, biocomposite material that is formed by a soy matrix and natural fibers. The products do not contain the carcinogen formaldehyde or any other toxins (E2E Materials, 2013).

## Conclusion

Ithaca has a well-developed and comprehensive plan for sustainability over the next decades. A main reason that Ithaca has been so successful in implementing green policies is that a majority of the community is behind the initiatives, with help from both students and administration at Cornell University and Ithaca College. While it is hard to compare Ithaca to cities with large populations, there is no doubt that the city has set a standard for other college towns to follow, regardless of location. Ithaca’s sustainability plan lacks very little and is a shining example of a few crucial green practices.

Ithaca’s energy efficiency programs are impressive, and the city also offers many forms of renewable energy, such as a very strong solar program (Solarize Tompkins). The town government has also committed to using one hundred percent renewable energy in the future, offsetting large quantities of carbon dioxide emissions. In another attempt to limit emissions, the city has begun to convert its bus fleet to hybrid vehicles, and it has also begun purchasing biofuel. Although this is typical for many urban transportation fleets, Ithaca has also worked to develop walking and bicycling options by constructing a waterfront trail that doubles as a route of transportation and a green space on Cayuga Lake. This path connects to the network of the city, including the small businesses downtown, community gardens, and the farmers’ market. An area for improvement in Ithaca would be to construct more green buildings, increase the number of ecovillages, and remodel existing buildings to meet LEED certification standards. Although Ithaca is lagging behind in green building production, the green business associations in the city are beginning to encourage changes. Green and local businesses are by far Ithaca’s most impressive practice, with a strong presence in building a strong local economy in Ithaca, using a unique payment method to support small businesses, Ithaca Hours.

Although green business associations in Ithaca are the city’s best practice, the practice itself is not completely portable, and it may not work well in other cities. In larger cities, it is harder to create a united network of support for small businesses, with more incentives for big box stores to come into town and to drive smaller locally owned stores out of business. For example, the Ithaca Hours program works perfectly in the city because college students and other residents buy into the program, and a large percentage of small businesses in the area accept the medium of exchange. However, applying such a system in most cities would be an incredible headache, as the demographic range of the consumer pool is much wider, and the sheer amount of businesses would be too overwhelming to get enough store owners on board to adopt the system. Already a leader in sustainability, it will be interesting to see how Ithaca can influence change in other college towns and like-communities in the future.

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## Sustainable Transportation in London

By Brooke Bartley, Becca Cunningham, Brandon Fross, Alex Perraud, and Christie Zettler

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The capital of and largest city in the United Kingdom, London has a population of 8,174,100. The population density is 4,542 inhabitants per square kilometer (11,760 /sq mi), more than ten times that of any other British region, a feature that encourages heavy use of public transportation (World Association of the Major Metropolises 2010). London is the 25th largest city in the world and the fastest-growing region across England and Wales in 2011 (Office for National Statistics 2012). The region has a temperate oceanic climate that is characterized by abundant precipitation throughout the year and moderate to cool summers. London generates approximately 20% of the United Kingdom's GDP with its largest industry being finance. Over half of the United Kingdom's top 100 listed companies and over 100 of Europe's 500 largest companies have their headquarters in central London. With this large population, ongoing population growth, and significant place in the world's financial industry, London has the need and resources to generate several green initiatives in response to the trend of developing sustainable practices.

London has long been a world/economic leader, and the city now has declared that it will also strive to be a worldwide example in sustainable and green practices. Although the efforts have just recently begun, London has made monumental strides towards making the city greener. Almost all aspects of the city such as business, transportation, green spaces, recycling, buildings, and food have started to be transformed. Among the many green initiatives that London has implemented, the most effective practices are within transportation.

In the following section, a general overview of the various sustainability efforts both currently in effect and forthcoming will be presented. Then, an extended analysis will be focused on London's best "greening" practice – its emphasis on greening transport within the city. Lastly, a conclusion will evaluate the key efforts discussed in the paper, summarize the strengths and weaknesses of London's current sustainability efforts, and discuss the portability to other cities.

### Overview of Sustainability Programs

This section will outline the programs and initiatives that London has committed to developing in areas such as green jobs, transportation, green spaces, buildings, waste management, and food, and how they plan on successfully promoting them. Although there is no one central initiative, the East London Green Jobs Alliance and the East London Green Grid Program have been designed to meet the needs of that specific facet of the city. London Mayor Boris Johnson has spearheaded this development of flagship green programs such as energy efficient building production, planting more trees, and promoting new waste technologies (Greater London Authority, 2012). In order to successfully carry out these plans, he has hired new staff to push these programs forward, such as an Environment Advisor. The Mayor commented, "Creating jobs and stimulating growth are my top priorities for the next four

years. A key part of this is my determination to deliver a world class quality of life and strong, healthy communities” (Greater London Authority 2012).

Green business has been at the forefront of London’s sustainability initiatives. From the year 2009 to 2010 an INNOVAS report on the city of London showed a four percent increase in green industries for a total of 9,000 companies providing 160,000 jobs for Londoners (Hessman 2011). Reports such as that one also portray the outstanding commitment the city of London has made to a more sustainable environment and to greater opportunities to create this environment through the increase of green industries and jobs. Of these industries the strongest were low carbon energy, finance, geothermal and solar energy, with carbon employing over 23,000 people (Hessman 2011). This drive to increase green job opportunities has continued with the creation of new plants and factories, such as the new solar modules manufacturing plant in East London (London Community News 2011). This plant alone resulted in the creation of 200 jobs for London residents, a byproduct of the Ontario Liberal Plan to create 50,000 clean energy jobs by the end of 2012 (London Community News 2011).

An example of the Mayor’s efforts can be seen with the East London Green Jobs Alliance—a coalition of trade organizations, NGOs, community based organizations and green businesses that have joined together to create green jobs for the citizens of East London (Rio+20 2012). They seek to help people acquire these jobs by providing training in green industries, as well as making the green jobs more desirable for workers through wage negotiation and equal opportunity. The East London Green Jobs Alliance is just one organization that represents the mission of the city of London to further its development of green initiatives, programs, jobs and industries.

London has set a goal to cut its carbon emission levels by 60 percent from its 1990 level by the year 2025 (City of London 2012c). The metropolitan government recognizes the necessity of transforming the methods of transportation within its bustling city if it is to reach this lofty goal; therefore, it has taken active measures to ensure that London stays at the forefront of the green transport movement. Ten different types of hybrid buses are in use, and each bus is tested to ensure that it cuts fuel use and carbon dioxide production by at least 30 percent from the amounts used and produced by standard gasoline-powered buses. In addition, five hydrogen fuel-powered buses have recently been added to the fleet, placing London on the cutting edge of new forms of green technology (Transport for London 2012a).

The city of London has also made attempts to encourage citizens to purchase electric cars. The national government already offers a grant which will pay for 25 percent of an electric vehicle, up to £5,000. The city government is attempting further to encourage this purchase by increasing the number of “plug in points” for electric car drivers (City of London 2012a). 1300 stations are set to be built in London by 2013, which will outnumber the gasoline stations in the city; an annual payment of £100 will allow an electric automobile driver unlimited charges at all locations in London. The local government hopes the accessibility and relatively low cost of this source of energy will make it more commonly utilized by its citizens, lessening the strain on the environment made by the numerous vehicles that frequent the city (City of London 2012a).

Green space in London consists of heaths, forests, gardens, commons, parks, and woods. The green areas in London, like in all countries, are being evaluated against a competing land use. The first overall assessment of these green spaces, in respect to health and welfare benefits, stated that they were worth £30bn a year (Harvey 2011). Many of the green sites in London are deemed of importance for nature conservation and biodiversity and are protected in the Westminster Unitary Development Plan, a plan which details future development of Westminster, and the Mayor of London’s Biodiversity Strategy, which aims to both protect and enhance these areas. Public parks and open green space are usually managed by contractors. These contracts usually put an emphasis on preserving ecological characteristics of the site, if only for economic purposes, but funding is slowly being cut to such public programs (BBC News 2010).

Some of the more famous green spaces in London are the eight Royal Parks which cover a total of 4883 acres (Hansard 2002). These parks are considered the Queen's property, but have been opened for public use. The largest green spaces are Watling Chase Community Forest, which covers 46080 acres, and Thames Chase, which covers 24,320 acres (Thames Chase Community Forest 2012). Both of these forests have large community organizations surrounding them. More recently, there are plans to replace the site of the 2012 Olympics with a large park covering 109 acres. The park, planned to open around 2014, will be built through £200m of the public's money and will just under two and a half miles long. Its purpose is said to be to both reduce London's carbon footprint and fight obesity (Booth 2008). Continuing efforts to maintain and build green spaces demonstrate London's efforts to keep up with the global trend of going green.

With respect to waste and recycling, London's recycling programs are not only widespread and efficient but the resources concerning the programs are also readily available and easy to use. Many areas in the city of London have different programs, each focusing on the importance of recycling in the local and global community (North London Waste Authority 2012b). In Camden, for instance, a new initiative just began, which includes a free and complete recycling kit, containing a kitchen caddy, an outdoor caddy, garden waste bags, paper and card bags, and an introductory supply of liners (Camden Town Hall 2012). The North London Waste Authority has encouraged many programs regarding recycling and waste-reducing efforts, including the Say No to Unwanted Mail program. London citizens have five different avenues through which they can stop the creation of unnecessary paper waste and dramatically reduce the printing of "junk mail," not to mention also eliminating the tens of pesky papers in their letterboxes each week (North London Waste Authority 2012a). By spreading this recycling program to other areas of London, the city could improve its green initiative with regards to recycling. Thus, in the future, there is much hope for a greener London through more recycling by using Camden's plan in other areas and, thus, creating a better, more eco-friendly London.

Another area of urban greening involves buildings. In the summer months of 2012, the whole world had its eyes turned upon the athletes of the Olympic Games hosted in London, England. As the city started to prepare for millions of viewers to be exposed to its rich culture and architecture, the heads of the Olympic committed realized the magnitude of the audience and the influence that London could have on them. They wanted to create a lasting impression, especially in how they sustainably constructed their athletic venues, to implant the idea of a green movement within every viewer across the world. Six weeks until the games, London made environmental changes in its architecture that will continue to influence the city and others for years to come. Because of urban sprawl more than 20% of London's outer urban areas that were supposed to be the centers for the Olympic venues needed renovation. The Olympic Park was one of the biggest green buildings built in East London for the games. This venue was complete with wind turbines, reusable structures, and a three-megawatt biomass boiler for more energy efficient heating and cooling. In the other sports complexes, the Olympic Delivery Authority made sustainability the primary goal. Starting from the ground up, the developers made sure to use low carbon emitting concrete, having to concoct special recycled materials into concrete mix. In the building of all the venues, all materials that were used were from recycled sources, and almost all (about 97%) of the construction bi-products were reused or recycled. In the Olympic Stadium, Aquatics Center, Olympic Village, and the Media Center, the infrastructures provided for birds and bats, giving them boxes in an attempt to protect the wildlife among the construction. Other green accommodations included toilets that used less water, reused water in the water complexes, and rainwater harvesting. (Natural London, 2012; China Daily, 2012; Action Sustainability, 2012)

London has also launched several other major green design initiatives. When the city hosted the Olympic Games, it launched the East London Green Grid program to connect the residences, shopping and commercial areas, and businesses with the rivers and new green spaces. The goal was to create a more attractive and environmentally and tourist friendly area and to show other developers how these

green changes could not only benefit the community environmentally but also economically, encouraging more green infrastructure changes such as green roofs. (Greater London Authority, 2012; Natural London 2012). In 2002, London launched a new program calls the “The Bed ZED project” — Beddington Zero Energy Development. Not only did the program aim to reduce the carbon emissions impact by residents, but it also wanted to reduce poverty in that area. The new housing has features such as recycled insulation that keeps heating and cooling costs down and decreases the amount of energy to stabilize the inside conditions and easy access to a car pooling system and public transport as to reduce the amount of fuel used in commute. (White, 2012) Along with its Olympic green initiatives and improvements in housing, London is now planning on building the world’s largest solar paneled bridge. The Blackfriars Bridge, originally built in 1886 over the Thames River, will boast over four thousand solar panels that will run the station. (Huffington Post GREEN, 2012)

London has also made sustainable food procurement a top priority. In preparing for the arrival of the 2012 Olympic Winter Games the Greater London Authority Group, an administrative body consisting of the Mayor of London and an assembly of 25 elected members, signed a Sustainable Food Procurement Commitment in December of 2010 which outlines the criteria for sustainable food procurement and whose commitment is monitored by the London Food Board’s Executive group (Greater London Authority 2010). This Commitment was built upon the Mayor’s Food Strategy of 2006. The commitment aims to localize London food production, decrease resource waste in primary production, manufacturing, and transport of food, and to build “seasonality” into catering contracts in order to ensure safe agricultural practices and to take advantage of variation of products among seasons (Greater London Authority 2010). The plan has a large focus on promoting local agriculture and thus benefiting the small farmer. The criteria of the commitment include the GLA group supply chains’ purchase of goods from “smaller and diverse” farmers (Greater London Authority 2010). The GLA group comprises five functional bodies, which together cater over seven million meals per year throughout the London area (Greater London Authority 2010). Because of the prominence of the Greater London Authority Group in the process of food procurement throughout London, the commitment also serves as an example for other large London organizations, demonstrating the positive impact sustainable food policies have both economically and environmentally (Lee 2012). The Greater London Authority hopes that these new guidelines for food procurement will result in large cuts in the use of fossil fuels and thus carbon dioxide emissions throughout the procurement process as both production and manufacture will be increasingly localized.

By taking progressive steps and focusing on eco-friendly practices, London has become an example to cities everywhere with a wide range of green initiatives, including the green buildings for the Olympics, to the new recycling efforts, to protection of green spaces has a focus on sustainability. While there is always more that can be done, London’s innovative and cutting- edge efforts will make it the environmental superpower that it wants to be. Due to the 2012 Summer Olympics, London was under a microscope, with the whole world focusing on what London was doing right and wrong. Because of these green practices, London was admired and became an example for other countries.

## Transportation

London is known for its transportation innovations, such as the London Underground, or the “Tube,” that are characteristic of the forward-thinking city. New additions such as high-speed rail, hybrid buses, and extension of the railway system, have been made, as well as possibilities for greener personal transportation, such as car charging stations. This section will also address modifications to the bus system and extension of the railway system.

London’s bus transit system, legendary for its red “double decker” buses, has long been one of the largest in the world; recently, it has also established itself as one of the most modern and forward-thinking systems. In 2008, the city of London was awarded the Sustainable Transport Award, a

prestigious prize selected by a committee of renowned environmentalists (OneWorld 2008). The high ridership rate for the bus system was cited as one of the chief reasons for the committee's selection of London for the award. Rather than merely accept their already award-winning bus system as it was, the city of London has continued to advance its bus transit system. For example, since 2006 301 diesel-electric hybrid buses have been added to the fleet that services London, and an additional 150 are to be added by March 2013. Henceforth, all buses added to the London public transit stable are to be hybrid buses. Plans are also currently in order to equip nitrous oxide-reducing technology to all buses, in order to help meet air quality standards for Greater London by 2015 (City of London 2012b). However, the most tentative advancement made by the London bus transit system is also its most promising possibility – the advent of hydrogen fuel cell powered buses in the double decker bus stable. Although Londoners rarely use them for travel inside the city, London's red "double deckers" have become a popular tourist attraction. In early 2011, London introduced five buses powered solely by hydrogen fuel cells, which emit only water as an exhaust. These buses are considered by many to be the most promising advancement in the greening of transport. As of July of 2012, the buses had traveled 100,000 miles and had been refueled 1000 times, an event commemorated by the city. Based on the success of this trial, the city of London hopes to institute more hydrogen fuel cell powered buses to its fleet (Fuel Cell Today 2012).

The London Underground, also known as "the Tube," is the oldest metro station in the world, and it hosts one billion riders per year (Tube Upgrade Plan). With so many people using the Tube, there is a significant impact on the environment. As a major part of London's transportation system, the mayor realized it was crucial to renovate the old infrastructure into a more sustainable and environmentally friendly transportation system. The goal of London Underground is to improve resource use and waste management, improve air quality by reducing carbon emissions, and managing energy/fuel use (Pitcher 2012). Not only is London Underground trying to minimize environmental impact, it is also trying to make the transportation system more efficient in getting passengers to and from their destinations more efficiently (Sustainable Development). All these efforts are to help London reach its goal of reducing carbon emissions by 60 percent by 2025. In terms of carbon emissions and energy use, the London Underground was the top ten electricity consumer in the UK. Organizations like Tube Line Limited are planning on a low-carbon station initiative to reduce greenhouse emissions from the stations (Pitcher 2012). Through modernization of the station, London Underground is also purchasing diesel-electric hybrid buses that produce 40 percent less carbon dioxide than the current trains (Environment). In the LU Environment Strategy 2008-2013, objectives are to not only purchase new technology but also influence their suppliers to improve the carbon footprint of their businesses. Just as the infrastructure of the buses and the station is important, the London Tube also wants to improve the resource and waste that is produced in conducting and transporting passengers. London Underground aims to increase the range of sustainable and environmentally friendly products that they use on the trains. In addition, it will target the resources used by passengers by improving the methods of recycling. London Underground worked with contractors to sort and recycle more than 73% of newspapers, plastics, cardboard, and cans from the stations (Environment). Even as antiquated as the tube is, London Underground is making monumental strides to reduce its environmental impact to help with London's environmentally sustainable goals.

The third main area of sustainable transportation involves emissions rules. The London Low Emission Zone, or LEZ, was put into place in 2008. This zone covers almost all of Greater London. Its aims to reduce emissions of vehicles in areas of London and does this by imposing fines on certain types of vehicles which do not meet the emissions standard. Administered by the Transport for London executive agency within the Greater London Authority, the LEZ choose the Euro 3 standard for particulate matter emissions and later switched some vehicle standards to the Euro 4 standard (BBC News 2008). As mentioned, not all vehicles are required to meet these standards. Heavy goods vehicles,

buses, and coaches were the base. Since then, larger vans and minibuses have been added (Freight Transport Association 2012). In the LEZ, cameras read license plates and read data from vehicle registration. It is important to register vehicles registered outside of Great Britain with Transport for London. If a vehicle does not meet the LEZ's standard, and the driver does not want to pay a daily charge, it is recommended to purchase a particulate filter to add to the exhaust system or to purchase a newer vehicle which does meet standards. The Mayor of London has published discounts of new vans and minibuses for drivers affected by the zone and major manufacturers have also offered to help owners buy new, cleaner vehicles. Future plans for the LEZ include a tighter standard in 2015 to include oxides of nitrogen for lorries, buses and coaches (Transport for London 2012b).

Electric charging stations throughout London contribute to the strengths of the city's sustainable transportation initiatives. The mayor of London, Boris Johnson, launched Source London, a citywide initiative to encourage electric cars by installing electric charging stations around the city, in May of 2011. This program creates about 1,300 charging stations, more than the number of petrol stations, by 2013 (City of London 2012a). By paying 100 pounds annually, citizens of London can take advantage of the 1,300 charging stations throughout the city. By increasing the number of electric car charging stations so dramatically, Mayor Johnson has greatly encouraged an increase in membership in the Source London program and, thus, more electric cars on the roads of London. As carbon emissions from cars are dramatically hurting the biosphere, this change, which promotes the purchase and use of electric cars, has a great impact on the green initiative and, thus, makes the transportation greening plan the best greening practice in London.

Finally, London is the hub and destination of both the Eurostar connection with the continent and a new high-speed rail system that connects with UK cities to the north. In January 2012 the British government announced the High Speed 2 (HS2) project, a plan to construct a high-speed rail line between London and Birmingham and on to Manchester and Leeds (UK Department of Transport 2012). Construction on this most recent transportation project is not set to begin until 2017 and is estimated to be completed by 2025. The government says that this new high-speed rail network will not only create thousands of new jobs in the region, but will also encourage more passengers to use public transportation systems by improving both inter- and intra-city connections thereby reducing highway use. Current rail lines are rapidly reaching their capacity. Should this happen, passengers will see a dramatic increase in fare prices resulting in a decline in public transportation users (Waterman 2012). Therefore, many view the new rail system as necessary. The largest criticism of the current plan is the inevitable degradation of the land through which the rail will pass. The rail is set to be routed through the Chilterns, a hilly region designated as an Area of Outstanding Natural Beauty (Encyclopædia Britannica 2012) just south of London. This has raised considerable opposition from those who fear that the construction of the rail will lower both the economic and aesthetic value of the region. However, the routing of the rail system has been directed[D1] in such a way as to minimize the impact of construction on the "local communities and the environment" (UK Department of Transport 2012). The United Kingdom's Department of Transportation predicts that the proposed rail system will benefit the surrounding environment exponentially more than it will damage it.

In summary, transportation for large cities such as London can be the backbone of sustainability initiatives. London has a comprehensive program of sustainable transportation in all facets of public and private transportation. Its initiatives both encourage a shift from automobiles to public transportation such as the Tube, and the greening of all kinds of vehicles, from trains to cars. The bus system has been redeveloped to run on diesel-hybrid engines. Initiatives have reached beyond the city, such as with the HS2 Project that has expanded the greening of London's rail system out to other UK regions. The organization and successful initiation of London's sustainable transportation programs serve as an example for further sustainability efforts in the city.

## Conclusion

Since the 2012 Olympic Games, London has committed to greening all aspects of the city, including transportation, green businesses, buildings, food, and recycling programs. London has no centralized plan, but rather has a number of individual programs with an overall goal of making a sustainable city. The transportation greening plan encourages greater use of public transit by making various systems available across the city, thus lowering carbon emissions. For green businesses, the East London Green Jobs Alliance sought to provide green jobs for citizens by giving proper training for the employees and by making these jobs more desirable for workers. The Sustainable Food Procurement Commitment, signed by the Greater London Authority, promotes sustainable food production and distribution throughout the city. The Low Emission Zone that was implemented in 2008, aims to reduce carbon emissions dramatically within the city by requiring vehicles that enter the city to uphold certain emission standards. With regards to recycling, London has cut off paper waste at the source by discouraging junk mail with the "Say No to Unwanted Mail" program and has helped recycling efforts with programs like the Camden recycling initiative. Although the recycling initiatives in Camden are strong and widespread, those efforts are not present throughout the city, allowing for improvements with regards to extending the recycling program.

Because the city is so reliant on public transit, London has prioritized the development of greener transportation, making it the city's strongest green initiative. In order to meet its goal to reduce its carbon footprint, London has succeeded in not only improving existing transportation systems, but also in developing new forms of transit. For systems that are already in place such as the "double-decker" buses and the Tube, new programs are being implemented to renovate the fuel systems and to reduce the total waste created. Programs involving the high-speed rail, electric charging stations, and low-emission zones are also being developed to encourage public transportation use and make a shift to cleaner fuel usage. Because the London transportation initiatives are successful and efficient thus far, no downsides are prevalent.

The implementation of programs such as the ones in London could only be realistically applied to large cities that can afford to invest in large infrastructure changes. For example, creating an entire high-speed rail system requires a lot of resources, in particular financial resources. Fortunately, the larger and more developed also have the largest carbon footprint. These cities have the capability to implement parts or all of the London transportation plans to dramatically reduce carbon emissions. This makes London not only a leader in greening initiatives worldwide, but also a great example for what large cities should strive to become.

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## Madrid: Sustainability and Green Space Initiatives

By Tabitha Hill, Autumn Henderson, Tricia Lebkuecher, Madeleine Moorhead, and Grant Weekley

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With a population of approximately 3.3 million people, Madrid covers 604.3 square kilometers and has a population density of 5,390/km<sup>2</sup> (INE, 2011). The third largest city in Europe with the third largest GDP, Madrid is also a major center for international business and commerce (EasyExpat, 2003). The capital of Spain since 1562, Madrid sits in the geographic center of the Iberian Peninsula. The city's location on the plateau in the high altitude atmosphere creates an extreme climate of hot summer temperatures and occasional snowfall in the winter. Despite the extreme temperatures, the weather is generally warm, dry, and pleasant. Rain in Madrid is uncommon, but there is a short rainy season in late October. Madrid is ranked as the tenth most livable city in the world (Madrid Wikipedia, 2012).

Since 2000 the city of Madrid has worked to create a more sustainable living environment for its citizens. Some of the ways in which the city has worked to accomplish this goal are through its efforts in green spaces, recycling, transportation, food, green businesses, and bio-construction. For example, Madrid has made multiple efforts to improve green spaces, and the city has more trees and green surface per inhabitant than all other European cities (Green City Guide: Madrid). In a bid to make its transportation system more environmentally friendly, Madrid implemented the BUS/VAO program, which promotes the use of the city's buses and carpooling on the highway by designating certain lanes for only buses or cars that contain more than one person. Although recycling initiatives are minimal, the city does have water conservation initiatives for hotels, some local food initiatives, and some green building initiatives. Additionally, the city promotes ecotourism and conscientious eating, and it offers courses to its citizens to teach them how to create small gardens that they can use to grow their own food (Green Travel. 2012, Habitat Madrid. 2011). The green businesses in Madrid work to promote ecotourism through hotels that are committed to conserving natural resources such as water. Madrid has also been a pioneer of "bio-construction," a practice that focuses on renewable energies and using more ecologically sound materials when constructing and refurbishing buildings (C-40CITIES Summit Sao Paulo 2011, EMVS 2012). Of all of the city's sustainability programs, the most effective has been Madrid's work with green spaces.

The remainder of the paper will first analyze the various plans and programs that Madrid has in place reduce the negative effects that the city has on the environment. In the following section, we will then examine Madrid's best practice, green spaces, and how several of the programs implemented have positively impacted both the environment and the people who live and visit Madrid.

### Sustainability Initiatives

Although Madrid does not have a comprehensive sustainability plan, several departments of the city government have come together with community initiatives to build a more efficient, environmentally friendly city. Making changes to the transportation system, encouraging individuals to recycle and make sustainable food choices, creating more green spaces and eco-friendly buildings, and supporting green businesses have been among the top priorities.

An important aspect of an environmentally conscious city is clean transportation. Despite the city's popular metro system, there was still heavy congestion on the highways, with many people opting for private transportation instead of public. With the help of a private initiative, Madrid implemented BUS/VAO, a program similar to HOV (High Occupancy Vehicles) lanes in the United States. The BUS/VAO program promotes the use of the city's buses and carpooling on the highway by designating certain lanes for only buses or cars that contain more than one person. Promoting carpooling helped cut back on carbon emissions and the congestion that once plagued the highways. Since buses also can use the BUS/VAO lane, buses became faster and a more convenient way to commute. The bus system extends from the village of Las Rozas to the Moncloa Metro Terminal, where patrons can access the metro, other bus routes, parking lots, and other forms of city transportation, making it convenient for commuters to use buses. The BUS/VAO system also allows Madrid citizens to connect with other commuters. By logging into the website and inputting desired origin and destination, commuters can find other people going the same direction, allowing the carpool system to extend beyond just coworkers or family members. The BUS/VAO system is an example of an effort to promote carpooling and transportation sustainability in the city of Madrid (Danish Architecture Centre, 2008).

Although there are no major initiatives with the recycling of solid waste, there are significant efforts with respect to water conservation, a problem that is especially acute given Madrid's dry climate. In 2009 Canal Isabel II, the public municipal water company that provides water for Madrid, gave Veolia Water a contract for operation of their largest water treatment facility (Veolia Water 2009). Since then, Veolia Water has been a pioneer in sustainable water management. Their efforts in aquifer recharging are particularly relevant because the Madrid aquifer is a critical water source for the region, particularly during Spain's frequent droughts (CGS Ingeniería, 2012). Veolia Water's improvements on treatment plant optimization also have had a significant impact on Madrid, where the recycling of used water is one of their most important local water sources (Soler-Rovira 2010). Overall, eleven percent of Veolia Water's energy is entirely renewable (Veolia Water 2010).

In terms of Madrid's water footprint, sixty percent of all water used by the city is used for meat production. Eighty-six percent of the local water used for all agricultural purposes is provided by rainfall, which is surprising considering the aridity of the region. The explanation for this unexpected fact is that four fifths of all water consumed by the Madrid is not from the area (Soler-Rovira 2010). Therefore, true greening of the Madrid water management system will come from increased domestic production, such as Veolia Water's aquifer recharging, or being more selective in their importing decisions. Parks and gardens use an incredibly small amount of Madrid's water supply, accounting for a smaller annual drain than system leaks do. Overall, green water sources, i.e. rainfall and soil moisture, account for triple the water production of blue water sources, such as aquifers and lakes.

Food is another area where Madrid has implemented several sustainability efforts, although they are almost exclusively on the personal level. There have been many movements in the country as a whole promoting ecotourism and conscientious eating, as well as efforts to teach people practical skills concerning sustainability. The city offers residents courses on growing small gardens in urban areas in yards, porches or window-boxes, as well as providing green spaces in parks for people to plant community-type gardens. (Green Travel 2012, Habitat Madrid 2011) Despite its lack of a city-wide implemented and enforced food sustainability plan, Madrid is very concerned with the global environmental implications of the food industry. Madrid hosted the 3<sup>rd</sup> European Organic Congress in 2010, which discussed the food stability of the entire European Union and focused on aspects of a long-term plan called "The Global New Deal," which was designed to make environmental issues a priority. Aspects of this plan included protecting biodiversity of plants and animals in the agricultural community and implementing organic farming as part of the solution to the problem of climate change. (Gente y Hogares Sostenibles 2012)

Madrid has also worked to improve its green spaces. The Madrid Rio Project, launched in 2008, has the goal of regaining use of the Manzanares River and the surrounding environment by transforming the area from a highway to a recreation area for residents and tourists. Another project was the Calle 30 project, which included moving the M30 highway underground in order to free more green space for recreation. In addition to these improvements to green spaces, Madrid has done much work with community and rooftop gardens. Madrid currently has 20 community gardens, which allows people to come together to produce locally grown food and allows them to gain skills for future jobs. Perhaps more importantly, community gardens bring people together in a way that they can get to know their neighbors. Together, these various projects have made green spaces Madrid's best practice. (NYC Global Partners 2012, Ayuntamiento de Madrid 2011, Veolia Water 2009, CGS Ingeniería, 2012).

With respect to businesses, Madrid is home to a fourth of Spain's green businesses (C.P. 2012). Businesses that received the Etiqueta Ecologica license from Medio Ambiente y Ordenación del Territorio were required to sign a contract promising to observe all environmental regulations while they kept the certificate. (C.P. 2012). There is also a wide variety of green businesses promoting eco-tourism. Tourists visiting Madrid can stay at green hotels such as the InterContinental Madrid, I Hotel, or Eco Alcala. All of the hotels are committed to conserving natural resources such as water, by cutting back on the number of bath towels that are washed. They also try to minimize waste and reduce/eliminate the use of "Chlorofluorocarbon (CFC) refrigerants and conduct environmental" checks on the hotels. There are also green restaurants that buy local organic food such as Ecocentro or Vegetarian Art. Madrid has managed to not only create green businesses, but also to keep those businesses in accordance with environmental regulations. (Team Planet Green 2008.)

With respect to green buildings, Madrid has also been a pioneer of "bioconstruction," a practice that focuses on renewable energies and using more ecologically sound materials when constructing and refurbishing buildings. The Empresa Municipal de la Vivienda y Suelo (Municipal Housing and Grounds Company) provides government grants to residential buildings that reduce their energy consumption, install solar water heaters, or perform any other number of ecological home improvements. They aim to provide one thousand additional units of either new or refurbished every year, all of which will meet their sustainability standards. In ten years, this project hopes to replace seventy-five percent of hot water and heating energy consumption with renewable sources. The entire operation is intended as a pilot scheme for both the rest of Spain and the entirety of Europe (the European Union even helps with funding). (C-40CITIES Summit Sao Paulo 2011, EMVS 2012) The pioneering design for a Madrid headquarters of Banco Bilbao Vizcaya Argentaria, to be built in 2013, is set to be teeming with gardens and vegetation and to utilize as much natural sunlight as possible, both in interior lighting and solar power. The plans also include architectural add-ons to facilitate both rainwater collection and purification and natural ventilation (Big Gav 2012)

Throughout the last decade Madrid has become a continental leader in environmentalism. Their efforts towards green spaces, bioconstruction, and more ecological transportation have been seminal across Europe, but Madrid's green spaces initiative is easily their best practice and should be considered in other countries looking for ways to make their cities greener. After implementing the Madrid Rio Project and the Calle 30 project, Madrid now has more trees and green land per inhabitant than any other city in Europe. Despite lagging behind somewhat in the areas of recycling and providing more environmentally sound food, Madrid has more than earned its title as one of the greenest cities in Europe on its green spaces alone, not to mention its significant strides in green building and transportation. The pioneering progress made in both the public and private sectors has made the city one of efficient public transit, extensive green spaces, and environmentally friendly housing.

## Green Spaces

This section will discuss in more detail Madrid's efforts in sustainability for the greening of space, beginning with community and rooftop gardens, an initiative begun mostly to tackle some of the consequences of the recent economic crisis; then discussing efforts to make water more sustainable, by hiring a company to redesign their treatment plants and optimizing their water utility and renewability. The final part of this section will address Madrid's efforts to increase public recreational green spaces by outlining the initiatives taken to improve and increase Madrid's park areas and trees, as well as renovating previously carbon-creating spaces such as highways into carbon-reducing spaces such as parks, bicycle trails, and beaches.

The financial crisis that has hit the global community has forced many countries to reevaluate their lifestyles. Madrid in particular has had to reassess what they are spending their money on and how sustainable they are being. They have responded to this crisis by focusing their efforts on community gardens. The city has created more than 20 community gardens, which allow the citizens of Madrid to take a more active role in the food sector of the country. These community gardens are run by neighborhood associations, various universities in Madrid, environmental groups, and the Madrid city government. One particular group, the Regional Federation of Neighborhood Associations of Madrid (FRAVM), works to manage these different gardens so that they can continue to run smoothly and produce food for the residents that are involved in maintaining it.

Additionally the gardens serve as a place where the residents can learn gardening techniques, which will allow them to expand their skill set for future jobs. The gardens also serve as a place for the communities to meet and discuss various ideas. They have been the center for political discussions and a place where values can be promoted that are desired by the community. By allowing the residents to take such an active role in the maintenance of the gardens, it allows them to think about complex problems that community gardens bring up, such as urban land use and the monopolies that are created by food distribution companies. Additionally the gardens allow the residents to see the importance of eating organically versus the artificially created crops that exist in larger scale farms. The residents who created these community gardens also felt that they were important because children could be involved in their up-keep, and therefore the children would begin to learn the importance of nutrition and have a first-hand experience in creating a more sustainable life (Benítez, 2012).

One problem with the community gardens, however, is that they are not all legally sanctioned. The leaders of the Regional Federation of Neighborhood Associations of Madrid are trying to create laws that will provide a framework for the gardens and allow them to run more efficiently and more effectively. The Regional Federation of Neighborhood Associations of Madrid is also concerned with creating a legal framework, because many times residents will be loaned plots of land to create gardens that can be permanently given. The city government of Madrid allows for the land to be loaned out but because there is no legal framework in place, the plots of land can be taken back and utilized for different purposes at any times. This causes problems in the future when the government decides to take the land back and sell it to someone else for a different (more profitable) purpose (Benítez, 2012). Overall, however, these community gardens have worked to make the city of Madrid more sustainable and they have fostered a sense of community amongst the citizens, which has strengthened the city.

Madrid has made tremendous improvements with its parks and roads as it aims to become more environmentally friendly. The Calle 30 project was the first step in urban renewal and green space repurposing in Madrid. Introduced in 2004, the project reconstructed the M-30 highway that ran alongside the Manzanares River. This project took the highway underground in order to free up ten kilometers pedestrian and cycling routes. As a result of the road being moved underground, walkways and bridges have been developed that connect several districts in the center and south-east part of the city, and more people have access to the river and the many parks that the highway obstructed. (Metro Square 2010) The program was launched in part due to concerns about emissions caused by heavy

traffic on the highway. The city council predicted that reductions of emissions would increase from 35,000t to 64,800 tons per year, although these figures have been attacked as inaccurate by environmentalists. The Calle 30 project was implemented in 2004 and was completed in 2007. (Net Resources International 2011, EBR 2010)

Following up the Calle 30 project in 2008 was the Madrid Río project, which improved access to the Manzanares River. By providing pedestrian access to the river, the project could commence with creating a recreational area, parks, and other green spaces for residents of Madrid. The project included parks, a beach, bicycle paths, and the planting of 5,000 trees, which would result in a total of 26,000 trees in the area. Several new options for sports and recreation have been developed alongside the Madrid Río Project, which reinforces the benefits this plan has. Skate parks and exercising facilities have been added and historical monuments and bridges restored as a result of this project. By offering these new amenities, the Madrid Río Project has become a model for other cities by showing the multiple uses that are possible for green spaces. (Madrid Río 2011)

Together, the two projects enhanced the beauty of Madrid and made the city more environmentally friendly by aiding the reduction of carbon emissions. The Calle 30 and Madrid Río Project reclaimed more than 2961 hectares of land for repurposing into green spaces and public parks and are considered to be some of the great initiatives that the city of Madrid has taken to become more environmentally friendly. (NYC Global Partners 2012, Ayuntamiento de Madrid 2011). In response to the Madrid Río Project, many other green spaces around the city have been created, including the Virgen del Puerto Park and the Aniceto Marinas Gardens. (Go Madrid 2012)

## Conclusion

Ranked as one of the most sustainable cities in Europe, Madrid has distinguished efforts in transportation, water conservation, food, green businesses, bio-construction, and green spaces. Of these efforts, green spaces has been the most successful and effective, including the implementation of community and rooftop gardens, the Calle 30 project, and the Madrid Río Project. Nevertheless, the green-space programs have some drawbacks. While the community gardens are effective in creating a sustainable food business and a sense of community, there is no legal framework with regards to community gardens. Because there are no laws that give ownership of the land, it makes it hard to keep the gardens because the land can be taken back at any time. Something else that is lacking in green spaces in Madrid is the development of community parks. Something else that is lacking in green spaces in Madrid is the development of community parks. Another weakness of the green spaces in Madrid is that while the Madrid Río plan has taken off, it was very expensive and created a lot of pollution during the construction.

Some of Madrid's green-space programs could be models for other cities, but some are unique only for the city. Madrid's moderate Mediterranean climate makes community gardening potentially more attractive there than in northern, colder regions or in those with erratic weather patterns unsuitable for planting. In contrast, the most prominent green-space initiatives involved remediating the planning disaster of having a highway located next to the river, a problem that has occurred in many other cities throughout the world. As a result, Madrid's achievements with respect to the highway and riverfront may hold lessons for other cities, because other cities have also decided to put highways underground and reopen connections between the city and riverfronts. In summary, by creating more green spaces, Madrid has helped to reduce carbon in the atmosphere and made the city more attractive to potential residents looking for urban life without losing the suburban benefit of parks and pleasant green areas.

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## Melbourne: A Global Leader in Green Buildings

By Jaclyn Campis

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Melbourne is located in the southeastern state of Victoria in Australia. The city has a moderate oceanic climate, which is characterized by moderate summers and winters. However, because Melbourne is located between hot inlands and the cool ocean, it can experience a range of weather within a short span of time. Melbourne is the second largest city in Australia with a population of 4,077,036 people, projected to grow by more than 90,000 people a year (Colebatch and Lahey 2009). In addition, the city is the capital of Victoria making it the center of economic and cultural activities. As it continues to grow, Melbourne needs to construct more living and office spaces to serve the large population and commercial industry. Some of the main industries in Melbourne included tourism, technology, trading, and banking. Melbourne has the busiest seaport (Port Philip) in Australia, in addition to having four airports to handle cargo. The fast-growing city is facing the issue of sustainable development, understood as meeting "the present needs without compromising the ability of future generations to meet their needs" (World Commission on Environment and Development 1987). Sustainability has become a major focus lately due to startling new data from scientists that suggests the current usage of resources will lead to a disastrous point where supply will far outstrip demand.

Termed as the "most livable city" in the world according to the Economist Intelligence Unit's Global Livability Survey due to low population density and crime, Melbourne is trying to pair livability with sustainability to create the best city (Ferguson 2011). In order to achieve this goal, the government of Melbourne has enacted initiatives in transportation, reuse and recycling, finance, food, space and infrastructure, and buildings. Despite the fact that there is not one comprehensive plan outlining all of the initiatives, the collaborative effort among the government, the people, and businesses have allowed Melbourne to progress steadily towards a greener, more sustainable city. A website, named "Sustainable Melbourne – The City Re-inventing Itself," has been created by an organization that condenses the different initiatives in one place on the internet (Sustainable Melbourne 2012). Melbourne's strongest area of development is in sustainable buildings; it has become a global front-runner in the construction of the green, sustainable buildings. However, in order to continue to become a leader in sustainable practices, Melbourne must implement plans in its weaker areas, such as a food and space and infrastructure.

In the next section, there will be an overview of the sustainability plans and initiatives in a variety of sectors. Then an assessment of Melbourne's best practice in sustainability, which is green buildings, will be presented to the reader. Finally, there will be a conclusion which highlights the main points of the paper and summarizes the overall purpose of the paper.

### Sustainable Plans in Melbourne

Melbourne, Australia has taken steps to promote successful initiatives in finance and business development, space, infrastructure, buildings, reuse and recycling, food, and transportation, in order to create a sustainable city. Although Melbourne does not have one comprehensive plan for its sustainability efforts, it is still a revolutionary leader in buildings, transportation, and water reuse. The plans are a collaborative effort among the businesses, people, and government of Melbourne. Despite

the large movements in the areas mentioned above, the city still has to expand its focus on the areas of food and infrastructure, in order to reach the goals of a truly green city. This section of the paper will outline the city's plans in transportation, water reuse, food, infrastructure and green buildings.

In order for Melbourne to continue to move in the direction of a sustainable city, the city needs improvement in its policies pertaining to small businesses. Recently, the city has taken steps towards the support of small businesses by creating a program to provide resources and information. The Shop Melbourne Movement, a citizen driven action, supplements the government initiatives to help the city focus on small, local businesses (Shop Melbourne Movement 2012). The grassroots effort is centered on an online website that allows citizens to sign up as members and locate local services and products easily. The website also educates members to the benefits of buying locally. The idea that the money will circulate within the community and benefit the local economy instead of being sent directly out by corporation chains is a big motivation behind the local movements. Another initiative is Invest Victoria, a government run organization that provides information and services to assist businesses in the province of Victoria (Invest Victoria 2012). The services include providing contacts, such as local partners for supplies, and valuable market information to businesses. The information provided helps assess market potential by researching existing companies, growth capabilities, and costs. The program also searches for suitable property based on requirements and needs. In addition, the services also link the business to any available government grants or support programs. After the initial set up of the company, the program continues to assist the nascent business by providing support in Australia and the home market to maximize the business's potential. This program is a huge incentive to new businesses because it helps with the initialization and continuation of the business. Both programs are beneficial to the greening efforts in the financial sector, however, there needs to be more support and advertisement of the programs offered. In addition, the development of more programs would also benefit the movement towards a sustainable financial sector.

Melbourne does not have well-developed initiatives in green space. The city has built and maintained over 50 large parks and other smaller recreational areas (The White Hat Guide to Melbourne Parks & Gardens 2011). Melbourne has been characterized as one of the "most livable cities" due in part to the fact that even though there is a population of over four million, there are still green areas for people to socialize and relax. The city prides itself on the diverse types of gardens it offers. However, the biggest criticism of the parks is that they are maintained through unsustainable practices by requiring large amounts of water and maintenance such as inorganic fertilizers and special chemicals to keep up the diverse gardens. Melbourne is located in a very dry climate without an abundance of natural green space. In order to maintain the green spaces provided, Melbourne must use massive amounts of water, thus its recent endorsement of water reuse and recycling efforts. Water reuse is the use of gray-water, which is water drained from showers, baths, washing machines, and kitchen sinks, and then used for non-drinking purposes, such as garden irrigation. The gray water reuse would significantly cut down on the use of drinking water which is greatly needed especially in the drought months of Victoria. Melbourne needs to implement these water reuse and recycling strategies to maintain its name as the most livable city without sacrificing sustainability.

In order to support its efforts in water recycling and reuse, Melbourne must have the proper infrastructure to support its initiatives. One new initiative is to connect the Sugarloaf Pipeline to the Goulburn River System, which would significantly increase the water supply. Another initiative is the Food Bowl Modernization project which will provide a top-notch irrigation system to the horticultural industry reducing water losses. The Wimmera-Mallee Pipeline will replace the inefficient open channels currently in place (Invest Victoria 2011). Finally, a desalination plant is under construction. The plant will be the largest in Australia supplying 150 billion liters of water a year to Melbourne. In addition, it will have a renewable energy to cover operational energy (State Government Victoria 2011). Melbourne has

many pipelines and systems that in the process of being upgraded and built to all contribute to the goal of water reuse and recycling.

Reuse and recycling is a large initiative in Melbourne. For example, there is a website that condenses all the information for recycling different items to promote recycling. The site, "Recycling Near You" allows a person to select the type of item they want to dispose and a location near them (Recycling Near You 2009). The website provides complete information on the recycling centers including types of waste accepted, phone numbers, directions, and the location. Reuse and recycling is a large initiative in Melbourne. Water reuse using gray water is essential in a dry area such as Melbourne, as discussed in the above paragraph. In addition, there is a website that condenses all the information for recycling different items into an easy, user-friendly website to promote recycling. The website provides complete information on the recycling centers including types of waste accepted, phone numbers, directions, and the location. The website facilitates the process to citizens in an effort to promote more recycling. Melbourne has extensive plans for organic recycling which will be discussed in the next paragraph.

In the past food was not a main focus of Melbourne but recently has received more attention. The Food Policy has many ambitious goals planned for the city of Melbourne. One of the goals is to increase production, distribution, and consumption of locally and regionally grown food to 30% of total consumption. Recycling is a large part of the Food Policy. In addition, The Food Policy also covers raising awareness and creating a safe, sustainable. It encourages residents and businesses to reduce organic waste to landfills by listing, on a website, businesses that take surplus food, as well as tips on home composting. There are new facilities being built which will allow for curbside organic collections. The collections will be processed in a bio-digester, which dries out the food waste, reducing its mass by up to 70%. The organic waste will then take up substantially less space in the landfill. In addition, the city hosts an annual Sustainable Food Festival. Vendors come to the convention center showcasing sustainable food, alcohol, and beauty products. It also brings awareness to the city to move towards more sustainable practices (Food Policy Discussion Paper 2012). Overall, Melbourne's plans in food are very ambitious and if implemented can make Melbourne a leader in food sustainability.

Transportation is has many initiatives in it to make it one of the leading sustainability efforts in Melbourne. The main aim of the initiatives is to reduce the environmental footprint of the city by promoting the use of public transportation. The majority of greenhouse gases come from the use of private cars, so the government is focused on getting people out of their cars and into public transportation. The trams are one of the defining characteristics of Melbourne, as well as being a major form of transportation. The trams are in the process of being upgraded; the new trams allow more passengers in a single car, making the trams more efficient. In addition, level boarding station stops are being built around the city to make the trams more accessible to handicapped passengers. The trams also have priority over cars on the streets, making the trips faster and more efficient. The greening initiatives of the trams are geared more toward increasing the use of trams than changing the actually greenhouse gas emissions. The commuter rail is the most used form of public transportation; it is centered around the Melbourne Central Business District and the famous Flinders Street Station. The train system is a rapid transit hybrid model. The trains are located underground separated from car traffic, with fast service and high capacity. Melbourne is also instituting an initiative that allows riders to purchase reduced fare tickets if they completed their journey before 7 am. A new train line is being built from Caulfield to Dandenong. This will reduce congestion on other lines and increase the ease of using the trains to travel (Railways in Melbourne 2012). Buses are also a large part of the transportation in Melbourne. Buses provide transport to suburbs and feed into train and tram lines, which are the main forms of public transportation.

Melbourne has made revolutionary changes to the greening buildings and is a model for other cities in Australia. Many newly constructed buildings have received the highest rating from Green

Building Council of Australia. The Council House 2 building, or CH2, is the first building in Australia to achieve a six star rating from the Green Building Council of Australia. CH2 is meant to be a standard for all new buildings. The Melbourne Convention and Exhibition Center (MCEC) has also gained a six star rating, making it the greenest convention center in the world. Both structures are the crowning achievements of Melbourne's shift to greater sustainability. Another initiative the city has implemented is the 1,200 Buildings program. Sixteen corporations have signed up to managing the transformation of 30 CBD buildings with an aim to reduce their greenhouse gas emissions by 38 percent. The program helps companies design buildings to improve performance, with results including lower operating costs, environmental footprint and greenhouse gas emissions; improved indoor environment quality; money saved investing in energy infrastructure; and higher overall capital value of the building (1200 Buildings 2012). The companies will not only be cutting costs but also taking an important step towards the greening of businesses. The various buildings and the 1,200 Buildings program make sustainable buildings Melbourne's best practice. The initiatives are wide-spread and ambitious, and most importantly the plans are being implemented.

In summary, Melbourne has many goals planned for the future. There are food and infrastructure plans, but they have been yet to be implemented. In order to bring these areas to the globally competitive level of transportation and green buildings, Melbourne must make a decisive effort. As supported by the evidence provided above, Melbourne's best practice is green buildings. The initiatives that Melbourne has developed and implemented are world changing. Overall, Melbourne is doing an adequate job to progress the city to a sustainable state. However, there is still room for improvement in making these goals and movements reach a larger scale.

#### Best Practice: Sustainable Buildings

Although Melbourne has strong sustainability initiatives in transportation, recycling and reuse, and green buildings, the latter has far surpassed all others and has become the model for all other cities to follow. The initiatives and construction of green buildings in Melbourne have set a global standard. This section will review the green practices regarding buildings and programs in Melbourne, with a focus on the Council House 2, the Melbourne Convention and Exhibition Center (MCEC) and the 1,200 Buildings Program. Then it will discuss the current progress in green buildings and outline the problems and the future of initiatives in this area.

As discussed above, Melbourne has made a global impact in green buildings, especially with the Council House 2 and Melbourne Convention and Exhibition Center. The Council House 2 (CH2) and MCEC have both received six stars, the highest rating possible from the Green Building Council of Australia – GBCA (Green Building Council Australia 2012). The CH2, built to accommodate the growing staff of the City of Melbourne, was designed to conserve energy and water as well as improve the conditions within the building. The climate of the area was taken into consideration in the construction, based on the concept of cold energy storage. The building has different modes, including summer, winter, day and night. During the day mode, wind cowls, installed on the roof, spin to generate electricity. The electricity is supplemented by photovoltaic cells that capture the natural sunlight and convert it to usable energy. The water demands in the building are completely filled by heating from solar panels. There are several measures in place to provide optimal air quality. High ceiling fans push the warm air into ceiling spaces, leaving cooler air to circulate among the workers. Atmospheric air is funneled into building and cooled by shower towers are placed strategically around the outside of the building. The CH2 building can then change to night mode. In night mode, the wind cowls spin to push the air outside completely venting the whole building. The hot air contained in the ceiling during the day is circulated out by the vertical vents and wind cowls (City of Melbourne 2012).

There are seasonal modes as well. Winter mode reduces glare with a planting landscape. A light shelf and balcony floors help block the northern sun, while still allowing some light to enter the building.. On the north side of the building, plants are used to help catch water and store it in the basement for future use. Heating pipes are used in the morning to help remove the cold from the building before workers arrive. During summer mode, the western side of the building is covered with timber shades, one of the most recognizable characteristics of the building, that allow some sunlight to stream in but blocks the heat. On the roof, there are water collection devices that feed into plant-rooms growing different types of vegetation. In addition, summer terraces are multipurpose, serving practical as well as social functions. Overall, these technologies have reduced electricity consumption by 85%, gas usage by 87%, and water main supply by 72% compared with conventional buildings. The Council House 2 building is a model for new offices being constructed around the city (City of Melbourne 2012).

The other major accomplishment of green buildings is the Melbourne Convention and Exhibition Center, which is the greenest convention center in the world. The convention center has been a focal point of media since its construction, bringing the world's attention- and competition- to Melbourne. A six star rating was awarded to the convention center by the GBCA. The convention center can hold 8,400 people in the foyer and an additional 5,000 in the auditorium. The air is circulated through a method of displacement ventilation, meaning cool air is pumped in on the floor pushing the warmer air up to the ceiling. Solar water heaters supply 100% of the water used in public facilities, and supplies 40% of the hot water demand for the whole complex. Within the convention there is also water reuse; water collected from waste and storm water is treated and used for non-drinking water, such as toilets. In order to minimize water usage, the building was constructed with water efficient toilets, sinks, and other items. The convention center is also decorated with eco-friendly furnishings and carpeting. Paints and sealants that were used in the construction of the building were all rated low in Volatile Organic Compounds (G Dag 2009). Also during the construction, a significant portion of the timber used was endorsed by the Forest Stewardship Council, an organization that “promote[s] responsible management of the world's forests” (Forest Stewardship Council 2012). The food and wine served at the conventions all comes from local, sustainable sources or organic providers. The commitment to local and organic providers helps the community reap the benefits. Buying locally is an important step towards sustainability because it keeps the money within the community before leaking out to corporations. The Melbourne Convention and Exhibition Center is not only a leader because of its technologies but also due to its policies.

In addition to the city's newest buildings, Melbourne has implemented an initiative called the 1,200 Buildings Program. This program's goal is “improve their energy efficiency by approximately 38 percent, 383, 000 tonnes of greenhouse gas emissions (CO<sub>2</sub>-e) will be eliminated per year” (1200 Buildings 2012). The plan focuses on retrofitting existing buildings and installing new technologies to improve energy efficiency. Sixteen companies have partnered in this initiative and started to make the changes outlined in the plan. The program also includes funding to these companies to supplement the cost of retrofitting. Recently, the program got a boost from the Victorian Government, with a \$500,000 award. A quote from Lord Mayor, a political position in Australia, accurately describes the program: “The 1200 buildings program is one of the greatest economic and environmental opportunities we have and will place Melbourne at the cutting edge of the green building movement. It will transform existing commercial buildings into centres of environmental innovation, showcases of engineering excellence and engines of economic growth” (Starc 2010). The 1,200 Buildings Program will help boost Melbourne into the next level of sustainability.

Despite all of the positives of the efforts in Melbourne, there are also problems associated with the initiatives. The main problem in the construction of new, green buildings is cost. The Council House 2 cost 51 million Australian dollars to build; however, the city expects the technologies installed on the building to repay within a ten year period (VIC 2007). On the other hand, the Melbourne Convention and

Exhibition Center had a complete cost of \$1.4 billion (King 2012). These prices are extremely high and were only supported by government aid. In a city that does not have as many funds dedicated to sustainability, it might be hard to follow the ambitious plans of Melbourne. In addition to the financial costs of the buildings, the 1,200 Buildings Program also requires significant financial support. Other cities do not have large funds dedicated solely to sustainability plans, and even Melbourne must tread carefully in the coming years. There will be an explosion of greening to buildings, and large sums of money will be needed to help complete the various initiatives.

Overall, green buildings are by far Melbourne's best practice. The initiatives in new as well as existing buildings are quickly replacing obsolete technology with greener technologies that improve the energy efficiency. The Council House 2 and Melbourne Convention and Exhibition Center will serve as models for future buildings. The 1,200 Buildings Program will continue to grow until Melbourne has transitioned into a sustainable city. Melbourne's best practice in buildings is wide-spread and growing. It only faces success in the future.

## Conclusion

The capital of Victoria is a growing city that is booming with industries and cultural activities. The challenge is to maintain the livability of the city while adjusting to both growth and the need to undergo greening. The initiatives that have been made are not in one comprehensive plan but spread throughout the community as a collaboration of government, business, and the people. The collaboration allows Melbourne to reach the goal of striving towards a greener city without sacrificing its unique identity. Because of its success, Melbourne has been in the media spotlight concerning its efforts in green buildings. Even though green buildings are Melbourne's main focus in area of sustainability, the city still pays plenty of attention to its other initiatives, such as transportation, recycling and reuse, food, space and infrastructure, and finance. Melbourne is well on its way to becoming a green and sustainable city.

As discussed above, Melbourne has been the center of attention for its sustainable actions in buildings. The Convention Center has set a global benchmark that all cities are trying to emulate. The initiatives in place in Melbourne are not specific to its particular location. The technologies used in the buildings are used for all seasons, due to the climate, enabling them to be used in any area of the world. Many cities can, and are, following the model buildings that Melbourne has developed. The program has been instituted can also be implemented in any city with the proper amount of support. Overall, Melbourne is a city to watch as it continues to march towards to the goal of the ultimate sustainable city.

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## Montreal's Green Buildings

By Alex Hagar, Kya Jones, Almaz Mesghina, Lucas Polson, Shailoah Wilson, and Pamela Wu

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Montreal, Quebec is a sprawling city that exists as an international hub and the cultural capital of French Canada. A predominantly French city, Montreal is named after Mount Royal (Mont Real), which sits at the heart of the scenic city. Located on an island of the same name, metro Montreal has a population of nearly 3.9 million (Montreal Census Profile 2012), making it the second largest Canadian city after Toronto (Montreal Census Profile 2012). The population of this city is comprised of mostly bilingual citizens, and it contains many large minority groups throughout (Montreal 2000). These Montrealers enjoy a relatively cool climate, with summers that average around 80 degrees Fahrenheit, and winters and autumns that average 14 degrees for the high and over 7 feet of snowfall in total (Canadian Climate Normals 1971-2000 2012).

Montreal is also at the forefront of the movement to green cities. Its government's efforts towards green buildings, food sustainability, recycling, mass transportation, green business, and green space are just a few of the approaches Montreal has undertaken in pursuit of becoming a more sustainable city. These initiatives are laid out in the Montreal Community Sustainable Development Plan, 2010-2015, an all-encompassing program that plans on creating a greener environment for Montreal with small but effective changes. This plan has been put into place by the Ville de Montreal with the hopes of reducing the city's emissions by 30% by 2020 compared to 1990. Although this plan certainly addresses a wide array of sustainability concerns, Montreal's most effective area of sustainable practices seems to be in the sector of green buildings.

The paper will review the city's progress, evaluate its strengths and weaknesses, and discuss the portability of the best practice for other cities. In the next section, an overview of sustainability plans from different areas in Montreal will be given. Then the best practice of sustainability in Montreal, the green buildings initiative, will be presented and discussed in greater detail. Finally, the main points and the overall purpose of the paper will be reintroduced and summarized. The paper will review the city's progress, evaluate its strengths and weaknesses, and discuss the portability of the best practice for other cities.

### Overview of Sustainability Initiatives

Montreal is a sprawling Canadian city in the province of Quebec. This predominantly Francophone city is considered one of the world's greatest international hubs and the city is at the forefront of urban sustainability efforts. Their efforts towards green buildings, food sustainability, recycling, mass transportation, green business, and green space are just a few of the approaches Montreal has undergone in pursuit of a greener environment for the second largest city in Canada. The Montreal Community Sustainable Development Plan, 2010-2015, is an all-encompassing program that plans on creating a greener environment for Montreal with small but effective changes. With this program, and the initiatives of smaller groups as well, Montreal has set the standard for a more environmentally knowledgeable city.

Montreal is taking large steps in order to insure that the city develops in a manner that leads towards sustainability, especially with regard to buildings. Two projects, Montreal 2025 and the Montréal Community Sustainable Development Plan, seek to direct green building initiatives. The Ville de Montreal, realizing that 20% of the city's CO<sub>2</sub> emissions are caused by buildings, launched the Community Sustainable Development Plan, which will change building codes for new homes and tighten restrictions on renovations of homes. In addition, all new buildings over 500 m<sup>2</sup> will have to achieve LEED gold certification, and large renovations of older business buildings will have to achieve LEED silver certification. This plan will also provide incentives for individual owners to get rid of old, inefficient heating systems, leading to less energy consumption. From a water conservation standpoint, the plan will make public developments have water retention systems and will place requirements on businesses in certain areas to provide plant cover for the absorption of runoff water, as well as requirements forcing them to adopt low-flow toilets and water saving fixtures. In addition to the Community Sustainable Development plan, Montreal 2025 is a plan in place which seeks the modernization of significant buildings, such as those of the Quartier de Spectacles, a collection of 80 cultural performance and exhibition venues (Montreal 2025 Quartier de Spectacles). The project also includes the Montreal Harbourfront, Montreal Technopole, and a Space for Life. These initiatives together have the objective of reducing emissions by 30% in by 2020 compared to 1990 (Montréal Community Sustainable Development Plan 2010--2015).

Montreal is also making efforts to make local businesses more sustainable. Because making a profit is the goal of businesses, some are anxious about using green technologies, which can be very expensive. In order to encourage businesses to start using green technology, various organizations and public authorities are beginning to offer incentives. The Government of Quebec has created a program called Ecotech Quebec, which provides incentives to businesses by helping to fund green technologies in the private sector (Ville de Montreal 2010). Government officials can increase the amount of green technologies used by businesses by passing legislation that provides financial support to businesses who aim to become more sustainable and eco-friendly. The Green Business Rewards organization of Montreal is also taking providing incentives to Montreal businesses to become more environmentally friendly. This non-profit organization is teaming up with Montreal businesses that are already using green technology and trying to spread these practices. (Green Business Rewards 2012)

Moksha Yoga, a business teaming up with the Green Business Awards organization, takes pride in being a sustainable business and encourages other businesses to start implementing these same practices. They do this by giving "green" advice to their customers through videos on their website (Moksha Yoga 2012). Another business, Crudessence, is a sustainable restaurant chain. They attain their status as a sustainable company through not only the ingredients they use, which are frequently organic and local, but by their business practices as well. These practices include composting, recycling, delivering food by bicycle, and obtaining food from local sources. (Crudessence 2012) With the help of grassroots, non-profit organizations, such as The Green Business Rewards program, combined with public help from legislators who have access to more funds, the private business sector in Montreal is becoming more eco-friendly and sustainable. What allows these businesses to thrive in Montreal are programs such as the Green Business Awards organization, as well as publicly funded programs such as Ecotech Quebec, which provide incentive to private corporations to become sustainable.

Montreal's massive transportation system is one of the most well organized and user-friendly of its kind. The STM (Société de Transport de Montréal) is the fourth largest public transit system in North America, and it is the second largest in Canada. STM's public buses and the local subway system, the Metro, serve an estimated 2,524,500 people daily (Transit Ridership Report 2012). First, the city's world renowned Metro subway system transports millions daily and contains 4 lines of track with 68 stations distributed among them. The Metro is praised worldwide for its simplistic and efficient methods for transporting people, and for its diverse and local architecture that decorates each Metro station.

Secondly, the city of Montreal has a fleet of nearly 1,700 buses on 192 routes that run in and around the main island. The buses constitute only 2% of the city's pollution; compared to 50% for automobiles (Everything About the STM). In 2010, the city stated that it had plans for all their buses to be electric by 2025. The city also stated that by 2012, all buses would either be electric or they would have hybrid engines. There has been a great push in recent years to get more citizens onto buses.

However, there are alternatives to the mass transit system which includes busing and the Metro. The city has also implemented a program called Bixi Bikes. This program allows residents to rent out bicycles for low daily or hourly fares. It encourages bicycle usage for short travels in the city and nearby destinations. Another alternative is automobiles, which still have a heavy influence in Montreal. Despite the prevalence of public transportation and greener initiatives, the citizens of Montreal depend on cars to get on and off the island, and traffic congestion on the major auto routes is still a great concern for the city. Now, with automobiles producing eighteen times more pollution than their bus counterparts (Everything About the STM), it is important for the city to continue on its path towards more environmentally conscious transportation.

Although Montreal does not have a city-wide food sustainability plan, the city is making strides in the field mainly due to the work of individual organizations. Lufa Farms is environmentally responsible in many areas. For example, the water they use on their crops is harvested rainwater, rather than water from Montreal's water supply. They also control pests using bugs that prey on these pests, rather than using "synthetic pesticides" which have been known to cause "serious health problems" (Lufa Farms 2012). Rooftop greenhouses allow farmers to produce food year-round, which makes farming more profitable. Although the start-up cost to such a business is high, its operating costs are low. Lufa Farms representatives say that the rooftop gardens can reduce twenty five percent of the carbon footprint of the city. Representatives hope that their initiatives will promote local buying (innovapedia.org 2011). Another organization, the Victory Garden Network strives to educate the Montreal community about local farming. The Victory Garden Network was the first collective garden initiative in Montreal. They have ten organic gardens that bring the people from all over the community together to ensure food security. Residents share a portion of their harvest with the rest of the community (Action Communiserre 2012). Community gardens and rooftop greenhouses are not the only initiatives that Montreal has for food sustainability. The Montreal community also has programs to ensure that the food they produce is being used to its fullest capabilities, mainly through initiatives by college students.

A non-profit student organization based at McGill University, Montreal Urban Community Sustainment, has several programs to promote urban sustainability, including a Dining Co-op and the Zero Food Waste Network. The Dining Co-op works to create an engaging community space in Notre-Dame-de Grace where people can cook, share meals, and partake in group food buying which is cheaper and more sustainable. Zero Food Waste Network takes surplus food from local businesses and redistributes it to local food security organizations (DAC & Cities 2012). These three organizations are a small portion of groups dedicated to empowering the localism movement in Montreal. There are also many farms, retail stores, and restaurants that support the movement. With the amount of community support that Montreal has, the city is moving in the right direction towards food sustainability and security.

In recent years, the city of Montreal has placed much of its effort into revamping its current recycling initiative. The recent global economic crisis has drastically cut the earnings that recycling companies once made off of their recycled materials, which may cause Montreal's recycling program to be discontinued (Hour Community 2008). The recycled materials are sold to recyclers, who transform them into substances that can be used to create new products. Montreal's recycling center is solely funded by the revenue that they receive from their recycling sales (Enviromontreal 2011). Unfortunately, China and India, two of Montreal's highest bidders, stopped their demands for recycled materials to manufacture into new products. Due to this sales cut, the prices of common recyclable

materials such as metal, mixed paper, plastic, and glass have decreased by over fifty percent and some materials are no longer recieved at all. There is now very little money available to allocate to equipment, payroll, and storage expenses (Hour Community 2008). However, in an effort to improve the “greening” of Montreal, a green waste collection has been put into effect and applies to all residential and institutional building types. In addition to the routine Friday garbage collection, the green waste collection will now also be put into effect (Waste Management 2012). Initiatives such as these show how Montreal is making an effort towards the betterment of its community.

Montreal is also known for having verdant parks that contain large mountains and pristine lakes. Montreal has 18 major parks and about 1.2 million trees on public land (Ville de Montreal A 2012). However, among Canadian cities, it has one of the lowest amounts of green space per inhabitant (Greater Montreal 2012). Its loss of green infrastructure was due to the fact that much land was developed between the 1980’s and 2000’s. “It is estimated that the disappearance of 90% of the island’s forests led to the loss of 60% of its biodiversity” (Greater Montreal 2012). In response to the loss of green space, in 2004 Montreal set a target of protecting 6% of its land, and by 2010 green space has grown to 5.2% (Ville de Montreal A; Greater Montreal 2012). This city is also planning on increasing the canopy cover from 20.5% to 25% by 2025 (Ville de Montreal A 2012). By increasing the canopy cover, Montreal will be able to combat their loss of biodiversity as well.

In summary, Montreal is launching many new programs and plans to help increase awareness of the environment. Some of these initiatives, such as food and recycling, are on the weaker side, considering that the city has no definite plans for these programs. However, not all of Montreal’s sustainability efforts are in vain. Under the umbrella of the Montreal 2025 program and the Community Sustainability Plan, sustainability projects continue to be developed. Because of these initiatives, Montreal is currently a world leader in sustainable development and plans to continue on the path towards a greener city through the promotion of its strongest initiative, the greening of its buildings.

#### Best Practices: Green Buildings

Within the green buildings initiatives, three different sectors seem to be the most conducive of positive influence on Montreal’s carbon footprint: LEED Certification requirements, water conservation projects, and the green building goals of the Montreal 2025 Plan. LEED Certification requirements and the water conservation projects fall under the Montreal Sustainable Development plan for 2010-2025, while the Montreal 2025 Plan is handled by both public and private firms to create a more sustainable city. Each project will be all encompassing, affecting both public and private buildings, and while these projects will come at a large cost to both the city and individual businesses, there seems to be a large support base among both public and private sectors.

The Montreal 2025 plan has four strategic initiatives related to buildings: the Quartier Des Spectacles, Montreal Harbourfront, Space for Life, and Montreal Technopole (Montreal 2025 Project 2010). The Quartier des Spectacles alone will cost 1.9 billion dollars and is aimed primarily at the urban district, with hopes of converting the cultural and educational centers of the city into sustainable landmarks that will be world-class destinations. The Quartier des Spectacles initiative encompasses a 1km<sup>2</sup> district containing 80 cultural venues, 45,000 jobs, 27,000 students, and 450 cultural businesses (Montreal 2025 Project 2010). Montreal Harbourfront will cost approximately 6.4 billion dollars and is primarily focused on reconnecting the city to the St. Lawrence river through recreational areas which will utilize vacant land. In addition to these efforts, the city is currently working on a Space for Life, which will be Canada’s largest natural science museum complex, costing 189 million dollars and featuring the Biodome, Botanical Garden, Rio Tinto Alcan Planetarium, Insectarium, and Biodiversity Centre (Montreal 2025).

While these initiatives are impressive individually, the Montreal Technopole, at a cost more than the other three initiatives combined (C\$ 10 billion) is clearly Montreal 2025’s leading initiative. This

project has goals of expanding the city's science and technology assets, utilizing its 11 higher education institutions, 200 research centers, and 200,000 workers in the aeronautics, life sciences, and information technology sectors alone (Montreal 2025). 8 billion dollars will go towards the expansion and construction of 3 university hospitals, as well as efforts to create health research districts. The other 2 billion dollars will be invested in the expansion of universities, such as McGill University, which are in need of larger spaces to accommodate growing student populations (Montreal 2025). These large construction projects will occur under the stringent efficiency requirements of the Sustainable Development Plan and therefore will not only make the city a cultural, educational, and technological mecca, but will do so through sustainable development and the creation of green spaces.

An important specific aspect of the Montreal 2025 initiative and other sustainability efforts is the LEED (Leadership in Energy and Environmental Design) certification of Montreal buildings. In a 2008 report by the Commission for Environmental Cooperation, it was determined that Canadian buildings accounted for 35% of greenhouse gas emissions, 33% of total energy usage, and 50% of consumed natural resources for the country as a whole (The Gazette 2008). Montreal took the first step in curbing the great carbon emissions of buildings by requiring LEED certification for all new large buildings (over 500 m<sup>2</sup>) and by financially rewarding those older buildings that renovate in order to gain certification.

Certification is achieved in order for buildings to be constructed, operated, and maintained through clean and efficient methods. Buildings are ranked on a 100 point scale, with 40% being the bare minimum "certified" level (Lampert 2011). Montreal, however, strives to surpass the bare minimum standard by a large margin. The aforementioned larger buildings are required to reach the second-highest certification, gold (Lampert 2011), whereas the older renovations must reach only silver certification. The city government has stated that it plans to follow through and ensure that any new municipal buildings are LEED gold-certified and all previously existing municipal buildings reach silver LEED certification (Beaudin 2009). Montreal alone is currently home to seven of the twenty-two LEED-renovated buildings in Canada (Lampert 2011).

Another area that is related to the greening of buildings involves water conservation. Montreal has an abundant supply of water through lakes, rivers, and underground aquifers, but reduced flow in the St. Lawrence River has caused Montreal to implement many methods that would conserve water. In 2007, the Mayor of Montreal signed the framework agreement for water conservation of the Great Lakes and St. Lawrence cities initiative. The city is committed to reduce potable water production by 15% by 2015 compared with 2000. The agreement also calls for 30,000 water meters to be installed in buildings during the next five years and the installation of 450 sites measuring flow and pressure (Great Lakes 2009). By adding water meters and water-efficiency measures, buildings have become a central site of improvement for the city's water conservation efforts. In a matter of two years, Montreal was able to cut potable water production by 7% (Ville de Montreal C 2012).

LEED certification also motivates building owners to improve water efficiency and conservation. New buildings with LEED certification must employ strategies that in total use 20% less water than the water use baseline for the building. They must also have a permanently installed water meter that measures all potable water use for the entire building and associated grounds (Canada Green Building Council 2009). This reduction can be accomplished through the use of high efficiency fixtures or dry fixtures and water saving devices. It can also be accomplished through the use of alternative on-site sources of water like captured rainwater and stormwater. Another LEED certification requirement is water efficient landscaping. The buildings can reduce potable water consumption for irrigation by 50% (compared to the calculated midsummer baseline), or they can also go another route and use no potable water for irrigation (Canada Green Building Council 2009). Potable water consumption for irrigation can be reduced by irrigation efficiency and/or through the use of alternative water such as captured rainwater and treated wastewater. In conjunction with the Great Lakes and St. Lawrence Cities

Initiative, Montreal is able to reduce potable water use, increase water efficiency and distribution, and conserve/recycle water.

Another major milestone in the sustainability of Montreal is their world renowned underground city. In 1962, the city of Montreal began its underground city, officially dubbed 'La Ville Souterraine' (Underground City 2012). Intended to keep Montrealers safe and warm during the winter months, this subterranean complex features shopping centers, offices, residences, and even a few select buildings from Montreal's public universities (Underground City 2012). This underground system has greatly benefited the city of Montreal as a whole. Firstly, this building complex has allowed for adequate living conditions to be sustained without even emerging above land. Secondly, shopping in Montreal no longer requires automotive transportation between stores. Since many of the businesses are now located in the underground tunnels, gasoline-fueled methods of transportation have been nearly cut out. Finally, this underground tunnel allows for the participating buildings to lower their energy bills and conserve energy. By relocating below the surface where the cold weather does not greatly impact the environment, the buildings and businesses of La Ville Souterraine can maintain their indoor temperatures with less energy. Thus, this complex prevents the effects of unnecessary opening and closing of doors that would otherwise cause increases in heating and cooling costs and energy usage. Because of Montreal's drastic change in the location of buildings, Montrealers enjoy a comfortable, cleaner shopping experience, and the less sustainable above-ground retail development nearly came to a halt for the latter half of the 20th century (Underground City 2012).

Montreal's model green building is the Air Transat head office in Saint-Laurent. Air Transat is the only LEED platinum in the city. It was awarded the certification for existing buildings, becoming the first of its kind in Canada. The office was built in 2004. (Massicotte 2012). In 2007, the company decided to reduce its carbon footprint by adopting environmental policies (Canadian Property Management 2011). Since then Air Transat has decreased their energy consumption by ten percent and their water use by forty percent. It has also implemented a waste management system that focuses on composting and recycling. Air Transat's adoption of green policies has led suppliers to "offer a wider range of environmentally friendly products." The company does not plan to stop with the head office building, but to expand its green practices to all areas within its operation (Transat 2011). Air Transat serves as an example for other buildings that are striving to become LEED platinum or more environmentally sustainable in Montreal.

Making buildings more sustainable is essential to reducing the carbon footprint of a city. Of the three areas we examined that influence the public and private sector to make buildings more sustainable, the Montreal 2025 plan outlines how to reduce the city's carbon footprint. When relating specifically to green buildings, the section of the Montreal 2025 plan that directly influences the sustainability of buildings is the LEED Certification program. Our third sector when relating to green buildings was water conservation in the city of Montreal, which has a direct impact on the local environment, and therefore is an essential aspect when relating to the sustainability of buildings in Montreal. The Montreal 2025 plan, the LEED Certification system, and water conservation are three areas that are extremely important when it comes to the greening of buildings, as well as reducing Montreal's carbon footprint as a whole.

## Conclusion

In summary, Montreal is striving to become a leader in the realm of urban sustainability programs. The city still has work to do, but its efforts in sustainability have not gone unnoticed. Montreal's sustainability initiatives include recycling, green spaces, food, green buildings, transportation, and green businesses. The greening of buildings is arguably the city's most advanced initiatives. This is not to say that the other sustainability plans are weak, but the city has made some impressive changes in the greening of buildings.

Montreal's green buildings initiatives are a key part of its sustainability plan. The portability of Montreal's green buildings practices is very realistic and these practices could easily be used in many cities around the country because the conditions allowing them to thrive are not unique to Montreal. The LEED certification system is used internationally, and Montreal's government has simply taken efforts to ensure that many of its buildings are LEED certified. The uniqueness of Montreal, however, lies in its source of water from the St. Lawrence River, which, as previously mentioned, has reduced flow in recent years, which is one reason for water conservation efforts. Along with the greening of its buildings, Montreal is also looking to conserve the amount of water used in those buildings. Most cities have a river supplying their water, therefore water conservation is an important factor that can be used in the sustainability plans of other cities. Through a similar sustainability plan, as well as government initiatives, the sustainable buildings plan that has developed in Montreal could easily be achieved in other cities across the globe.

Montreal's strength in creating greener buildings is through the Montreal 2025 plan. When the plan's goals are fully achieved, Montreal will be a leader in the field of green buildings and environmental sustainability overall. The emphasis the city has placed on LEED certification will result in a large amount of buildings becoming greener. The work that has been done with water consumption is impressive and can only improve. Another strength of Montreal's green buildings initiatives is the support it has received from both the private and public sectors. One downside is that most of the city's building initiatives are still in their early stages, making it difficult to tell if they will be able to achieve their goals by 2025. Also, the cost of the plan is another weakness that can affect the implementation and final result of the initiatives. Although many cities across the world are concerned with energy conservation and buildings, the showcase projects found in Montreal are likely only to be affordable in wealthy cities in the most developed countries.

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## The Greener, Greater Buildings of New York City

By Autumn Henderson

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New York City is home to eight million inhabitants and will be housing almost one million more by the year 2030. As the most populous city in the United States, it requires massive amounts of food, energy, and buildings in order to sustain the population. Recent studies of health and livability problems in New York City, including growing rates of asthma, along with awareness of the negative impact the city as a whole has on the environment, have led New York City government and local organizations to devise and enact plans and policies that will make it a more sustainable and environmentally-friendly city.

Various organizations have taken the initiative to help New York City become a greener city. The Pratt Center for Community Development assists in funding retrofits, and food organizations such as the Greenmarket Farmers Market aim to make it more convenient to obtain fresh, local food. With PlaNYC, which is New York City's sustainability plan, Mayor Bloomberg set goals to prepare the city for one million more inhabitants while reducing New York City's impact on the environment and improving the quality of life for its residents. Established with targets for the year 2030, this plan brought together over twenty-five agencies to work towards a greater, greener New York. The comprehensive plan includes all aspects of New York City life, from concerns with the water supply to solutions for alternative energies. Of the various areas discussed in PlaNYC, the section of greatest concern to New York and that is arguably the most detailed is its plan for the greening of buildings.

The analysis that follows will first highlight the several areas of concern that PlaNYC focuses on in an attempt to create a greater, greener New York. I am going to discuss what makes this plan an example for other plans to follow, as well as examine its areas of strengths and the areas that could use more attention and more initiatives. In the second part, I will draw attention to the area that New York City is making great strides in and why it is of big concern to the city: its buildings. New York's buildings require a lot of focus, as they heavily impact the environment. What PlaNYC lacks in other areas of concern it makes up for in its initiatives and plans to make its buildings "green buildings."

### About PlaNYC

PlaNYC is New York's complex sustainability plan that focuses on reaching goals in the next twenty years, which is when population is expected to reach nine million, one million more than right now. It highlights every area of main concern, from air quality to water supply. Although the plan's goals are forecasted for 2030, it is already putting into motion various solutions for short-term living. PlaNYC is bringing together "over 25 city agencies to work towards a vision of a greener, greater New York."<sup>1</sup> PlaNYC covers the major areas of concern that need to be addressed. Among these areas include housing and neighborhoods, parks and public space, brownfields, waterways, water supply, transportation, energy, air quality, solid waste, food, buildings, and natural systems.

What makes PlaNYC a model for other cities is the construction of the plan itself. It specifically mentions all the areas that need to be worked on and provides deadlines for when smaller projects in those areas need to be completed. Its main goal is to have its initiatives completed by 2030; however,

smaller, short-term goals have been set that will contribute to the overall goal. Each area of the plan clearly outlines what the key issues are and what the status quo is. It moves to a specific set of initiatives and steps necessary to complete those initiatives. Then the plan specifies a date when the projects mentioned should be completed and who they will be completed by. By having this sort of goal system with deadlines, it makes the initiatives listed a reality instead of ideas being thrown around but not necessarily being implemented. Overall, PlaNYC's design is to give us an idea of issues, goals to address these issues, ways to accomplish the goals, and time frames by when the goals are to be completed. It provides a structure for which New York City can work to become a greener city.

Although PlaNYC is taking great strides in shaping New York City into a green city, it has its weaknesses. There are some areas not necessarily covered as well as other areas even though they are just as important. Among those areas include food and energy.

*Weaknesses:* There are several community organizations that are trying to solve food crisis, such as the Greenmarket farmers market and City Harvest. The Greenmarket farmers market was created to allow farmers to sell locally grown produce directly to consumers and increase the availability of fresh produce to New Yorkers. It caters to low-income areas by accepting EBT or food stamps and also supports immigrant farmers and creates jobs. City Harvest is a food rescue organization dedicated to catering to those in need of food by food rescue and distribution and education. It is focused on solving the growing crisis of malnutrition and obesity by providing cheap, healthy foods in low-income neighborhoods. Some of the areas it focuses on are the South Bronx; Stapleton, Staton Island; and Bedford-Stuyvesant, Brooklyn. These two organizations, along with several other organizations and programs, move New York into becoming more sustainable.<sup>2</sup>

However, the plan itself does a poor job in addressing the food situation. In the original version, for example, food sustainability was not even included. The current vision mentions it, but only briefly in two pages. The plan's primary concern is increasing the community and school gardens and the availability of fresh, local food in low-income areas. New York City's Department of City Planning has made it possible to compile a list of the issues the city is facing and to devise a plan to reconcile these issues. The Department of City Planning conducts analyses in order to create policies and zoning regulations for individual neighborhoods, businesses, and the city government. One issue that arose was about neighborhoods not having enough markets. The mayor requested that City Planning in conjunction with the Housing, Economic and Infrastructure Planning division conduct a study of shortages of markets. The analysis measured areas of greatest need for fresh food based on neighborhoods with high levels of diet-related disease and largest populations with limited opportunities to buy fresh food. The study was necessary to aid in the development of policies that could address the high crisis of diabetes and obesity. In addition to promoting healthy lifestyles, the policies would be accompanied by more jobs and an increase in property value in the city.<sup>3</sup>

Unlike the food situation, energy is actually mentioned extensively in the plan. However, most of the plan's initiatives on energy feed back into its plans to green New York's buildings. Actually trying to find out what New York is doing to move to more renewable energy is difficult. New York is ahead of the national average for clean-energy consumption, primarily due to its use of hydroelectric power and nuclear power. However, the possible closure of Indian Point, the nuclear power plant located in Buchanan, New York, could possibly drive the city to invest in other resources.<sup>4</sup>

*Strengths:* Although PlaNYC has its faults, it has other areas that are more detailed and comprehensive, such as addressing parks and public space in New York City. The overall goal for parks and public space is to have all New Yorkers living within a ten-minute walk of a park. The parks serve the city by increasing the overall health of an individual, by providing a place for community development, and by having an effect on the economy in terms of raising property values. The big initiatives in this plan are to target high-impact projects in neighborhoods underserved by parks, create destination-level spaces for all types of recreation, re-imagine the public realm, promote and protect

nature, and ensure the long-term health of parks and public space. These sound like ideas with no sustenance to them, but the plan goes into greater depth with each area. For example, planting one million trees is part of promoting and protecting nature, and a website is set up to advertise this initiative and discuss what has been done and what is to come in the future. 5

Another area PlaNYC is doing a great job of addressing is transportation. The plan's main initiative with its transportation system includes expanding sustainable transportation choices and ensuring the reliability and high quality of their transportation network. The main focus is to improve the efficiency of their public transportation. New York City seeks to expand the options of transportation and decrease traffic congestion, hoping to expand and improve services such as subways, commuter rails, and buses. The city is more concerned with less use of personal vehicles and the shift to public services and alternative transportation such as biking and walking than it is with greening transportation, although it is making moves in that direction. New York City's Department of Capital Program Management is seeking to green the public transportation system to provide better air quality. So although not necessarily mentioned in the plan, transportation is being worked on in terms of being greened.<sup>6,7</sup>

#### The Greener, Greater Buildings Plan

Amongst all of PlaNYC's areas of concern, its plans to make New York City's buildings green are perhaps the most extensive and comprehensive of all the plans for the other areas. Greening buildings is a major focus of New York City because its buildings account for almost eighty percent of carbon emissions. Furthermore, one percent of its buildings are producing more carbon emissions than the city's cars and trucks combined.<sup>8</sup> Because of the buildings' carbon footprint, the city "has enacted a set of efficiency requirements" for existing buildings. To respond to the carbon emissions of buildings, the city has developed four policy reforms to remove loopholes in the energy code and authorize a set of cost-effective energy upgrades and evaluations.

*The Laws:* The first law, Local Law 84, enforces the act of benchmarking buildings. Benchmarking refers to measuring "the total electricity, natural gas, steam and fuel oil consumed in a building and adjusts for other factors so that the city can understand which facilities are operating inefficiently."<sup>9</sup> Benchmarking allows the city to prioritize which buildings need to be addressed first and to appropriate investments according to the buildings that are the most in need.

The energy code, comprising of laws Local Law 1 and Local Law 48, "require upgrades to meet code for any renovation or alteration project, instead of those only affecting more than 50% of the building system."<sup>10</sup> The previous code only required buildings where more than half of the building's system was being renovated. However, most of the buildings in New York undergo renovations that contain less than fifty percent of the building's system. Therefore, the energy efficient gains that could have been made in these buildings did not happen. The new energy code affects any building undergoing renovation without regard to how much of the building is being renovated.<sup>11</sup>

Local Law 87 requires buildings to undergo energy audits every ten years and to retro-commission buildings to ensure they are running efficiently. Before the law, several buildings were not undergoing audits that would have resulted in energy savings. Now, the audits are required of those buildings not exempt and the audits "must include all of the base building systems, including building envelope, HVAC systems, conveying systems, and electrical and lighting systems."<sup>12</sup> The law requires that the buildings also undergo retro-commissioning comprising of an analysis of all required base systems of a building.<sup>13</sup>

The final law, Local Law 88, requires that non-residential buildings undergo retrofits of the lighting systems to upgrade to more energy-efficient lighting. Because such advancements have been made in energy-efficient lighting, the law requires buildings to take advantage of the new technology that will result in lower energy costs and energy consumption. The law also requires buildings to install

electrical sub-meters so that energy consumption can be monitored more effectively. Before this law, buildings were only using one meter and being billed a standard rate regardless of how much energy was actually used. Therefore, buildings were unaware of how much energy was being consumed, and now that buildings are required to have more than one meter, energy can be effectively monitored.<sup>14</sup>

A solution to make buildings in compliance with requirements of the laws is retrofitting, which is the renovation of homes and buildings to make them “green.” Retrofitting is the art of making a building both sustainable and environmentally friendly by upgrading old systems with new appliances, equipment, etc. Not only do large buildings emit carbon, they also produce most of the waste and consume most of the water supply in New York. Switches will be made to alternative energy sources, such as solar panels, and equipment will be installed that will reduce much of the waste, water consumption, and energy used. For example, many of New York’s buildings are required by the Greener, Greater Buildings Plan to use Energy Star equipment and appliances. (Energy Star appliances are more energy efficient appliances that emit less than regular appliances.) Buildings will also be renovated to have a cleaner and more environmentally friendly environment, thereby increasing employee productivity. From improving light quality to adding plants, the retrofits will have a positive impact on the work environment.<sup>15</sup>

*Financial Support:* Although the requirements set forth by the Greener, Greater Buildings Plan will lead to energy savings and efficiency, spending is necessary to acquire the savings. Help for funding the investments include The Pratt Center for Community Development with their Retrofit NYC program and the New York State Energy Research and Development Authority (NYSERDA). The Pratt Center for Community Development offers professional skills in order to aid communities in building a more sustainable environment. “Retrofit NYC Block by Block brings six neighborhoods in four boroughs into an unprecedented campaign to get New Yorkers to reduce their energy use through smart investments in their homes.”<sup>16</sup> It basically influences residents to make retrofits to their homes and assists in helping property owners track their energy use, calculate their energy savings, and schedule retrofit work. In general, Retrofit NYC is about building community trust in order to exert influence. NYSERDA is aiming to combat the costs of retrofitting by assisting in financing the purchases of new equipment such as solar panels, lighting, and other energy-efficient equipment. In particular, their FlexTech program provides funding “for comprehensive, customized energy studies for commercial, industrial, institutional and government buildings.”<sup>17</sup> Those interested can receive fifty-percent funding for energy audit and retro-commissioning studies. The Pratt Center and NYSERDA are just two of several organizations and programs that can reduce the costs associated with making buildings more energy efficient.<sup>18,19</sup>

## Conclusion

New York City is well under way toward building a more sustainable city with enacting plans to become a greener city. Initiatives ranging from the city government’s plan to organizations being developed have driven New York closer to its goal. PlaNYC has laid out a basic framework to mold New York into a more sustainable city by outlining goals to be reached and making headway in several of those goals. Aside from PlaNYC, organizations such as the Greenmarket Farmers Market have made it a priority to provide healthier foods grown by local farmers to consumers, whether they have cash or food stamps. These efforts are part of a mobilization to make New York City a sustainable and environmentally friendly city while housing nine million people.

PlaNYC lacks developed plans for moving towards alternative energy. There are plans to retrofit buildings with solar energy; however, not many moves have been made to rely more on alternative energy sources, primarily due to the fact that New York City uses hydroelectric and nuclear power. New York is above the national average in using cleaner forms of energy, but with the possibility of Indian Point closing, it needs to develop plans to move away from nuclear energy to alternative energies.

Not only is energy a weakness, but food is not extensively planned out in PlaNYC. The original plan did not even discuss the issue of sustainable food. And whereas there is a section on it now, it is covered in two pages and not well-developed. Community organizations are working to reconcile the issue of local food, but the city government itself is lacking in addressing the problem.

Out of New York City's many initiatives, creating its greener, greater buildings is its best practice. New York has structured a well-developed plan for greening its buildings, making retrofits to its buildings being of top priority. The idea is to make building energy efficient and improve the work environment of businesses, and NYSEDA along with other organizations make funding retrofits more affordable, thereby influencing homeowners and business owners to invest in retrofits. As the most populous city in the United States, New York has a hard time being green and accommodating its residents at the same time, and addressing its many buildings in the way that PlaNYC has laid out brings New York one step closer to being environmentally friendly.

Even though this plan has its weaknesses, PlaNYC is the epitome of a strategic plan to make a city more sustainable, and thus is a model that other cities could follow. Not only is it well laid-out and detailed, it includes deadlines and a grading system that gives the impression that the plan is serious and is going to be followed out. Initiatives that New York is taking to make its buildings greener could be effective for other cities depending on the resources they have to undertake this task and depending on how much in need a city is for these initiatives.

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## Oakland's Green Jobs

By Jacob Brenner

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The city of Oakland has devoted millions of dollars and countless hours to providing an ecologically friendly community for all of its citizens. As a result of its effective planning, Oakland has been ranked among the nation's top ten greenest cities eight times in the past decade. The city is currently in phase one of its sustainability plan, mitigation, which involves developing and implementing basic strategies to minimize its carbon footprint.

Established in 1997, the Sustainable Oakland Program provided a systematic organization of the city's departments to work towards limiting poverty and achieving sustainability in all aspects of the built environment. Sustainable Oakland is developing the Energy and Climate Action Plan (ECAP), Oakland's first noteworthy layout to reach their goals. This plan aims to limit Oakland's greenhouse gas emissions and energy consumption through a number of specific guidelines involving buildings, jobs, food, waste, and transportation. Moreover, the ECAP serves as a template for local communities to participate in more sustainable and efficient activities. Although Oakland is lacking in its ability to establish effective local food practices and sustainable businesses, it has an innovative plan to develop green jobs training initiatives all over California (City of Oakland 2011).

In this case study of Oakland, I will analyze the Energy and Climate Action Plan's strengths and weaknesses and then offer suggestions on how Oakland can refine its plan. It is imperative to grasp the basic ideas of the sustainability plan before choosing a best practice. After breaking down the city's proposal, I will then to explain why Oakland's unique approach to green jobs is a valuable model for other cities.

### Strengths and Weaknesses of the ECAP

The first aspect of the Energy and Climate Action Plan is to achieve zero waste by 2020. In 2006, the Oakland City Council established a goal to reduce about 90% of the solid waste sent to landfills each year. Throughout the past four years, Oakland has already reduced approximately 100,000 tons of its solid waste disposal. In addition to the zero waste goal, the Bring Your Own Bag (BYOB) campaign has improved Oakland's waste management system. It has led to the distribution of efficient, reusable bags to replace single-use bags in grocery stores and other shops throughout the city. These bags minimize litter and reduce contamination to waterways and other resources that are crucial to our survival (City of Oakland 2009a).

Oakland's waste reduction efforts have also been successful on a residential scale. Initially, the municipal recycling program only served half the city, but within the past decade, the curbside recycling program has been expanded to all of Oakland, resulting in a considerable increase to its total recycling tonnage. In order to sustain the current progress, the Energy and Climate Action Plan designed a proposal to refine the waste management system. Under the new system, there will be economic incentives for businesses and individuals to reduce their waste and modifications to the types of materials permitted to be recycled.

Oakland's measures to limit its waste production have been successful not only because the city council has increased the scope of the waste management system, but also because the legislative actions are pragmatic. As a result, the city's waste production has been declining exponentially for the

past five years, and the city could achieve its goal of getting close to zero waste. Establishing incentives will inspire people to further engage in recycling practices, especially in our current economic recession.

Another category in which the ECAP excels is transportation. Public transportation is a leading source of carbon dioxide emissions. Limiting the use of fossil fuels in Oakland's municipal fleet would not only mitigate the depletion of the ozone layer in the atmosphere, but it would also decrease the instances of asthma and other illnesses. To lessen the negative effects and consumption of greenhouse gasses, the city government has advanced a variety of alternative energy fuels, including hydrogen and compressed natural gas (CNG). The enactment of the Green Fleet Resolution promotes the application of these sustainable fuels to Oakland's public transportation. Along with the Truck Replacement Project, which provides trucks the necessary funds to add a filter to their exhaust system, city officials hope to have created a completely "green fleet" of public vehicles in the long run. But achieving sustainability in public transportation is only half the battle; reducing the amount of cars on the road is also fundamental to reducing greenhouse gas emissions. Therefore, Oakland provides a free downtown shuttle to displace the number of people traveling via cars (City of Oakland 2009a).

Governmental officials are still in the course of discovering new, efficient methods of transportation. For example, they have been looking into Bus Rapid Transit "to make transit easier, faster, more reliable, and more convenient" (City of Oakland 2011) due to its favorability in other cities such as New York City. This systematic transportation network allocates specific lanes for buses to reduce traffic and improve punctuality. Even though segments of Oakland's transportation proposal are still in their initial stages, the city is continuing to develop its transportation efforts to reduce its carbon footprint. Alternative fuel stations have been constructed throughout the city, and the comprehensive "green fleet" of public transportation stimulates excitement and attracts hundreds of car-owners to ride the buses each day. In short, it is difficult to spend a day in Oakland without observing its green modes of transportation.

Similar to Oakland's measures to limit waste and practice green transportation is its focus on green buildings. The Civic Green Building Ordinance requires LEED silver certification for all buildings constructed after 2005 (City of Oakland 2009a). Moreover, "this ordinance further promotes green-building techniques such as the use of sustainable wood products, reduction, reuse, and recycling of waste" (Hess et al. 2010). Oakland is one of few cities that have passed legislation with respect to environmentally friendly buildings. In addition, the city has collaborated with QuEST, Community Energy Services Corporation, and PG&E to put the Oakland Shines Program in place. This program helps to retrofit buildings with modern appliances such as Energy Star heating, ventilation, and lighting systems. Companies are also provided with free energy audits to receive further assistance in retrofitting buildings. In an effort to expand these initiatives to the private sphere, the city passed the Weatherization and Energy Retrofit Loan Program, which gives impoverished homeowners the ability to reduce their energy expenses and improve the efficiency of their appliances. Oakland has also incorporated solar energy to accompany retrofitting. Solar panels on top of the Municipal Services Center account for 2.3% of the city's municipal electric load and continue to provide energy for other facilities. Oakland's green buildings policies are exceptionally diverse largely in part due to the connection between governmental policies and citizen support of retrofit programs. The government has been actively involved in establishing up-to-date standards while it continues to form partnerships to regulate Oakland's public buildings (City of Oakland 2009a).

Despite the Energy and Climate Action Plan's many strong points, there are still some shortcomings in its local food policies. Oakland's approach to stimulating people to buy locally is undoubtedly less detailed compared to its focus on waste, transportation, and buildings. The plan calls for the development of regulations to enable urban agriculture and food production without any specific guidelines or goals. For instance the sustainability plan claims, "The City will study options to allow for...small scale forms, civic/community gardens, and industrial forms on urban land" (City of Oakland

2011). This vague wording provides deficient insight into where and how Oakland intends to institute its communal food projects. Furthermore, its sustainability plan aspires to “promote policies and programs that increase the consumption of food” but fails to recommend how the city will carry out these strategies (City of Oakland 2011). The Oakland Food Policy Council needs to describe explicit steps and instructions for urban farmers to follow in order to achieve progress parallel to that of the other aspects of Oakland’s green plan.

It is equally important for Oakland to improve its green-business initiatives. The Oakland Shines and QuEST partnership provide resources and knowledge to business owners to jumpstart their sustainability initiatives. This partnership is well thought out and advantageous to retrofitting public buildings, but it will face problems when trying to influence business owners to participate in their program, because, “they still have businesses to run” and “spend very little time thinking about energy and energy efficiency” (Torres 2010). Oakland Shines is insistent upon achieving unattainable goals. For instance, officials have targeted a 120-block area to revitalize 300 to 400 business buildings. Tackling a vast region before attempting to effectuate its practices on a small scale is counterproductive. Oakland Shines should initially focus on a pilot program of retrofitting a few dozen businesses to learn what needs to be improved. Then, after more observation and research, the program can potentially be a leader in green business initiatives (Torres 2010).

The StopWaste partnership works side-by-side Oakland Shines to upgrade businesses. Its goal of stimulating the greening of businesses is more feasible than that of Oakland Shines, but it is not as extensive. Not all businesses are eligible to receive the benefits of StopWaste. For instance, a business must have at least two cubic yards of waste to receive grants, whereas K-12 schools are limited to general agency mini-grants under specific conditions. Even for businesses that do receive grants, the maximum award is \$5,000, which is relatively insignificant because waste reduction services and energy-efficient machinery are extremely expensive. Thus, small businesses do not always have the capability of matching the necessary funds to accelerate the process. Big companies such as the Ghirardelli chocolate company have made the most headway in greening their business because they contain a prodigious quantity of employees and funds. If Oakland were to expand its partnerships to encompass locally owned businesses, then we could consider its green buildings initiatives among the foremost in the world (Alameda County Waste Management Authority 2011).

### Green Jobs as a Best Practice

Oakland’s city council has spearheaded green workforce training programs, which not only improve the city’s sustainability efforts but also alleviate poverty and crime throughout destitute areas of the city. A paradigm of green jobs training, the Oakland Green Jobs Corps (OGJC), was founded in 2008 from a \$250,000 donation of the city council with help from the Oakland Apollo Alliance. Primarily based on their model of green-collar jobs, the OGJC functions to provide “green pathways out of poverty for low-income adults in Oakland” (Ella Baker Center 2011). Green jobs fortify a connection between Oakland’s built environment—including buildings, municipal waste services, and transportation systems—and its citizens through employing the mentally handicapped, ex-felons, immigrants, and the uneducated. Van Jones’ Green For All Program established the four goals of the OGJC to encompass helping young adults with career advice, restoring the environment through a knowledgeable labor force, supporting green business growth, and advancing Oakland as a world leader in economic and environmental sustainability.

In addition to securing the Oakland Green Job Corps’ funding, the Apollo Alliance augmented the backbone to the OGJC’s training model. After recruiting about forty individuals between the ages of 18 and 35, the OGJC operates in three phases including hands-on training, environmental education, and internships. The first phase takes place over the course of three months and provides training in general life skills and supportive services like child and health care. Additionally, the OGJC helps the recruits to

become fully literate, competent in math and English through a hands-on approach, and mentally ready to sustain a long-term job. During this stage, trainees are informed of the importance of labor unions and apprenticeship programs. The next phase proceeds with educating the trainees in four-week rotations about environmental terminology dealing with renewable energy and energy efficiency. The future OGJC graduates have the opportunity of earning \$9/hour and working up to twenty hours per week. In the final stage, trainees earn a living wage and participate in a six-month internship. Financial advisers assist the green jobholders to responsibly manage their money and ensure that they do not end up back on the streets. The Oakland Green Jobs Corps continues its managerial services for at least a year after the trainees graduate (Ella Baker Center 2011).

After completing training in the Oakland Green Jobs Corps, the employees continue to work in green projects throughout the city. They have helped to convert Oakland's Port to biodiesel, creating further demand for jobs because people are needed to construct fueling stations (Jones and Wsyskida 2006). They have also assembled solar panels on the city's ice rinks and other public facilities (City of Oakland 2009a). But most importantly, the OGJC gives people the chance to feel accomplished and productive because they contribute to the green-collar economy in Oakland. Olivia Caldwell, an Oakland Green Jobs Corps graduate, claimed that after the green jobs training she received, she felt she was able to provide for the future of her one-year-old daughter and the future of her planet. Overall, green jobs are associated with safe working conditions, satisfactory pay, and good benefits. These incentives are key to the appeal of green jobs (Wilson 2009).

One of the major reasons for the Oakland Green Jobs Corps' success is the strong government subsidies behind it. The enactment of the American Recovery and Reinvestment Act provided multiple grants, including a \$938,000 grant to the Perla Community College District to promote job skills for the young people at risk (criminals, handicapped, or impoverished). Laney College also received \$1,000,000 to train unskilled workers in eco-literacy and sustainable building strategies. The Cypress Mandela Training Center was awarded \$500,000 to supplement environmental training programs and an additional \$55,000 to remediate highways and other transportation methods. On an individual level, these grants expand on-the-job training sites and allow for more stability in the green-collar economy. However, to see critical changes in the green-collar economy, politicians and business owners must work in unison to establish green policies (City of Oakland 2011).

## Conclusion

The Energy and Climate Action Plan lays the groundwork for innovation and adaption of greener techniques in the future. Compared to other cities, Oakland has a thorough sustainability plan comprising green buildings, local food production, green jobs, green businesses, transportation, and waste. However, with regards to local food production and businesses, its sustainability plan is vague and incomplete. In order to have a substantial impact on communities, Oakland should lay out deadlines and specific goals to ensure that more farmers' markets and community gardens are established. With respect to green business, partnerships should put more emphasis on amplifying their resources to represent the needs of local businesses. As Oakland transitions into phase two of their sustainability plan, it is imperative that its citizens carry on their current sustainability practices.

Despite some of the ECAP's inadequacies, Oakland remains a world leader in green jobs training. Oakland's Green Jobs Corps is the archetypical model of green workforce training. Its practices are not only effective in transforming archaic technology to be modern and environmentally friendly, but they also serve as a successful method of alleviating unemployment. Oakland's green jobs practices could easily be implemented in other cities as long as regional governments publicize the availability of green jobs and provide extensive training for prospective employees. The city has also made progress in establishing partnerships with organizations to reduce the energy consumption of businesses, but forming these collaborations would be difficult in cities without strong incentives for businesses to

become green. Therefore, adopting these policies would require additional legislation by the city government to establish those incentives. Regardless of some of the Energy and Climate Action Plan's shortcomings, Oakland will continue to be internationally acclaimed for its green jobs initiatives, especially as the unemployment issue remains on the top of our agenda.

President Obama promised to precipitate the growth of five million green jobs during his presidency (Kolbert 2009). In our current economic condition, finding such jobs poses a problem. . Bipartisanship in Congress is essential to advancing green policies and even more, environmental sustainability should be a priority for every politician, no matter what their party affiliation is.

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## The 20/20 Sustainability Movement in Ottawa: Focus on Quickway Bus Rapid Transit

By Greg Hawley

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Ottawa, ranked the third cleanest city in the world with the fourteenth highest quality of life, can be considered one of the world leaders in terms of sustainability and its impact on quality of life (Mercer 2010). Even as the fourth largest city in Canada, the nation's capital only has a population of 859,704. With a large focus on government operations and high-tech industry, Ottawa has the ideal foundations to be an innovative model for other cities. Recently, Ottawa has become an unsung leader of sustainability issues, especially in the area of transportation, as evidenced by its state-of-the-art light rail transit system.

In the past decade, the city has made a major push for creating detailed and viable sustainability goals. In the early 2000s, the city began work on the Ottawa 20/20 plan, a comprehensive view of the environmental, economic and social changes the city wanted to see by the year 2020. The plan offers strong metrics based on the current situation, future goals, and dates for progress reports. The city has created many sub-plans in various areas of the 20/20 plan in order to offer not only a comprehensive but also a detailed and plausible solution to the many sustainability issues it faces.

In this paper, the sustainability movement in Ottawa will be assessed, with a large focus on the development of the 20/20 Sustainability Plan. In the first part of the paper, various areas of the plan will be evaluated in terms of success and future feasibility, which includes transportation, greenspaces, waste management, environmental strategies, food, and green businesses. Both the strengths and weaknesses of the plan will be outlined along with the overall effectiveness of the plan. In the second part, one aspect of sustainability will be analyzed in depth, similar to a case study. In Ottawa, the "best practice," or most innovative practice, is the Quickway bus rapid transit system. Finally, to analyze the potential impacts of Ottawa's sustainability plan, its plausibility and portability will be discussed.

### Ottawa 20/20

Ottawa 20/20 is an innovative approach to city development that outlines a vision of the city in the year 2020. As the nation's capital, Ottawa aims to become a leader in creating innovative solutions to social, economic, and environmental issues. Beginning with a "Smart Growth Summit" in 2001, plans for a more sustainable city have grown into a comprehensive and detailed plan. Ottawa 20/20 is complemented by "supporting plans," which are more detailed reports on strategies for each area of sustainability. This unique combination of a comprehensive master plan and extremely detailed supporting plans inspires feasibility and plausibility. However, it is vital to consult not only official documents, but also local organizations, magazines, and newspapers when evaluating the strengths and weaknesses of the plan.

Ottawa's existing greenspace network, along with its plans to increase accessibility, affordability, and expansion, make it a world leader in green-space policy. Ottawa is famous for a "legacy of visionary community builders" who have installed scenic parkways, a greenbelt, and green corridors constructed along rivers and waterways (Greenspace Master Plan 2006). The city has gone through a huge movement to connect these areas, known as the Urban Greenspace Network. Multi-use pathways and green corridors seem to be the most plausible methods to achieving a connected series of green spaces. However, with a rapidly growing population, Ottawa's greenspaces face increased pressures as the 2020

deadline approaches. As a result, the city has already enacted a target of 4.0 hectares of a greenspace per 1000 residents (Greenspace Master Plan 2006). Furthermore, the city already has a target to have all homes be within 400 meters of a green space. More detailed reports suggest that it is feasible to increase the goal to within 250 meters by the year 2020 (Greenspace Master Plan 2006). A potential focus for the city is using recreation as a key for ecological protection (Erickson 2003). If the citizens are more likely to use the green spaces, then it becomes easier for the city to preserve them from urban expansion. Even though pressures are beginning to mount, especially to establish more spaces and organize funding for future projects, the city seems to be in good shape to handle them. With an already strong basis of the green corridors, parkways, and multi-use pathways that make up the Urban Greenspace Network, Ottawa has a detailed and feasible plan to implement new greenspaces and monitor current ones. The Greenspace Master Plan, a sub-plan of Ottawa 20/20, has strong metrics concerning the affordability, accessibility, and expansion of the Greenspace Network, strengthening Ottawa's position as a world leader in greenspace initiatives.

Although Ottawa has never had transportation problems that rival some of North America's other large cities, it has nevertheless become a leader in creating a sustainable network of transportation in the city through cycling, pedestrian, bus rapid transit, and light-rail systems. Part of Ottawa's Transportation Master Plan involves the increased use of cycling and walking as means of transport. The city is focusing on creating well connected, safe, and aesthetically pleasing trails practical for both leisure and utilitarian cycling and pedestrian trips. However, the city recognizes that cycling and pedestrian plans will not solve the transit problems the city is facing. As a result, Ottawa is already a leader in bus rapid transit (BRT), specializing in promoting BRT over a long-range use plan due to its greenspace policies. Ottawa has already served as a model city for cities such as Brisbane, Australia, as it already has a developed BRT system known as Transitways. These, according to the US Department of Transit, have resulted in Ottawa having the "highest per-capita transit mode share of any mid-sized city in Canada or the US" (United States Department of Transportation 2008). Even so, the city plans to add 42 more kilometers of Transitway lines and 58 new BRT stations (Transportation Master Plan 2003). Even with a pioneer BRT system, the city is making progress in establishing a new, more effective light rail transit (LRT) system. Even though the O-Train already exists and operates, the city believes that it could become as effective as BRT systems without the same amount of carbon emissions. On October 21, 2011, the city finalized the selection of three companies for the new LRT projects. The final proposal will be selected within the next year, and by 2013 construction of LRT should begin (EMC News 2011). The implantation of a LRT system is expected to generate \$3 billion of economic activity, along with providing 20,000 "person-years" of employment for construction alone. The LRT system, when completed, could turn out to be the "best and most cost effective solution to the city's long term transit needs" (EMC News 2011). This means that in the near future, Ottawa may not only be a pioneer in BRT, but also in LRT. Considering the fact that Ottawa is already a leader in bus rapid transit and has already served as a model for other cities, it may become an even greater model of sustainable transpiration with its implementation of LRT.

Ottawa's sustainability plan has made considerable progress in recycling and waste reduction; however, new technologies from a private company have the potential to turn Ottawa into one of the most efficient waste processing cities in the world. Currently, the city operates on a bi-weekly collection of blue and black boxes, which help to distinguish between different types of recyclable goods. Probably the most important reason for Ottawa's largely successful recycling programme is citizen participation in sorting and recycling their wastes. Furthermore, Ottawa is one of few municipalities to recycle all types of plastic (#1-#7), while many municipalities only recycle #1 and #2 plastics (Integrated Waste Management Master Plan 2003a). Ottawa's most innovative goal for waste management, however, comes from the private Canadian company Plasco Energy Group. This company aims to turn garbage into both electricity and construction aggregate while creating minimal toxic emissions (Ames 2009). In

order to convert municipal solid waste into these products, the waste is gasified and then refined to plasma to become inert gases or inert slag pellets (Ames 2009). Plasco Energy Group creates the “highest energy yield of any waste conversion technology presently being used on a commercial scale while keeping harmful emissions at or below the toughest environmental standards in the world” (Ames 2009). Even though this is a private company, the government issued a \$9.5 million grant for the development of the research (Plasco Energy Group 2010). The strategies may not be part of official city policy, but there is no doubt that the city is supporting this new technology that has the potential to produce ground-breaking changes in the area of waste management.

The city of Ottawa’s official plans include an Environmental Strategy Plan that addresses key issues such as health, air quality, and water quality. The Environmental Strategy Plan encompasses some of the plans already discussed, such as the Greenspace Master Plan and Integrated Waste Management Master Plan. However, aside from these areas, the city is trying to reduce pollution and environmental degradation by monitoring ground water, air quality, climate change, and forestry. The city is focusing on maintaining and preserving water flows and using these water sources without resulting in water pollution. The forestry plan ties in very closely to the Greenspace Master Plan outlined above; the city has so far been successful in maintaining its connection with nature, which includes forests. Air quality and climate change issues related to three major areas: transportation, waste management, and buildings. The main goals are to reduce energy consumption and to consequently lead to fewer greenhouse emissions and toxic chemicals. All of these goals also relate to human health, because they attempt to decrease the number of environmental illnesses, such as respiratory problems from emissions or acid rain. Many of the city’s goals concerning environmental strategy have been previously outlined in waste, greenspace, and transportation sections of this paper. However, it is necessary to outline the beneficial effects of these policies in greater detail (e.g. health concerns) to further evaluate the successes of the city’s official plan towards creating a sustainable Ottawa (Environmental Strategy for the City of Ottawa 2003-2008).

Ottawa’s official plan offers a comprehensive view of urban design through the City’s Design Objectives, which are particularly strong in the implementation of mixed-use buildings, maintaining cultural heritage, and preserving man’s connection with nature. With respect to preserving nature in the city, much of the work is intertwined with the design objectives of the Greenspace Initiative. However, a new goal within the design objectives is to maintain cultural heritage, considering that Ottawa is the capital of the nation. This is headed under the fourth design objective, to “Respect Established Character.” One of the main goals is to preserve community landmarks, such as Laurier Bridge. The city aims to continue development “with sensitivity as to not overpower or detract” from these historic monuments. Ottawa’s design objectives also aim to preserve local architecture and public art. The city’s overall goal is to increase a sense of community belonging and increase standards of living by sustaining the local heritage and culture of the city. The second, and perhaps most important design objective to be discussed, is titled: “Incorporate Adaptability and Diversity.” The most innovative of these plans is the implementation of mixed-use buildings, such as those found along Sparks Street or the Byward Market. Constructed as a mix of residential, commercial, and civic uses, these buildings are very successful in Canada. The public has been very open to the installation of mixed-use buildings, which fulfills a dual-goal of creating vibrant, livable communities and reducing urban sprawl. The combination of successful urban planning by the city and the reception by the citizens have made Ottawa’s mixed-use buildings, and thus its urban design objectives, very successful (The City’s Design Objectives 2011).

Ottawa’s experiments and planned use of solar energy have started to make it a quiet leader in renewable energy. As recently as January 7, 2011, the city has convened to discuss progress on solar energy in Ottawa. The report revealed that the original MicroFIT programme, which provided solar energy to a few households, resulted in “long-term price guarantees.” (Schepers 2011). The city also recognized that the preference for solar panels has been growing based on research on similar mid-sized

cities in Ontario that invested in solar panels. The city concluded that investment from the government, such as through various cities' hydro companies, was preferable to direct ownership because it did not incur "direct capital investment." (Schepers 2011). A presentation by the Sustainable Eastern Ontario energy network analyzed and summarized the most important parts of the city's solar efforts. Existing solar initiatives within the city include solar energy parks and solar rooftop pilots. The pilots have proved to be so successful that the city has developed a partnership with Energy Ottawa (20-year lease) to develop solar arrays (Sustainable Eastern Ontario 2011). Over the 20-year lease, it is estimated that Energy Ottawa will make between \$4-5 million in profits, thus providing incentive for the company to encourage renewable solar energy usage across the city (Sustainable Eastern Ontario 2011). Other potential benefits include increased financial stability due to new revenue flows, reduction of greenhouse gas emissions, and a shift away from other sources of non-renewable energy. Ottawa also has the potential for increased energy security because they would not be dependent on coal or oil from foreign sources. However, the plan is still underway, with the first solar arrays to be installed in 2012. From there, the programme could continue to grow and continue to strengthen Ottawa's position as a leader in renewable energy technologies in Ontario, and potentially in the near future, in all of North America.

Amidst the wide range of strengths in the Ottawa 20/20 plan, food initiatives are noticeably lacking. The city does not have any significant plans in the area of food sustainability. However, this may be due to the fact that many local organizations have already created their own policies concerning food issues. There is not a pressing need for the city to include many plans because of grassroots and local organizations. Farmers markets have been organized by local organizations and are very popular in Ottawa, without needing much government incentive or endorsement. Perhaps the only significant mandate coming from the City of Ottawa is the Savour Ottawa "seal of approval" (Wagman 2011). This seal indicates products that are locally grown and produced and helps them stand out to consumers in specialty food stores. However, the success of farmer markets should be credited more towards local organizations than the city office. The farmer markets are also helping to spur another non-governmental movement: the Ottawa-Gatineau Slow Food Movement (Hall). In a brief description, the Slow Food Movement attempts to counteract the consumption of fast food by encouraging citizens to eat local, such as from farmers markets. Even though it is a relatively new movement, it is slowly becoming more popular in the Ottawa and Gatineau regions. From the information presented above, it is evident that sustainable food policies are carried out largely by local and other non-governmental organizations. However, when help is needed, the government has offered support, such as through the Savour of Ottawa seal of approval. In reality, what is a weakness in Ottawa's 20/20 sustainability plan is actually a strength in terms of localist movements.

Another major deficiency in the 20/20 plan is a lack of initiatives on green businesses. Even though there are some policies that encourage the construction of reusable buildings and the greening of buildings (e.g. green roofs), the plan does not promote sustainable business practices. Maybe this is also a byproduct of the fact that much of Ottawa is comprised of government operations, many of which have already undergone attempts to become greener (e.g. the use of solar panels on City Hall). However, it cannot be ignored that the 20/20 plan focuses solely on social justice issues, such as encouraging the growth of small, local business. Ottawa definitely has a strong community of small local businesses, especially since it is dominated by government buildings and has high immigration rates, so there is a need to develop this aspect of the city's green plan (A Window on Ottawa 20/20 2003c).

#### Bus Rapid Transit

As outlined above, Ottawa 20/20 has strong metrics to continue developing and carrying out innovative sustainability plans. Of these plans, some that stand out are Ottawa's greenspace network, development of the transportation industry, and research into waste management techniques.

However, if one practice had to be chosen as a “best practice” in terms of current execution, success, and originality, it would be the Bus Rapid Transit (BRT) system in Ottawa.

Ottawa’s Transitway system has resulted in the highest per capita transit use, by a large margin, of any mid-sized city in North America. In fact, Ottawa has been a pioneer in the BRT industry and has created an innovative system of bus transit. A US Department of Transportation report even went as far as to say that Ottawa has “not copied from other cities, but evolved out of Ottawa’s need to achieve certain targets and goals.” The Transitway system in Ottawa, known as Quickway, has grown out of demands and responses to public sentiment, dating back to public sentiment against road expansion that occurred in the late 1970s. In response, the city began to pass policies favouring public transportation and soon began a heavy focus on the BRT system. In creating a unique and personalized transit system, Ottawa is not only a leader in sustainable transportation but also continues to strive to incorporate even more sustainable methods of transportation (United States Department of Transportation 2008).

One of the unique parts of Ottawa’s Quickway transit system is its organization and prioritization of bus transit. Grade separation is key to Ottawa’s bus transit, which creates right-of-way priority for bus transit. Even though there are somewhat inhibitive start up costs before reaching more cost-efficient grade-separated lanes, the gradual development of transit lanes in Ottawa has enabled the city to overcome cost restraints. An important feature of Ottawa’s BRT is that buses move through stoplights by means of timed light intervals and bus sensors. One noticeable divergence from grade separation is that transit lanes do not exist in downtown in order to reduce costs. Instead, other priority methods such as controlling stoplights are crucial for downtown. As a result, BRT is a convenient method of transportation that has allowed the city to have the highest per capita transit use in similar sized North American cities (United States Department of Transportation 2008).

Another important feature of Ottawa’s transit system is the BRT stations. The stations are located at one-mile intervals, which drastically improves the convenience of taking the bus. Furthermore, the stations have enclosures in order to withstand harsh winters and not to deter passengers for travelling on even the coldest of days. The stations are also all made of common design in order to prevent citizens from not using certain stations based on design. Perhaps most importantly in the implementation of stations has been government supports; there has been “strong political support for high quality stations.” BRT stations highlight Ottawa’s strength in not only a more cost-effective and sustainable transit system, but also in making transit more practical, convenient, and comfortable (United States Department of Transportation 2008).

The use of BRT vehicles also demonstrates Ottawa as an innovative leader in BRT. There are no special vehicles for BRT; instead, the Transitway was itself designed to permit more efficient use of the fleet already in existence. Instead of upgrading to greener running buses, Ottawa has been considerable progress in making transport more sustainable by adapting the Transitway to sustain current buses. One new addition has been the addition of low-floor buses, which are not used to replace old vehicles but are now being purchased as the fleet grows. Due to the fact that these vehicles still do not have any special markings, Ottawa has successfully discouraged vehicle branding. By doing this, the city attempts to maintain a socio-economic equity that exists with current users of BRT. By addressing both infrastructural, environmental (greening), and social issues in the use of buses, it is apparent that Ottawa is by far a leader in sustainable transportation (United States Department of Transportation 2008).

With the combination of innovative transit lanes, stations, and vehicle control, the city’s personalized Transitway plan, called the Quickway model, is an innovative and ideal set-up of a BRT system. As mentioned before, one of the most innovative transportation plans is Ottawa’s successful implementation of a grade-separated network. This provides greater access to an increasing number of residential zones, a decrease in travel times for passengers, and the ability to target key destinations.

Being the birthplace of the Quickway model, Ottawa has also developed some unique Quickway-specific plans, such as express branching and right-of-way policies. Furthermore, Ottawa has even begun to incorporate light-rail principles, such as a service spine, into its BRT initiatives. This unique combination of initiatives and goals has turned the Quickway into a revolutionary transit design, one that has already been copied around the world in cities such as Brisbane, Australia. According once again to the US Department of Transportation, Ottawa's "combination of fixed infrastructure but variable service plan has been identified as one of the major strengths of Ottawa's approach." The design of Ottawa's transit lines and bus priority systems, or fixed infrastructure, has resulted in the service being of very high quality, potentially the best in the world. Ottawa is already first in North America in transit mode split, eclipsing such sustainable powerhouses as Calgary and Vancouver. The result of Ottawa's Quickway system is upwards of 200,000 trips per day, an impressive number considering Ottawa's population is only just above 800,000 (and spikes to about 1.2 million when including all surrounding areas). The Quickway infrastructure and service are sustainable not only in terms of maintaining an effective transportation industry but in creating a massive increase in public transport. The Quickway system is an innovative design that has pushed Ottawa to the top of the ranks in sustainable transportation systems (United States Department of Transportation 2008).

With the Quickway system proving to be very successful in increasing public transit, the public had one issue: safety. Worried about the risk of crime at bus stations or even on the buses themselves, some citizens were scared to take the bus into the night hours or in less-safe neighbourhoods (which in turn had the potential to create a socio-economic disparity on the buses). In response, OC Transpo (the City of Ottawa's transportation body), installed 450 camera and surveillance systems at buses stations and on the buses. Furthermore, safe areas were made at boarding sites in stations. Buses are also equipped with emergency lines that alert the driver and give the driver a possibility to prevent the crime or call the police immediately. The city, with an already impressive programme, responded swiftly to the minor safety concerns. This goes to show how important BRT is in Ottawa and how much the city is willing to invest to make itself a leader in sustainable transportation (Hurley 2011).

As can be seen in the analysis of Ottawa's transit lines, the Quickway is one of the most innovative transportation systems in the world. Its accessibility, usability, and practicality have all made public transportation extremely attractive in the city and has thus resulted in one of the highest per capita transit rates in the world, approaching even those of European cities. The high rates of public transportation usage in Ottawa have placed a new standard on sustainable transportation for North American cities. Considering that the city is already a model for other cities, it is still making its own improvements. The Transportation Master Plan from 2003 proposed \$53 million to be spent on BRT alone as part of the 20/20 Plan. Furthermore, it announced seven new corridor projects, many of which have already been completed. Even as a leader in sustainable transport, Ottawa continues to raise its own standards for improving its innovative BRT system (Transportation Master Plan 2003b).

Even though the Quickway is a state-of-the-art transportation system, it is possible that it may not be practical for all cities. The Quickway offers a much denser web of services than most cities, and it may have pushed transit service over a "tipping point" that many cities will not even be able to reach. Even Brisbane, which has experienced success in copying the Quickway system, is much less efficient than Ottawa in encouraging public transit. In the United States, there exists a huge barrier to this innovative transit technology: cost. Grade-separation, a key component of Quickway, has the potential to be more cost-effective in the long run but also has higher up-front costs. It has already proven to be an obstacle for some US cities and may be completely idealistic without the immense city and public support found in Ottawa (along with many places in Canada). This could also contribute to a lack of knowledge regarding the Quickway system. Looking at a combination of both reasons reveals that the state-of-the-art BRT system in Ottawa may be innovative, but may not be portable to all cities (United States Department of Transportation 2008).

## Conclusion

Ottawa's sustainability initiatives currently rank as some of the most feasible and innovative plans in the world. Recent developments in the areas of transport, waste management, greenspace networking, urban design, renewable energy, and environmental strategy are beginning to turn Ottawa into a leader in green practices. Some of the most promising policies in the city include the large investment in solar energy, implementation of mixed-use buildings, and the development of the light-rail OTrain. However, the city's most innovative plan is the development of the Quickway bus rapid transit system. Even though Ottawa is strong in many areas of sustainability, its plan does not include many innovative ideas on local food, and there are significant improvements in general to be made in the areas of green jobs and businesses.

Even though Ottawa has the potential to serve as a model for other cities in many areas of sustainability, many of its policies may not be plausible in other cities. Part of what makes the sustainability movement so successful in Ottawa is government participation and a very liberal view on sustainability policies. This has allowed for many innovative changes, such as government financing and citizen participation in the implementation of solar energy. Furthermore, Ottawa is also a relatively small city with a unique landscape, making the implementation of policies easier and more feasible. For example, creating a network of green spaces may be difficult in city's that do not have an already strong balance between nature and urbanization. Ottawa could serve as a model city for waste management and environmental strategy, but many of its urban design, renewable energy, green-space, and transportation policies may not be portable to other cities. Aside from merely serving as a leader in sustainability policies, Ottawa also has the potential to bring in other successful sustainability plans in areas that need improvement, because of huge public support and government investment. Due to Ottawa's innovative sustainability plans and possibility for potential growth, it should continue to be a global leader in sustainability for years to come.

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## Sustainability and Transit in Paris

By Caroline Saunders, Morgan Huston, Chelsea Parks, and Carson Hedberg

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Paris is not only the capital of France but also one of the cultural capitals of the world. Its population is roughly 2.2 million, and the Ile de France region in which the metropolitan area resides is home to over 12 million people (Paris Digest 2013). The city is famous for its fashion and art industries in addition to its historical buildings and a deep tradition of good food. Every year Paris is host to upwards of 44 million tourists, making it the most visited city in the world (Paris Digest 2013). The most serious environmental issues facing the city are water pollution and air pollution, both largely due to industrial output and the vast amount of solid waste produced within the city limits (Encyclopedia of the Nations 2013). Interestingly, the geography of Paris should allow toxins in the air to be dispelled so as to fall below significant levels; however, due to high population density and activity levels, such dispersal of air pollutants is impossible (Air Quality in Europe 2013). Other issues include biodiversity loss and species extinction. Due to high population density, the sheer amount of tourist traffic, and its respected position as a world leader of cities, it is crucial for Paris to set an example as an innovative, sustainability-minded metropolis. Cities in Western Europe and the rest of the world that look upon Paris as a model for cultural and financial success are likely to implement practices Paris adopts successfully; as such it has the opportunity to export environmentally conscious thought.

Paris has made sustainability gains in a number of areas, including green spaces, waste and recycling, green business associations, energy, green buildings, local food, and transportation. Some areas are particularly strong, among them green spaces and local food, whereas others are relatively weak, such as green business associations and waste and recycling. Paris's best practice is transportation, which includes an array of public transportation options: a metro system, commuter trains that run in the city and into the surrounding suburbs and countryside, a tramway, buses, and bike/bus/taxi lanes. Some of those forms of public transportation are in the process of or will be switched over to more sustainable fuels, but for now they contribute to overarching sustainability by reducing reliance on transportation by private car. Paris also has Velib, the world's most renowned and decorated bike-share program.

This study will begin with an overview of the sustainability programs in Paris, including its efforts to maintain and develop green spaces, green buildings, renewable energy from the sewer system, and local food. The following section will examine the efforts to expand, develop, and green its transportation system. The conclusion will evaluate the transportation programs in Paris and assess their portability for other cities.

### Overview of Sustainability Initiatives

Although Paris has no overarching sustainability plan, it has diverse efforts to promote sustainability in a range of fields. Green spaces are a Parisian strength, thanks largely to a deep heritage of parks and gardens. Waste and recycling are a weakness—despite valiant government efforts, it is difficult to corral public support for more sustainable methods of dealing with waste. Green business associations in Paris are lacking, and any semblance of them comes only in the form of national and

international organizations operating somewhat insignificantly on a local level. However, Paris has such a strong culture of small businesses that this is an area that could feasibly see vast improvement in the coming years. The city has a better record when it comes to sustainable energy; Paris has resourcefully utilized their sewer system and data centers to generate heat which runs directly into the grid. Just over the past few decades, green buildings have been on the rise in Paris. All greening efforts in buildings are optional, but some, like the HQE (comparable to LEED certification in the US), have proliferated in new buildings due to public concern and image. Local food is a particular strength in Paris, largely driven by community and private support. Due to the long history of good and local food, government intervention is not necessary.

Green spaces are a critical part of Paris's heritage and cultural identity; such names as the Bois de Vincennes, the Seine, and the Champs-Elysees spring to mind as city landmarks that are, first and foremost, green spaces that exist for the sake of preserving natural beauty within the bustling metropolis. Such weight attached to green spaces makes for a heavy emphasis on their care and expansion. Many of the city's 400+ parks are historically significant and are a regular part of both tourist and citizen itineraries. Notable examples include the Champ de Mars on which the Eiffel Tower sits; the Bois de Boulogne, created in 1852 to rival London's Hyde Park; and the Bois de Vincennes, which includes woods dotted with lakes, floral gardens, and the Chateau de Vincennes (A View on Cities 2013).

There is no shortage of lay interest in green spaces, nor in regulatory and planning focus. For example, the Atelier Parisien D'Urbanisme (APUR) frequently publishes studies on, among other topics, green spaces and nature within Paris's city limits. These workshop-style studies bring together scientists of varied disciplines, city planners and government officials, sociologists, and professors to put forward cohesive (though very issue-specific and discrete) action plans for increasing the quantity and quality of Paris's green spaces. One overarching three-year study titled "The situation and long-term view of nature's place in Paris," analyzes "the role of nature in densely urbanized cities" and emphasizes reinforcing the relationship between urban social patterns and nature in order to minimize harm to the environment (APUR 2013b). Broad perspectives are taken by the APUR on green spaces, as is apparent in their treatment of Paris's bois ("woods") and champs (literally "fields" but roughly translated as expansive, walkable streetways with both natural and shopping attractions). Entire studies are dedicated to determining and preserving water quality in the Bois de Vincennes and Boulogne (APUR 2013d). For the Champs-Elysees—Paris's most famous shopping street and street-border gardens—and the Champ de Mars—the promenade near the Eiffel Tower—the APUR offers diagnoses of their natural and cultural significance, and prospective maintenance plans.

Other initiatives include monitoring and expanding the use of heavily-tree-lined public highways (as opposed to bare roadways) as a means of enhancing aesthetic appeal, more efficient water cycling, increased carbon sequestration, and "contribution to complex ecosystems" (APUR 2013a). Geographically central to the city's quartiers and network of cultural monuments is the Seine River, whose banks are set to be entirely remade into green spaces over the coming years. The Berges de la Seine (Banks of the Seine) project is a massive undertaking that will promote pedestrian access to and activities around the river, while also increasing biodiversity. The project is in the nursery stage, and the city government has invited residents to put forth ideas before the project is initiated (Davies 2011).

As of the past few decades, waste in Paris is mostly incinerated in order to contribute to the electricity grid and also to reduce the solid waste problem. Recycling is one of Paris's weaknesses, though not for lack of government effort. Rather, there is far too little citizen interest in recycling and reuse in Paris (Bortlin 2007). There are three different bin lids in Paris—yellow lids for paper, plastic, and metal; white lids for glass items; and green lids for non-recyclable waste (Letkemann 2010). Despite the simple system, Paris recycles only 25% of its waste, and three out of every 10 waste products that go through waste processing plants have been incorrectly sorted by Parisians (Bortlin 2007). Despite the shortcomings, one promising feature of the recycling program is that recycled products like newspaper

(half of recycled materials in Paris by volume) pulp are kept within France's borders so as to reduce the carbon attached to transport of recycled goods (Bortlin 2007).

The only plastic recycled in Paris is plastic bottles; all other plastic products are incinerated along with the rest of Paris's disposed-of waste at an out-of-city Syctom plant. The heat from the incineration process is used to heat apartments, or it is converted into electricity (Burelle 2008). Incineration plants across the city have combustion-capture filtration systems so that toxins are not emitted and circulated into the air during the process. Spokespersons for the recycling program justified the choice of incineration over recycling by describing Parisians as being "nonchalant about rules" so that any new constraints imposed upon them would be ignored (Bortlin 2007). The incineration model, as long as the combustion-capture filtration systems hold, is an effective way to move away from landfilling. The Syctom plant's location on the banks of the Seine allows for the slag (leftover waste products after combustion) to be sent by barge down the river with no carbon emissions from plant-to-river transport, and carbon emissions are also kept down by the plant providing district heating (Burelle 2008).

Many of the recycling program's shortcomings will have to be solved through grassroots efforts. For example, a new and blooming movement from the bottom-up in Paris is the emergence of *ressourcerie*—"resource stores"—small, privately-owned boutiques which "collect unwanted goods" and proceed to sell, upcycle, or recycle them (Yunker 2011). According to the national network's website, *ressourceries* "collect and add value to waste to resell objects at modest price, increase public awareness of 'eco-citizen' acts of reducing waste through the three R's, act for the environment, [and] develop an economy of solidarity and cooperate openly with all" (Ressourcerie 2013).

Information regarding Paris' green business associations is very limited, but there are a couple of councils that France as a whole is affiliated with a global organization called the World Business Council for Sustainable Development (WBCSD). This organization functions by meeting annually to discuss its priorities and confer on strategic issues as they pertain to laying the foundation for a sustainable future (WBCSD 2013a). Because the council is composed of the chief executive officers of member companies, these meetings provide a forum for global business leaders to really analyze, understand, and develop plans of action for sustainable development (WBCSD 2013a). France's representation in this council is facilitated through *Entreprises pour L'environnement* (WBCSD 2013b). This association is comprised of forty large companies from various economic sectors that have the desire to consider the environment when making strategic decisions and evaluating their current management structure (EpE 2013). The organization has a mission comprised of two complementary parts: the use of a think tank to analyze and anticipate upcoming regulations and future market standards and to use the exchange of knowledge and the best environmental practices to contribute to company mobilization (EpE 2013). The organization focuses on key issues such as climate change and other environmental trends, the linkage between health and the environment, biodiversity, and the economy of the environment (EpE 2013). The organization's partnership with the World Business Council for Sustainable Development gives this association visibility on an international scale as well as helps to broadcast the work of the WBCSD to the larger French population.

Additionally, the organization Dalkia began in France and now operates in more than thirty-five countries with the mission to "develop, construct, and operate greener and more economical energy systems" (Dalkia 2013). Specifically, the company has the goals of increasing energy efficiency, renewable energies, cogeneration, district heating networks, biomass, and geothermal energy. Interestingly, biomass, which is wood not considered valuable to the lumber industry such as branches, prunings, and even recycled wood, is France's most abundant renewable energy source (Dalkia 2013). The company posits that by 2015, it could be recycling more than four million metric tons of biomass in France alone. Dalkia aims to provide green solutions to companies worldwide in an effort to produce a sustainable future.

With respect to energy more broadly, there are several ways in which Paris has innovatively implemented renewable energy in the city. One way uses the 1,500 mile-long network of underground sewers as a source of geothermal heat. Because the average temperature of the sewers is almost seventy degrees Fahrenheit, it has been suggested that heat-conveying fluid be piped through the sewage so that energy can later be extracted from the fluid (Casey 2013). Because the pipes would be sealed off in a closed system, there would be no fluid residue from the pipes left in the sewage. Currently, this system is being implemented in some Parisian schools and is planned to extend to the Elysée Palace as well as a town hall and public swimming pools (Casey 2013). However, Casey (2013) asserts that this system will have limited impact due to the fact that it is only effective up to approximately six hundred feet from the original source. This means that this innovative system could only reach about ten percent of Paris.

Another way that Paris has been innovative in its move towards renewable energy has been in implementing a system that generates heat recovered from data centers. Because of the heat that these centers generate from the use of the technology, they must constantly be cooled by air conditioning units that generate substantial amounts of heat that can now be collected (Dalkia 2013). A heat exchanger connected to a new heating network now allows the recovered energy to be used in buildings around Paris (Dalkia 2013). This venture will result in buildings powered by one hundred percent green energy and save more than 5,400 metric tons of carbon dioxide emissions each year (Dalkia 2013).

One method that France as a country plans to employ in encouraging the use of clean energy will be to levy a tax on other sources of energy, including nuclear energy and fossil fuels producing carbon emissions (Vorrath 2013). This will be done in an effort to finance the country's energy transition – power based on a mix of energy efficiency and renewables. The country plans to cut energy consumption in half by 2050 and fossil fuel use by thirty percent by the year 2030. It will also introduce incentives to citizens with hopes to encourage efficiency in private residences (Vorrath 2013).

Although Paris does not have a plan to improve the sustainability of buildings, green architecture is becoming a significant part of the Paris cityscape, and sustainability is seen as a major trend in recent and upcoming buildings. France has developed standards for green buildings called the HQE, or Haute Qualité Environnementale, which are similar to the LEED certifications in the U.S. These standards were developed in 1996 and emphasize the joint goals of managing impacts on the outdoor world as well as creating a pleasant and functional indoor environment (Association HQE, 2012). This is achieved through integrating construction methods and building materials with the surrounding environment, minimizing energy and water use, and reducing the amount of waste the building produces. The functional indoor environment is maintained through hydrothermal control measures, air and water quality management, hygiene and cleanliness, and appropriate visual appeal. The standards are monitored by the HQE Association which is a non-profit organization that promotes sustainable development by providing training, funding, education, and a network for green builders to work together (Association HQE, 2012).

Though sustainable building practices are voluntary and not enforced by the Parisian or French government, it is clear that the techniques are proliferating throughout the city. There are many individual green buildings that have been recently constructed in the last decade or are being commissioned to be constructed in the future. In 2010, the RATP building, the primary site for maintaining all of Paris's public transportation, was constructed with huge helicopter blade-like structures on the roof that are covered in solar panels which produce energy for the building. This building also has other features that improve the efficiency of its resource uses such as insulated concrete walls, windows oriented for passive heating, and a chimney that also acts as a ventilation system for the entire building. The Philharmonie is a new concert hall that is currently being constructed with plans to go beyond the HQE requirements for sustainability (Philharmonie de Paris,

2013). Green architecture has expanded beyond public buildings to include residential and commercial buildings as well. There are several housing projects that have been recently constructed that focus on passive solar heating and incorporate green roofs to increase efficiency and increase urban green space. There is even a building that is to be completed in 2014 called the Tower of Biodiversity that will be completely covered in plants from natural wilderness areas outside of the city. The builders are hoping the winds blowing by this high rise tower will carry the seeds from these plants throughout Paris and increase the biodiversity of the city (Biotope City Journal, 2012).

Buying local food is a common practice in France, even in Paris, its most urban environment. Farming is a major industry in France and uses over half of the country's land and employs 3.5% of the population. France is unique in that it is one of the few European countries that can grow almost all agricultural goods because of its geography and climate (US French Embassy, 2012). Small specialized food stores and outdoor markets are abundant throughout Paris, and most citizens choose to shop at these places over supermarkets, especially the older generations. A notable market is the Marché sur l'Eau which receives exclusively local produce through flotation down the Seine, cutting the carbon emissions associated with transportation to almost zero. There are also programs in the city where people can order boxes of fresh, in-season local produce to be delivered to their home every week (Lebovitz 2012). Though there are many corner markets in Paris, this doesn't inherently mean that all of the food and produce found there is from France or even Europe. Like most nations, France imports large volumes of food but because it is in the European Union, all food must be clearly labeled with its origin. This policy makes it easier for citizens who prefer local produce to easily distinguish it from imported goods. The largest wholesale food market in the world is Rungis International. This huge market receives food from all over the world, but it supports local producers by reserving a large area exclusively for products from Paris and the surrounding area (Rungis Marche International, 2013). All of the programs that support local food are community driven and supported, the Parisian government is not involved. This is mainly because local food is already embedded in the French culture and way of life making government intervention largely unnecessary.

Paris has a very advanced transportation system. Their multimodal system allows for exceptional coverage, reaching to the suburbs outside of Paris. The various forms of transportation are also well integrated, making public transportation fast and convenient. Paris has many buses, a transportation program which may be made more sustainable in the near future by changes in fuel. They also have an underground metro and an above-ground tramway. In addition, they have a train system that runs inside and outside of the city (the RER). Some of these modes of transportation share stops for expediency. Paris also has an award winning bike-share program called Velib (The Guardian 2008). There are designated traffic lanes separated from the road and used by bikes as well as buses and a few other vehicles (Wong 2008). The Parisian government has a 30-billion-euro plan to expand their public transportation system in order to improve the density of the system, among other improvement aspects (The Transport Politic 2011). Transportation is Paris' best practice, and will be discussed further in the best-practice section.

Despite its lack of sustainability plans, Paris has many diverse, component sustainability efforts that sum to a respectable overall environment of sustainability. Among the city's strengths are green spaces, sustainable energy, and local food. Weaknesses include waste and recycling, and green business associations, though there is clear potential for improvement in the latter area through the medium of small-business culture. Green buildings are already showing signs of grassroots improvement, but government regulation of sustainability standards may be necessary. Transportation is the strongest area already, and also has tremendous room for improvement.

## Transportation

Out of all of their green initiatives, transportation is Paris's most comprehensive practice. It requires the least amount of effort in order to make it sustainable in comparison to the other practices described. Also, out of Paris' various projects transportation is one of the only sectors that actually has a clearly defined, government-directed plan for the future. Due to its present multifaceted and complex strategies as well as its arrangements for the future, transportation is Paris' core sustainability focus. The various forms of public transportation will be described as they function currently (buses, the metro, the tramway, the trains, and bikes, respectively). Any plans for the future that are associated with each individual form of transportation will be explained along with a description of each system's current practices.

The RATP group runs most of the public transit in Paris, including the bus system. The network has 4,490 buses, more than 12,500 stops, and 347 bus lines (RATP 2013a). Buses are the most developed form of public transportation presently operating in Paris. Their contribution to the overall public transportation system in Paris operates first through sheer quantity and availability, along with convenience of use. Paris also has the Noctilien, a night-bus system (Soot Free for the Climate 2013). This improves the universality of public transportation, since it is not limited to those who, for example, only work or travel during the day. Paris has a bus rapid transit system named Le Mobilien (Press 2008). Dedicated lanes are an important aspect of the buses' success in that they exempt buses from the delays and complicated maneuverings of regular traffic, making them faster than transportation by car. The lanes also make the buses more convenient to use by improving the frequency between bus arrivals, which lowers wait times (Arbury 2010). Many of these barricaded lanes were able to be created as a result of the removal of on-street parking (Press 2008). The fact that they are barricaded makes them permanent fixtures to make taking the bus or other forms of transportation more desirable than getting around by private car. The bus lanes also allow bikes and taxis (Wong 2010). In terms of plans for the future, Paris is concerned with changing the fuels they use in their buses. The "RATP is exploring alternatives to traditional fuels – hybrid vehicles, biofuels, NGV, LPG – in order to renew its fleet with more fuel-efficient, less polluting vehicles" (RATP 2013a). There is also an "Eco-challenge" contest every year between the buses in which the ones that reduce their fuel consumption the most are rewarded (RATP 2013a). Buses in Paris are looking to become more green and are a convenient option for travelers.

Paris's metro system, also run by the RATP, is quite impressive as well. It has 14 lines in total and is one of the densest metro systems in the world, having nearly 1.4 million passengers annually (RATP 2013b). Consisting of 300 stations and 213 km of tracks, the Paris metro system is able to claim that there is a metro station within 500 meters at any given location in Paris (RATP 2013b). Although some lines do extend to the suburbs, it is more a city-based system. It has more stops than the RER and is usually slower (Paris by Train 2012). Therefore, people who want to travel through the city rather than into the suburbs tend to use it. Paris also has a plan to spend 30 billion euros on public transit improvements by 2025 (Freemark 2011). Their plan focuses on making public transit faster and more streamlined as opposed to serving more local communities with more stops (Freemark 2011). The RATP created a plan to extend four of its metro lines to enable more suburb-to-suburb travel through the metro system (RATP 2013c). In addition, the RATP is also making its metro trains more efficient. It is replacing some of the MF67 trains with the MF01 train, which uses less energy, saying that "161 MF01 trains can provide the same service previously performed by 170 MF67 trains" (RATP 2013b). In terms of tickets for the metro, there are various options. The Ticket t+, which is a single ticket, can be used for certain transfers, such as between the metro and the RER (Paris by Train 2012). There are other tickets available as well, such as day tickets (known as the Ticket Mobilis), discounted books of 10 or 20 tickets, multi-day tickets (Carte Paris Visite), and week long passes (Navigo Découverte) (Paris by Train 2012). Its

mere density, the greening of some of its technology, and its plans of extension all contribute to making the metro a fundamental component of Paris's system.

The tramway is a fairly new form of public transportation in Paris, but it is already an integral part of Paris' overall system. It connects to five of the fourteen metro lines at various points, as well as to two of the five RER lines (Traub 2013). It also "connects to the southeast suburbs" (Traub 2013). Not only is it an essential piece of Paris' public transportation network, it is also already very environmentally friendly. Running on electricity and being "the most environmentally friendly method of transport, tramways help cut air pollution, reduce energy consumption and avoid noise pollution" (RATP 2013e). They have their own dedicated routes as well, making them convenient due to their high speeds. So far, there are five tram lines with 137 stations (RATP 2013e). But this is only the beginning. The RATP very recently extended two and created three of its five tram lines, with the next tram being scheduled for creation in 2014 (RATP 2013d). The tramway is scheduled to become "the largest network in France" and "the third largest in Europe" in 2016 (RATP 2013e). Over the coming decades, the tramway may well become the pride of Paris's transportation system.

Trains also have a very important place in Paris' transportation system. The RATP also runs the RER (réseau express régional). It is a train system that goes into the suburbs to bring people into the city (Freemark 2011). It has five express trains (Traub 2013b). It shares stops with the metro, facilitating the interconnectedness of the overall system. The previously mentioned plan to spend 30 billion euros by 2025 on the enhancement of public transportation includes improvements to the RER system (Freemark 2011). The elimination of (free) parking in the city is also an effective strategy that is being used (Project for Public Spaces). It discourages driving and encourages people coming into the city from the suburbs for work to take the RER. In terms of green technology, the RER trains are a relatively clean form of transportation. They run on electric power from an overhead line (RER 2013). There is also another train system operating in Paris named the Transilien that is run by the SNCF. With its 381 stations and 6,000 trains, it is connected to some RER and tram lines (SNCF 2013a). This again aids in the unity of the transportation structure. Transilien train lines "extend towards the outer suburbs of Paris" (Public Transit as Told by HARTride 2012 2012). The two train systems allow Parisians to travel from the suburb to city and vice versa with ease.

Bikes are a significant part of Paris' transportation system in that they are obviously emissionless. Paris arguably has the best bike-share program in the world. Velib uses over 20,000 bicycles, with 1,800 easy-access stations across the city, 300 meters apart. The first 30 minutes of the rental are free, which discourages short trips by car, bus, or any energy-expending form of transportation in favor of a free, emissionless bike ride (Velib 2013a). In addition to hour-long rentals, people have the option of longer-term memberships up to a year. There are also discounts for those who qualify for free access to public transportation and for students and young professionals under 26 (Velib 2013b). Velib has received several awards over the years, including *The Guardian's* Ethical Travel Award (The Guardian 2008) and an international Sustainable Transport award in 2008 (De Maio 2008). Bikes are allowed on the RER trains and the Transilien trains during certain times of the day (RATP 2013f, SNCF 2013b). The efforts of the RER and the SNCF make bike riding a more realistic and convenient alternative to driving. The city of Paris has also showed their support for bike riding via the dedication of lanes. There is claimed to be 645km of routes for bikes, with some being only for cyclists and others being shared with other vehicles such as buses (Startt 2013). Through the bike share program, integration with other forms of transportation, and dedicated lanes, bikes are widely used in Paris.

In summary, Paris is a world lead in urban transportation, and its new investments will continue to assure a leadership position for the city. There are many forms of public transportation (buses, the metro, the tramway, trains, and bikes) available for whatever type of trip an individual could be making. Whether the traveling be within the city or from the suburbs, Paris has a system that fits the needs of the people. Its network is already well developed, and it is in the process of extending and creating lines.

Its multimodal organization is well integrated and convenient. Some of its systems are already green in nature, such as the tramway and bikes. It is working on making the parts that aren't already sustainable, such as buses, more environmentally friendly. Due to its vast nature and planned future endeavors, transportation is the best system currently operating in Paris.

## Conclusion

Paris is making strides toward becoming a more sustainable, eco-friendly city. Many sectors have seen substantial greening efforts, including green buildings, sustainable energy, local food, and green spaces. The earth-friendly developments made to city transport have been the cornerstone of Paris's sustainability efforts, with the most successful, large-scale and wide-reaching effects. Not all areas are in acceptable condition, however. Despite government effort, the condition of waste and recycling in the city is poor, and a Parisian attitude-shift is necessary. Green business associations are lacking in Paris, though the strong culture of small businesses has the potential to change that. The lack of Parisian green business associations can be interpreted as a lack of environmentally-conscious synchrony within the business sector. In addition to injecting a theme of sustainability into the business sector and the economy, the formation of green business associations could potentially disseminate environmental awareness to its patrons, improving the overall culture of sustainability, which might give waste and recycling the boost of fervor it needs. Paris would benefit greatly from a sustainability plan--itinerating goals and standards in different sectors would make improvement efforts significantly more efficient.

Despite many shortcomings in the realm of sustainability, Paris has the most comprehensive and widely-used bike-share in the world and has been instrumental in providing the global economy with an example of how to successfully implement green mass public transit. Paris's efforts to become a more environmentally responsible city are crucial because of the international emphasis placed on the French town as an economic and cultural hub. However, only cities that have the same resources as Paris would actually be able to implement such systems. With 44 million tourists each year, the transportation system must be honed carefully, and sustainability efforts in transportation are amazing but not complete. Alternate methods of transportation must be found because the city's most travelled areas cannot consistently sustain such roadway traffic in the city.

Portability to other cities of Parisian sustainable-transport methods will be limited by the wealth and resources of the cities in question, but for those with the resources, Paris serves as an efficient model. At the very least, the city can encourage greening efforts around with world with its global influence, even if the techniques are not replicated. Ideally, the city's cultural leadership will inspire global improvements in sustainability.

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## Citizen Participation as the Driving Force behind the Portland Plan

By John Iaia

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Portland is a city often viewed as the leader in all things sustainable in America. This is because of its long history of environmentally focused decisions. Portland has had a head start on the rest of the country, because in the late 1970s city planners in Portland began making environmentally conscious decisions. Portland is a city with a huge amount of green spaces. Among its offerings is the largest urban forest park in the country, with a size over 5000 acres. In addition, Portland's waste and recycling programs often are leading the national trends. Portland has also developed a transportation system, the Trimet, which features a green fleet whose routes service nearly the entire city. Furthermore, Portland emphasizes land-use and the prevention of urban sprawl, which has resulted in the city being widely referred to as a "planners' paradise."

In the late 1970s, the citizens of Portland passed a bill, which set aside annually one percent of highway funds for the development of alternative modes of transportation. Additionally, in the late seventies Portland instituted an urban growth boundary, which limited urban sprawl and increased population density. This was responsible for Portland's becoming the beacon of light in the urban design world as it is seen today. Because of these two actions, by the twenty-first century when sustainability plans began to hatch, Portland, Oregon would already be ahead of the curve.

The city today has a vast number of programs in place to help to maintain and develop sustainability practices in Portland. In fact, in SustainLane's 2008 (most recent) city rankings, the city was rated the number one most sustainable city in America, beating San Francisco and Seattle, and topping the charts in categories such as city innovation, energy and climate change, knowledge and communications, green economy, and green buildings. It was also ranked first in SustainLane's previous rankings and in a ranking of America's 50 Greenest cities by *Popular Science* magazine (Elizabeth Svoboda, 2008). The city government also has a department dedicated to planning and sustainability issues: the Portland Bureau of Planning and Sustainability. As the name suggests, the bureau is divided into two divisions: the planning division and the sustainability division.

One major endeavor that is being undertaken by the Bureau of Planning and Sustainability is the Portland Plan. This plan, which is a 25-year plan, attempts to direct the city in such a way that the Portland of 2035 will be a safe, environmentally friendly, and economically prosperous city. The plan is, and will continue to be, the central driving force behind Portland's continuing success. This is because it works toward the development of long-term sustainable lifestyles, as opposed to the immediate cessation of pollution, which although effective is often in conflict with business interests, therefore impeding the implementation of the program as a whole.

Due to this central goal of the development of sustainable lifestyles, we see that the people are thoroughly integrated into the city's planning process; the government is not simply making a legal change to how things work, but rather working with the citizens to bring about meaningful change. Couple this with the fact that the Portland Plan in itself was conceived only after intensive citizen participation, and we begin to see a theme of citizen participation that is present in nearly everything the city does. Although Portland is internationally recognized for its leading initiatives in urban design and land-use, what really sets this leading green city apart is the Portland Plan and its exemplary practices involving citizen-government interaction.

This paper will review the Portland Plan and discuss its strengths and weaknesses. Then it will take an in-depth look at Portland's best practice, and it will provide a brief summary concluding by analyzing the reproducibility of these programs in other cities and by offering suggestions as to its potential improvement.

#### Portland Plan – Citizen Participation

The Portland Plan is a proactive and practical solution to the very real issue that is facing the urban world today: how to go about urban city growth in a sustainable manner. The Portland Plan is a 25-year plan that has been created by Portland's branch of government solely devoted to sustainability in regard to the city: the Bureau of Sustainability and Planning. As the name suggests, the bureau is divided into two separate yet cohesive divisions, the planning and the sustainability divisions. Putting both planning and sustainability together, Portland ensures that future growth is done in an environmentally responsible and sustainable fashion. Without the Bureau, this plan would not be possible, which is why few other cities have anything near as comprehensive as the Portland Plan; few other cities have separate branches within their government addressing the dichotomy that is often perceived between sustainability and growth. The fact that all major cities have not created these is alarming, and the fact that so few have is indicative of the priority our country places on such issues. What really sets the Portland Plan apart, however, from other such plans is how deeply integrated into the city and its denizens the plan is. Every aspect of the plan was tailored not only by government officials, but also by the citizens of Portland themselves. This was done through various hearings, fairs, and other public events hosted for the simple purpose of gathering citizen input on the various aspects of the plan, and the plan has been modified to reflect those influences. The result of this is that the Portland Plan reflects the views of its people, and so the plan is viewed as having been formed by the people and for the people. The resulting plan thus serves as a positive reinforcement, a goal for people to strive for, as opposed to a set of rules being forced upon the people by the government hierarchy. This results in the formation of a positive feedback cycle: people's non-condescending view of the sustainability initiatives creates a much higher involvement in them, which in turn means a higher rate of support and success for those sustainability initiatives. In turn, the high support results in creation of/more support for newer future sustainability initiatives, as successes reflect positively on the city as a whole, politicians and citizens alike.

The Portland Plan is divided into five distinct phases of involvement. These phases of involvement are ways by which people may participate in the creation of, and later shape and mold the integration and implementation of the Portland Plan into something that represents them individually. The five stages cover basically everything from the formation to the implementation of the plan. Phase one of the Portland Plan began with the initial gathering of data. The phase asks the community the question, "Where are we now?" (Public Participation, 2) As the facts were gathered, policy makers and citizens alike were able to develop an accurate and overarching picture of the current state of Portland, Oregon. This first phase focused on doing thorough research to refine the facts, and utilized extensive public engagement to review this research.

Upon determining where they were as a city at that point in time, the city was really able to begin to see trends in the data, and was able to start to contemplate the question: "Where do we want to go from here?" (Public Participation, 2) This was the question asked in phase two of the Portland Plan's comprehensive materialization process. It was here that the various members of the city who were compiling the Portland Plan began to set their priorities, and it was determined what core values would shape and mold the Portland of 2035. It was within this second phase that community involvement was the largest, as priorities were expressed to the committee in charge of drafting the Portland Plan through community conversations in which thousands of people were participants. Opinions were collected through an online forum on the Portland government's online site, in which

thousands of comments were left. The result of feedback was that citizens were able to highlight a few key draft goals that citizens wanted the plan to stress. These goals included value statements emphasizing the economy, education, streams and watersheds, sustainability working together with prosperity, safe/accessible/walkable neighborhoods, and maintenance of existing infrastructure (About the Portland Plan, 1). With all things taken into account, the value that was clearly the most vital to the people of Portland seemed to be that of equity.

In response to the importance that the people placed on the value of equity, the government drafted an equity initiative, with particular emphasis on the idea of equal opportunity for all. Three primary goals were highlighted: education, economic prosperity, and affordability (About the Portland Plan, 1). These stages of involvement make the Portland Plan into much more than words on paper; the Portland Plan is not so much a plan as it is a living, breathing document that grows and adapts to reflect the City of Portland, Oregon, and the aspirations, goals, and needs of the people in it.

In the third phase, emphasis was placed on strategy building. The looming question was, “How do we get there?” (Public Participation, 2). Again, the question involved an open committee of Portland residents, including everyone from the unemployed, to teachers, to the very students they teach. To get the city of Portland from point A to point B, it was decided that the city needed a plan that would set clear investment priorities and would have quantifiable measures of success. This would ensure that the city could track their progress and make any necessary adjustments moving forward. At the onset of Phase four, a realistic Portland Plan, through a joint effort by the people of the city and the respective parties in the government, had been composed. This phase simply asked the denizens of Portland to look at this plan. The city has at this point moved from gathering and confirming fact to determining directions, objectives and integrated strategies, to creating the final 25-year plan for the city and its residents. In essence it is asking them, “What do you think of it [the plan]?” (About the Portland Plan, 2). In looking at this final plan, Portlanders were to decide whether or not the plan was representative of the people’s needs and aspirations, and whether the Portland of 2035 as molded by this plan was one they would want their children to be living in. This phase was to turn the final draft into a final plan, and is the phase the plan is at currently. The last phase, Phase 5, is the both least and most important of the phases. It is the follow through; it consists simply of the implementation of the goals laid out in the finalized Portland Plan by the respective Portland Plan Partners. (About the Portland Plan, 2) What is most important about this, however, is the nine action areas that were conceived as a response to this realization of the need for a successful plan to have quantifiable measures of success.

These nine action areas are: prosperity and business success, education and skill development, sustainability and the natural environment, human health/food and public safety, transportation/technology and access, equity/civic engagement and quality of life, design planning and public spaces, neighborhoods and housing, and arts/culture and innovation. (About the Portland Plan, 2) These are the directions Portland will be focused on moving toward over the next 25 years. All nine of the goals either explicitly or implicitly contain a focus on green/sustainable initiatives.

The nine action plan goals each contribute to the Portland of 2035 making it an integrated sustainable city with a unique sense of community and charm unlike any other planned city of the future. In regard to the goal of prosperity and business success, sustainability is ever present in the form of creation of jobs associated with renewable energy resources as well as the potential for various forms of urban innovation. The transformation of neighborhoods and integrating storefronts and homes will create numerous construction jobs as the plan progresses. Within the stated goal of education and skill development, there is much room to raise the bar for quality education and to teach more citizens (children, adolescents and adults alike) about the environment and easy, cost-effective tips that can help save them time and money, while helping to save the environment. Raising the bar on teaching knowledge and adding teachers will also further support the first stated goal: prosperity and business success. The goal, sustainability and the natural environment, readily aligns with human health, food,

and public safety agendas in that less carbon emission heavy activities (i.e., automotive transportation) mean more alternative methods of transportation such as biking, which in turn benefit the overall health of citizens, while also reducing serious health hazards such as pollution-induced asthma. The Portland Plan's goals in regard to transportation, technology, and access are focused within the realm of sustainability in that they all focus on a shift toward readily available, comprehensive and efficient (environmentally and economically) public transportation for all, as well as a shift away from roads and more towards bike lanes and sidewalks. As before, the execution of this goal will contribute to furthering the first goal of prosperity and business success through the creation of further jobs. The goal to increase equity, quality of life, and civic engagement is achieved by the move to combine homes and storefronts into one walkable neighborhood business district, which then reduces the need for frequent commutes, effectively greening the community as a whole. The creation of this walkable neighborhood would also reduce incentives to drive, and expedite the transition toward active, healthier forms of transportation such as biking. The design and planning of public spaces can also integrate the idea of walkable storefront communities, while simultaneously serving to create a public spaces that would be effective in the reduction of the overall congestion of the city, while also serving to foster eco-districts and community gardens. Goals relating to neighborhoods and housing are relatively easy to address, as simply greening houses with solar panels, wind turbines, and family gardens, etc. serves to not only dramatically reduce a household's footprint but also to reduce the effect on a homeowner's checkbook.

The final listed action area goal of the Portland Plan--art, culture and innovation--is key because it creates and sustains Portland's distinctiveness, part of which is its huge focus on all things eco friendly. (This is not by any means intended to be an exhaustive list of ways the nine action areas relate to sustainability, but rather examples of how they can be applied to Portland and its development within the context of sustainability.) Thus, the Portland of 2035 as will be created via the implementation of the Portland Plan is going to be a city with a strong core focus on, and a deep rooted historical focus in, the value of sustainability.

Along with a thorough discussion of anything comes the inevitable unearthing of its strengths and weaknesses. The Portland Plan has a number of strengths: it is comprehensive, inclusive, and should ultimately lead to a well-planned and sustainable city. The depth of the Portland Plan is a testament to its capacity to face any challenges to lead the Portland of today into becoming the Portland of tomorrow, because any potential question that may arise is likely addressed within the text of the plan. The mercurial nature of the plan is to its advantage, because anything not addressed within the text of the plan does not render the plan obsolete, but rather may be simply found by seeking the popular opinion of the citizens of Portland. Furthermore, this plan will have succeeded where others have failed in that measures of success within the Portland Plan are on the whole quantifiable, and so citizens and civil servants alike may actively track the city's progress in accordance with the plan. Finally, the biggest strength within this plan lies within its most unique aspect: its underlying theme of citizen participation. It is therein that the effectiveness lies, as it becomes a plan not simply forcing the people to be sustainable, as so many have attempted to do in the past, but rather a plan which gives the people of Portland a support structure by which to educate the people of Portland on these issues, and inasmuch provides them an outlet encouraging the development of long term sustainable behaviors and lifestyles. These strengths will allow the Portland, Oregon of 2035 to be full of closer knit, more self-sufficient, environmentally conscious communities.

Though this plan is aggressive and innovative in nature, it is not totally without risk. As sustainable technologies and even planning methodologies improve, a plan as cohesive as the current Portland Plan may leave little breathing room to accommodate the integration of future improvements without large investments and comprehensive re-planning. In addition, plans as comprehensive as this one tend to leave less room for creative expression, which adds diversity and charm to the cities neighborhoods. In terms of raw efficiency, the choice to make this plan a joint effort between the city

government and the citizens themselves, though a noble cause, can cause each step to take much longer, and even result in the delay of the project in its entirety due to the volatility of entire populations. One final risk of the plan is the risk associated with time. As any program needs money to continue on, people must continue to vote for the Portland Plan's various programs over the years in order for them to maintain funding so that they may continue bringing about the sustainable Portland as exists within the plan. The plan is to take place over 25-years, over the course of which any number of variables may change. Over the course of 25-years, the voting demographic will change, as 15-year olds who are too young to vote upon the plan's implementation will be 40 upon its completion, and so a huge challenge faced by the Portland Plan is its need to continue to attract support throughout the entirety of its 25-year implementation. The Portland Plan is a plan, which, if successful, will help solve the very real challenge that is sustainable urban development.

#### Best Practice

Portland, Oregon's best sustainability initiatives are the land-use and urban design practices. No discussion of Portland's land-use policies could start without mentioning that Portland was one of the first cities to make the decision to institute an urban growth boundary. This boundary, which set an outer limit on the expansion of the city dramatically limited urban sprawl and increased urban population density. This increase in population density catalyzed Portland to focus on the planning and development of land-use and urban design. Having only limited amounts of land to work with, Portland had to switch its focus to quality rather than quantity of development, and it was this focus on quality, which led to Portland becoming known as the 'planners' paradise' it is today.

The increase of population density directly served two purposes: the decrease of individual transportation (which had a corresponding increase in demand for mass transit) and the increased potential for green spaces. Transportation is an element of Portland's land-use and urban development that has been very successful. The development of the rural-urban boundary encouraged dense growth in the city, and it was this population density that allowed carbon-free transit and mass public transit to really become efficient and effective. Portland's I-205 Multi-Use Path runs 16.5 miles and parallels I-205, transporting thousands of Oregonians each day by rail, car, bike, and foot. (I-205 Multi Use Path, 2) Portland also devoted itself early on to bicycle-conscious city planning, passing a bill in the seventies setting aside one percent of state highway funds for bike lanes and paths. The result of this is that the city today boasts over 270 miles of bikeways, dramatically reducing the carbon emissions of Portland due to the increased use of active transportation methods such as biking and walking in lieu of driving. (Urban Cycling, 1) In fact, the city planners introduced in 2008 the nation's first-ever highly visible bike boxes. These bright green boxes are painted on the asphalt at intersections giving cyclists space to wait at the intersection with cars waiting behind them, thus giving bikes the right of way at intersections. This was determined to make the city as a whole safer, keeping cyclists in driver's sightlines and out of danger (Bike Boxes, 1). The city supports electric vehicles by streamlining the process to get a permit and by offering free plug-in parking spots for electric vehicles. The policies reduce not only the traffic congestion in the city but also the air pollution.

Portland is home to Forest Park, an urban forest reserve spanning over 5,000 acres and containing hundreds of bird and mammal species. (The Forest Park Conservancy, 1) Around this, Portland's Trimet transit authority utilizes a bus system, streetcars, a light rail, and an aerial tram. These four methods of transit are able to cover nearly the entire Portland area, due to the prevention of urban sprawl, to provide the people of Portland maximum convenience in the use of transit systems. This convenience provides an incentive for people to use the Trimet transit systems, which then further reduces pollution and increases air quality.

Portland's land-use policies as related to food are particularly unique. Portland has a Food Policy Council, which has an open application process anyone can join. This citizen interaction in the

realm of food policy is what I believe allows the city to be so responsive to the needs of the people. There are various learning gardens dispersed throughout the city, where they educate youth and adults alike on the topics of nutrition and gardening, allowing people to take their health and their food security into their own hands. Additionally, food banks are spread throughout the city to help distribute the healthiest food to the most people. The city has a website dedicated to community gardens, which creates a streamlined process by which one can register their community garden plots. This increased ease of use amplifies incentives to create and participate in farmers' markets, because there is no corresponding legal hassle to deter potential interested parties as there is in other cities. A similar non-government affiliated site exists for farmers' markets, which has an interface that allows for an easy way for buyers and sellers of locally grown produce to connect. Community gardens and farmers' markets are outlets by which citizens can buy locally grown organic foods that are simultaneously good for the environment and good for themselves.

## Conclusion

The Portland Plan has clear investment priorities and quantifiable measures of success that guide the city toward a vision of a more sustainable city. In doing so, the city will have created a model by which other cities may refer to, because the Portland Plan attempts not to force people to adopt sustainability practices but rather to give the people a support structure that encourages the development of long term sustainable behaviors and lifestyles. Inasmuch, Portland, Oregon is the forerunner, while other cities play it safe, follow in its footsteps and observe every action and corresponding reaction. Considering how much is actually at stake (our entire planet), it is a sad truth that so few are willing to put anything on the line for the sake of supporting sustainability measures, even for the very city in which they live.

Portland has been a leader in sustainable decisions since before sustainability largely became seen as something to strive for in societies. The diversion of state highway funds toward development of alternative modes of transportation and the urban growth boundary, both having been formed in the 1970s, were key components responsible for Portland becoming the beacon of light in the urban design world as it is seen today. Because of these two actions, by the twenty-first century when sustainability plans began to hatch, Portland, Oregon would already be far ahead of the curve. With respect to portability, the Portland Plan could be implemented in other cities; however, citizen participation may be unique to Portland's civic culture. There is no way to know what number of people in any given city will be receptive to and supportive of such a strongly environmentally driven city plan. Portland may, in fact, have such a large amount of citizens supportive of environmental programs simply because of their early gravitation toward becoming an environmentally conscious city in the late seventies and early eighties, which may have in turn altered the city's chemistry, because the sustainable practices of the city may have attracted more environmentally conscious people throughout the years.

Although it is hard to offer my own advice about a task as daunting as this, there are a few suggestions for improvement. The plan is very thorough and comprehensive, but its strength could also be a weakness. It is often so specific that its flexibility and resilience become an issue. In the event of change, be it in the form of new ideas toward implementation or new technology, if the plan is too specific, it may backfire, preventing the expedited implementation of the very change its original goal was to bring about.

The integration of sustainability and government that is taking place in Portland, particularly as underscored by the Portland Plan and underlying theme of citizen involvement, is an unprecedented experiment in urban development. The city is undergoing a transition to twenty-first century cohabitation, the results of which have the potential to permanently affect not only the role of sustainability practices throughout our nation as a whole, but also the way by which we go about urban development; Portland is effectively leading by example.

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## Green Business: the Leading Green Initiative in San Diego

By Katie Lopez, Bess McWherter, Marlotte De Jong, Sean Sheng, and Janetra Gleaves

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San Diego is the eighth-largest city in the United States and second-largest city in California. Located on the Pacific Ocean in Southern California, San Diego is known for its mild year-round climate. As scored by The Weather Channel, San Diego is ranked as one of the two best summer climates in America and is listed as one of the top-ten best (Geiger 2006; Kellogg, Erdman 2010). The population of the city in 2010 was 1,301,617 and was projected to grow at a rate of 6.9% (US Census Bureau 2010). San Diego has a natural deep-water harbor that is an integral asset to the U.S. Navy and its defense-related activities, and consequently the defense industry has become a main economic engine for San Diego. San Diego's economy also relies on tourism, international trade, and manufacturing. As a result of the University of California's proximity to San Diego, the UCSD Medical Center has aided in making San Diego a hub for biotechnology research, and the city has emerged as a healthcare and biotechnology enclave.

The city of San Diego is attempting to "go green" through sustainability plans and programs. The efforts include but are not limited to recycling, food, green buildings, transportation, green spaces, and green businesses. Great effort has been put into the expansion of the recycling program, implementation of community-run gardens, the "greening" of local transportation services, and the execution of green building ordinances. Although there have been very few collaborative efforts between different sectors, the various programs implemented individually by the people, local businesses, and city government are bringing about some successes. In order to increase green initiatives overall, the city needs to emphasize sustainable practices in industries such as recycling, transportation, and green buildings. However, San Diego's greatest strength is its green business initiatives, supported by large corporations, local government, and small businesses.

In the following section, there will be an overview of San Diego's current sustainability initiatives in several different sectors. Following this, there will be an evaluation of San Diego's best sustainability practice: its green business program. Lastly, the conclusion will analyze the relative strengths and weaknesses of San Diego's sustainability initiatives and its best practice, and it will analyze the potential portability of the best practice for other cities.

### Overview of Sustainability Initiatives

The city of San Diego has implemented numerous sustainability programs regarding recycling, food, buildings, transportation, green businesses, and green spaces. There is not an overall plan for sustainability initiatives in San Diego, but there are separate plans for specific initiatives. The recycling program has been growing in the past few years thanks to the city government. It is projected to expand even more in the upcoming future. The government has also put into effect city-run gardens to boost local produce sustainability. Local transportation services like buses and trolleys aim to reduce the amount of personal cars being used. The Port of San Diego encourages businesses to "go green" by rewarding them with more publicity for less emissions. The government is currently executing a plan to increase open spaces in the downtown area by promoting individual access to these parks.

With respect to food, San Diego has launched the San Diego Roots Sustainable Food Project to encourage the growth and consumption of regional food (San Diego Roots 2012). This project includes the San Diego Community Garden Network, which aims at a better management and development of the local community gardens by providing support services and technical expertise to the community partners (SDCGN 2012). More importantly, San Diego Roots focuses on the education of the idea of sustainability. It established Wild Willow Farm & Education Center, a farm where the staff teaches people essential sustainable farming skills (San Diego Roots 2012). They cooperate with local schools and have programs that inform the students what sustainability is and how to build a vibrant and sustainable local economy; students will also learn how to be sustainable farmers and how to support the local sustainability during field trips to this farm.

San Diego has also successfully developed various farmer's markets and related business. The San Diego County Farm Bureau is a non-profit organization that promotes the Buy Local campaign in San Diego. It invites farm owners to the farm stands and certifies and manages the farmer's markets, ensuring that the produce is being sold by the grower, is grown in California, and meets all California quality standards (San Diego County Farm Bureau, 2012). To encourage the farmers to join the organization, the San Diego County Farm Bureau rewarded its members with nationwide insurance, financial services, and travel discounts.

The city has also supported green buildings initiatives. The United States Green Building Council established its chapter at San Diego in 2002, and since then there have been more than 235 Leadership in Energy and Environmental Design (LEED) Certified Projects in San Diego, totaling more than 22,000,000 square feet of building floor area (San Diego Green Building Council 2012). Furthermore, in 2010, mayor of the city of San Diego Jerry Sanders introduced the green building Program for San Diego, a project called "Centre City Green" that sought development in water conservation, energy solutions, and clean technology to ensure San Diego's long-term environmental sustainability for future generations (Anonymous 2012).

The development of "green roofs" on top of buildings, which helps reduce runoff and improve the quality of water (Centre City Development Corporation 2012b), is one of the remarkable results of these public programs. For example, the University of California at San Diego recently planted more than 4,000 drought tolerant succulents, flowering plants, and low-spreading shrubs, and it built a recycled water system on the roof of one of its residence buildings, illustrating the growing trend of installing green roofs to make the building "green" in San Diego.

In the private sector, San Diego has a large number of private companies and institutions that either provide green home services and materials or offer green design or remodeling of houses that can best save the energy. One outstanding example of these private companies is Olive Branch Green Building Supply. It collects waste materials and reprocesses them into housing supplies, including floor, walls, lightings that save the energy as well as avoid emitting chemicals harmful to human health (Olive Branch Green Building Supply 2012).

Solar panel installations are another noteworthy achievement of the efforts that the private energy companies. As a city that has an average of up to 263 days with sun in a year (Current Results), San Diego is using its advantage and has become one of the leading solar cities in the country with more solar roofs than any other California city (Sunrun 2012). San Diego has also become increasingly aware of the fact that low-income families might not be able to afford the relatively high cost of solar panels. In response, Sullivan Solar Power provided free solar panels in the low-income neighborhoods in San Diego, such as Chula Vista (Scoop San Diego 2012). It promotes the utilization of solar energy and the reduction of energy cost by overcoming one of the shortcomings of solar energy: high price of equipment and installation. Part of the green initiatives of San Diego is the development of "green roofs" on top of buildings. These "green roofs" help reduce runoff and improve the quality of water

(Centre City Development Corporation 2012b). Overall, with the collective effort by the public and the individuals, the promotion and development of green buildings in San Diego is quite significant.

San Diego also prides itself on its extensive recycling efforts. It aims to reduce the amount of land used for landfill, conserve resources, save water and energy, reduce pollution while increasing jobs, and boost the local economy. California has strict rules regarding recycling and San Diego abides by them and other measures. Chapter 476, Statutes of 2011, specifies the requirements of statewide mandatory recycling programs, noting that the new state goal, as specified by the 2007 state recycling ordinance, is to get to 75% waste diversion by 2020, reducing greenhouse gases and allowing for the addition of new recycling services and manufacturing facilities in the state (*Division 7: Recycling Ordinance*, 2007). New mandatory recycling obligations for the city of San Diego were put into effect on July 1 of 2012. These regulations specify that all single-family homes, apartments and condos, and facilities that generate more than four cubic yards of trash per week must recycle (Environmental Services Department, 2012).

The city of San Diego also promotes the Dare to Reuse 2012 Paperless Calendar for its citizens as a way to reduce the number of printed calendars that are used and then thrown away at the end of the year (Student Art Exhibition: 'Dare to Reuse', 2012). San Diego also engages in various recycling events in order to aid in the recycling of products that are more difficult or troublesome to recycle and thus are often just thrown away. Involving Christmas trees, electronics, telephone books, and oil and oil filters, the events are instrumental in assuring that these difficult-to-recycle items are properly disposed of and therefore diverted from landfills (Environmental Service Department, 2012). San Diego is continuing to expand its recycling efforts by establishing various associations whose goals are to aid in the recycling efforts of the city.

San Diego offers a number of resources to its citizens in order to promote sustainable transportation. The city of San Diego has developed three different plans for its city to save energy such as: CCSE Toyota PHV Demonstrate Program, the Roush–Ferrell Gas Propane, and the 2050 Transportation Plan the San Diego Association of Governments (SANDAG). The California Center for Sustainable Energy Toyota PHV Demonstrate Program (June 2012) introduced 150 vehicles to demonstrate hybrid plug-in technology. The goal is to inform people on how to preserve fuel for sustainability and to educate the public about electric vehicle technologies. The plug-in features include both a hybrid and an electric mode of operation. The electric mode allowed the drivers to drive from 15 miles on a single charge to up to 62 miles while not having to use fuel that would eventually pollute the air. When the electric charge runs out, the vehicles are able to run on a hybrid mode while still allowing the driver to receive great mileage.

The company Roush-Ferrell Gas Propane has partnered with the California Center for Sustainable Energy and thousands of volunteers who help spread the awareness to save energy. According to Roush, vehicles that are powered by propane gas emit 24% fewer greenhouse gases and 20% less Nitrogen Oxide (California Center for Sustainable energy, 2012). Using vehicles that are powered by propane auto gas will help improve the air we breathe in and lower the costs from about 30% to 40% less than regular gasoline.

The San Diego Association of Governments (SANDAG) currently is in a process that will prepare a regional transportation plan called the 2050 Transportation Plan ( San Diego Imperial Environmental Center, 2012). This is San Diego's long-term region plan for expanding the roadways and improving the transit system up to the year 2050. The SCS (Sustainable Community Strategies demonstrates how the transportation network and programs can work together to preserve energy in the transportation systems by using more fuel efficient cars and more cars that are dependent on propane and other sources that are less harmful to the environment. These efforts are set up by the California Air Resources Board (2012).

According to the city of San Diego's website, it has 39,737 acres of both developed and undeveloped parklands. With three parks measuring between 1,000 and almost 6,000 acres each, San Diego entertains millions of tourists a year (The City of San Diego 2012b). Balboa Park is the smallest of the three but houses not only green spaces, but also the zoo, museums, and gardens (The City of San Diego 2012a). Mission Bay Park is the largest man-made aquatic park in the country. With half land and half water, the park is the second largest in the San Diego area. It is another popular attraction for not only tourists but also for locals (The City of San Diego 2012c). Mission Trails Regional Park is the largest park in the San Diego area and one of the largest in the country. The park offers tours and hikes around its 5,900 acres, as well (The City of San Diego 2012d). San Diego also has a number of open space parks including preserves and canyons. Open space means an area with little to no development that is used for preservation of natural resources, recreation, and science. San Diego has 26 miles of coastline and over 3,000 acres of canyon land. (The City of San Diego 2012e).

The city of San Diego has also implemented many new plans to increase the number of open space parks in the downtown area. The 2006 Downtown Community Plan calls for 125 acres to be developed in seven public spaces in neighborhoods. The idea is that every resident of the downtown area will be within 5 to 10 minutes of a park (Centre City Development Corporation 2012a). There are a number of smaller "pocket parks" and "finger parks" that add beauty and usefulness to the area. Most "finger parks" are located on land that has been deemed unbuildable. This is an excellent alternative use for the land considering it cannot be built upon and would otherwise not be used to its fullest potential.

In order to promote green businesses in San Diego, the Port of San Diego and San Diego Gas & Electric teamed up to start the Green Business Network. The program asks local businesses to green their operations and track their successes. Businesses are encouraged to participate, because their efforts are then broadcasted through a media campaign and an awards celebration. Each business in the network is given access to a tracking tool to monitor their efforts. They also attend monthly workshops that help them learn how to be more efficient, which then results in cost savings and enhanced environmental performance (Port of San Diego Green Business Network 2012).

In addition to the Port of San Diego Green Business Network, the city of San Diego has a website devoted to green businesses. This site is not as in depth as the Port of San Diego site, but it does offer resources for business to implement green projects such as water conservation and pollution prevention. Also on this site are links for training opportunities. The city of San Diego may not be as proactive as the Port of San Diego in encouraging business to be greener, but they do offer resources to help businesses reach this goal (County of San Diego 2012).

In summary, the city of San Diego has a lot of future plans to boost sustainability, but they are also lacking in several arenas. In terms of food, the city government is not especially active. Recycling is an area in which San Diego has made a lot of progress. Through the "Dare to Reuse" program, people are encouraged to use less paper and to recycle the paper that they have used. To increase the number of green buildings in San Diego, the Green Building Program was created in accordance with the County's Strategic Plan. As for transportation efforts, the city has promoted a lot of different types of public transit and green businesses are being promoted throughout the city by way of the Green Building Network. Green spaces are areas that the city is looking to expand. Currently, there are 81 acres of green space, but the city is hoping to increase this number so that each citizen can be close to a park. Although the city has made a great deal of progress in its sustainability efforts, there is also room to grow, especially in the areas of food and green buildings.

#### Green Businesses

The goal of green businesses in the city is focused especially on efficiency measures such as improving systems and equipment performance, reducing waste and energy costs, and providing a

better workplace environment. These voluntary efforts towards making the environment more sustainable help with energy conservation, water conservation, pollution prevention, and reducing waste. San Diego has developed many initiatives to green businesses in the city both by providing resources to business to help them operate sustainable and by incentivizing green technology in businesses. The resources provided to businesses come from the Port of San Diego Green Business Network and the San Diego Area Green Business Project. The incentives to produce clean technology are provided by the San Diego Cleantech Initiative.

Both the County of San Diego and the Port of San Diego have made strides towards improving businesses and making them greener. In 2011, the Port of San Diego hosted the Green Business Challenge, which asked local businesses in San Diego to green their operations and track their successes while being members of the Green Business Network. Their efforts were then highlighted in the media. Additionally, an awards celebration was held to recognize and challenge participants for their environmental leadership and for their commitment to energy efficiency. To help challenge participants, the Green Business Network provides tracking tools, resources, and monthly workshops that all help to improve efficiency and the greening of businesses.

The Green Business Network is so effective because there is no fee for businesses to participate. The lack of fees to sign up combined with the financial benefits gained from the greening of businesses encourages many businesses to participate in the program. The resources provided to the participants come from San Diego Gas and Electric and the U.S. Environmental Protection Agency, which both advocate for energy efficiency. The Green Business Network was extremely successful in its first year, saving buildings an average of 24-50% in energy use, 33-39% in CO<sub>2</sub> emissions, 40% in water use, and 70% in solid waste production. The network will likely increase efficiency even more in the next few years, which is why this initiative is so successful. The success of the 49 businesses in the network allowed the initiative to continue on (Port of San Diego Green Business Network 2012).

Another green business initiative is the San Diego Area Green Business Project, which is run by the County of San Diego. The project encourages “green” practices among business in the region via tools to implement more efficient and sustainable business operations. Green checklists are available to auto businesses, food facilities, and commercial offices to help them become more green. Additionally, the project provides useful tools for energy conservation, water conservation, solid waste reduction/recycling, and pollution prevention. The project also provides training opportunities to help businesses act sustainably (County of San Diego 2012).

A green business initiative that the city of San Diego established in 2007 is the San Diego Cleantech Initiative. This initiative “promoted economic growth...and created a clean-technology cluster (Hess 2010).” One goal of the initiative is to focus on creating greener businesses with “clean energy, transportation, and managing water (Hess 2010).” Another idea from this initiative is that new job opportunities will materialize in these industries, which is good for both the economy and the environment (The City of San Diego 2012a).

The city has also attempted to get local businesses involved with environmentally friendly technology, such as biofuels and solar energy. The city founded the Biofuels Initiative in 2008, which promotes finding an alternative fuel within both the public and private sector. They also recently founded the Environmentally Preferable Purchasing Program, which funds the further development of solar energy (Hess 2010). San Diego also ranks highest in solar capacity and number of solar panels in the state of California (Davis 2012). The idea of these initiatives is to allow businesses the opportunity and the means to promote environmentally friendly dealings. San Diego is leading the way in California when it comes to green business commerce.

San Diego's initiatives in green businesses are by far the city's best practice in sustainability. Groups like the Green Business Network and the San Diego Cleantech Initiative and their programs such as the Green Business Challenge and the Environmentally Preferable Purchasing Program not only endorse the benefits for businesses to "go green" but also have a marked effect on reducing energy use while promoting the implementation of solar energy use. Cleantech Initiative ranks seventh worldwide and third in the United States in a list of clean technology clusters compiled by Sustainable World Capital (San Diego is a hotbed for clean technology 2010). The Green Business Challenge was also commended and received acclaim from ICLEI- Local Governments for Sustainability USA. ICLEI was so impressed with the challenge that they are assisting the Port of San Diego by providing measurement tools, resources and training to participants (ICLEI USA Congratulates the Port of San Diego on the Launch of its Green Business Challenge 2011). Through green businesses, both those that are sustainable in practice and those researching alternative fuels, San Diego is ushering in a new era dedicated to environmentally sustainable practices.

### Conclusion

Although San Diego's initiatives in green businesses are, by far, the most instrumental element of San Diego's sustainability programs, the city's efforts in recycling, food, buildings, transportation and green spaces are all an integral part of the city's steps toward sustainability. San Diego's recycling plan, chiefly the Dare to Reuse program, and green spaces, like the Mission Bay Park, are particularly helpful in increasing green initiatives within San Diego. Although San Diego's transportation system, green buildings, and eco-friendly food sources are not as advanced as its improvements in green businesses, these areas have seen and will continue to see significant improvement through various programs like the 2050 Transportation Plan, the San Diego Association of Governments, and the San Diego Roots Sustainable Food Project.

The city of San Diego has done an excellent job overall of creating green initiative efforts for businesses in the area. There are numerous strengths to all of the plans that have been established. The Green Business Network is probably the most effective plan because of the free advertising, financial benefits, and no cost to participate aspects. There has also been remarkable progress by businesses participating in green initiatives across the city. As previously stated, buildings have saved 24-50% in energy use, and businesses have saved 33-39% in carbon dioxide emissions, 40% in water use, and 70% in solid waste production. However, there are a few weaknesses that the city of San Diego must address before they can be more successful in terms of sustainable green business efforts. The first, while the effects of businesses involved in the Green Business Network initiatives are significant, there are only 49 actual businesses involved in all of San Diego. Although this is an excellent start—the Network is only in its first few years of existence—there needs to be many more businesses involved before the plan can be deemed a success. Also, there are a few different and separate plans currently in action across the city. While this is a good thing in terms of covering many different aspects of green business initiatives, there needs to be at least one overall plan to affect the most change in the community.

San Diego's sustainability initiatives can be adapted for use in almost any city. Essentially all of the green programs put into place are not specific to certain unique aspects of San Diego. Rather, the sustainability programs in San Diego are broad plans that could be applied anywhere because they are general and can be tweaked to fulfill the needs of whatever city was implementing them. The Green Business Network, for example, and its useful tools like the green checklist and sustainable job training is an example of one of these programs. It would be beneficial in any city because it can be tailored to fulfill the needs of each individual business. The portability of San Diego's green initiatives are high because they can be applied to any city across the globe and have a positive effect in increasing sustainability.

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## San Francisco: Sustainability and the New Energy Horizon in a Model City

By Michael Diamond

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According to a 2011 Siemens/Economist Intelligence Unit study released at the Aspen Institute in Munich, San Francisco is North America's greenest city, beating out such heavy-hitters as Vancouver, New York, Seattle, and Denver. The City by the Bay took one of the top five spots for the categories of energy use, water quality, and air quality; second place for building standards and transportation; and first for waste management (Roggenbuck 2011). What factors can account for San Francisco's position as America's sustainability vanguard?

The city's famously/infamously liberal politics certainly plays a role. It does not take expert deduction to see how it may be easier for the city that brought us Harvey Milk, Gavin Newsom, and Nancy Pelosi to muster the political will needed to pass green legislation. Voters have passed, by wide margins, measures such as the 2001 Proposition H, which set the stage for community choice aggregation (Hess 2005), and the 2003 Proposition K, which continued a sales tax to fund socially and environmentally motivated transportation projects (County of San Francisco 2011).

San Francisco additionally has one of the oldest and most ambitious sustainability plans in the nation. Although there are some notable omissions, mainly in the realm of economics, strong environmental planning has helped San Francisco attain and maintain its position at the top of the list of sustainable cities.

San Francisco's experience with alternative energy, in particular, is illustrative of the benefits and pitfalls of the city's approach to sustainability. The (as of this writing) failed tidal and wave projects shows the tension between ambition and feasibility that plagues some of San Francisco's initiatives. Wind power, both in farms outside and smaller scale models within the city, has been more promising but is not yet well developed. However, San Francisco has been a leader in solar energy and has completed a number of successful solar projects. The city's solar incentive system, specifically GoSolarSF, can serve as a model for other cities wishing to create a more sustainable future. Although its ambitious initiatives occasionally fall victim to financial considerations, San Francisco has a true best practice in its offering of solar credits.

The next portion of this paper will focus on the city's general plans — the 1997 Sustainability Plan and the 2008 Environmental Plan — followed by an analysis of some of San Francisco's major initiatives in waste management and green building standards. Following the general discussion, the second part of the analysis will involve a brief case study of how the tension between ambition and feasibility derailed plans for tidal energy under the Golden Gate Bridge. The third section will be devoted to solar energy and San Francisco's best practice: GoSolarSF.

### Planning as a Key to Success

San Francisco's first sustainability plan and its environmental department, SF Environment, were created in 1996 (City of San Francisco 1996). The report uses the United Nations' definition of sustainability: "A sustainable society meets the needs of the present without sacrificing the ability of future generations and non-human forms of life to meet their own needs" (Brundtland 1987). At the

time, sustainability was somewhat of a novel concept, and the plan spends a considerable amount of space in the introduction explaining its basic ideas. The plan was drafted by experts and included stakeholders from environmental advocacy groups, business, local government, and academia. Furthermore, the draft was subjected to a public comment period. San Francisco adopted the Sustainability Plan as official policy in the summer of 1997.

Organizationally, the plan is divided into two sections, “Specific Environmental Topics” and “Topics that Span Many Issues,” with various subcategories of each. Each subcategory lists its specific drafters and contains long-term goals, goals to be achieved within five years, and specific actions to take to reach those goals. Additionally, the report contains a report card with the criteria “In Progress,” “Accomplished,” or “Not Yet Started” for each proposed action. The report card holds the city accountable for the progress, or lack of progress, being made on each initiative. Another section called “Indicators” provides easy-to-follow indicators that show whether or not San Francisco is meeting its goals and moving in the right direction. These two sections are intended to allow the public to easily keep the government accountable.

In 2008, then-mayor Gavin Newsom released an environmental plan to complement the city’s sustainability plan (Hess et al. 2010). The environmental plan, SForward, contains many of the same elements as the sustainability plan but is more focused and less detailed (City of San Francisco 2008). SForward is divided into eight main sections, each with a major goal and then a list of initiatives the city is taking to reach those goals. The sections are Climate Action, Renewable Energy and Energy Efficiency, Clean Transportation, Urban Forest (meaning green space), Green Buildings, Zero Waste, Environmental Justice, and Toxics Reduction. After an explanation of each of the goals, there is one unified section on the importance of education.

As a whole, San Francisco’s sustainability and environmental plans are meticulously organized and relatively easy for the public to understand. Furthermore, the actions described are generally concrete and possible to monitor for success or failure of the initiatives. The report card greatly facilitated accountability in the older report. Instituting a mechanism for continual updates also improved the plans and ensured that they remain relevant to municipal planning in general. Finally, the drafting of the sustainability plan by experts in the fields covered, and public acknowledgement of the drafters, enhanced the older document’s credibility. However, very little attention is paid to costs and limitations. In addition, plans to promote green jobs and businesses are largely absent outside the Environmental Justice section of the Environmental Report. Whereas San Francisco’s success in the realms of waste management and green buildings demonstrate the strengths of the city’s planning, its experience with tidal power clearly shows those plans’ shortcomings in terms of feasibility.

Waste management is one of the best examples of San Francisco’s city planning working as intended. The City of San Francisco officially has a Zero Waste policy, with a goal of becoming completely “Zero Waste” by the year 2020. Currently, San Francisco is able to recover 77% of the waste it discards, a significant step forward that exceeds the Environmental Plan’s goal of 75% landfill diversion by 2010 (City of San Francisco 2011c). In order to achieve its 2010 goal, San Francisco passed a Universal Recycling Ordinance in 2009 mandating that everyone in San Francisco properly separate their waste into recyclables, compost, and regular trash (Tam 2011). San Francisco has been ranked as North America’s top city for waste management because of this ability to set and achieve ambitious goals (Roggenbuck 2011). Of course, other factors affected San Francisco’s ability to reach its waste goals, including its public-private partnership with the employee-owned company Recology and broad-based public support for recycling, reuse, and composting efforts. San Francisco’s utilization of its resources from this public-private partnership and public opinion support to dramatically increase landfill diversion is one of the best demonstrations of the city wedding its ambitious goals to practical and feasible solutions (City of San Francisco 2011c).

San Francisco has also made huge progress in planning greener buildings. Priority permitting is given to private buildings that have been certified LEED Gold by the U.S. Green Building Council. In addition, all new municipal buildings and renovations of over 5,000 square feet are required to be certified at least LEED Silver. These are both steps toward the city's eventual goal of having all of its buildings certified as LEED Gold or higher (City of San Francisco 2011b). The city is additionally leading by example with cutting-edge LEED Platinum buildings, such as the California Academy of Sciences (California Academy of Sciences 2011a). The building has some interesting innovations, such as insulation made from 68% recycled blue jeans and its iconic Living Roof, which contains 1.7 million plants of nine native species that were chosen specifically for their ability to thrive in the local conditions of Golden Gate Park's climate (California Academy of Sciences 2011b).

In contrast to San Francisco's successes on most fronts, the city's experiments with tidal power did not live up to their potential. Former Mayor Gavin Newsom was an influential proponent of tidal and wave power, with detailed plans to develop a pioneer wave power project in the Bay. Federal permit applications were submitted and specific companies had been identified as potential suppliers based on which technology was used. Tidal and wave power avoid some of the complications associated with other renewable energy sources, such as the intermittence of solar and wind power (Newsom 2009). However, so far the pilot projects have been financially infeasible. Despite not having a clear, practical path to developing the tidal energy, the city went ahead anyway and ended up with an embarrassing failure. However, Newsom, now the Lieutenant Governor, is still pushing wave power, which is more practical than tidal power, and a project may finally be approved for 2012 or 2013 (Coté 2010). The initial failure of tidal power in San Francisco is a clear indication of the tension between ambition and feasibility in the city's plans. The future success of tidal and wave power, in addition to San Francisco's other more ambitious ventures, will depend on whether the city can learn this lesson about the importance of financial feasibility and practicality.

#### Best Practice: GoSolarSF

In computing, Moore's Law is the observation that the cost of computer chips decreases exponentially with time, halving every 18 months (Halter 2008). Many observers, including Nobel prize-winning economist Paul Krugman, believe that there is a similar "Moore's Law" for photovoltaic (PV) solar cells. Even though this growth is considerably slower — costs are estimated to be decreasing at an annual rate of about seven percent — the growth is still exponential. At some point, this exponential decrease in costs will make electricity generated by PV cells cheaper than electricity from coal. Krugman believes that the point is set to arrive at some time in the next decade and that if the government did not subsidize the fossil fuel industry so heavily, both directly and indirectly (not internalizing the cost of externalities), that point would likely have already occurred (Krugman 2011). For evidence, the Department of Energy's National Renewable Energy Laboratory has tracked PV prices since 1980, and the graph of its records suggests exponential growth. Moreover, the graph expressed on a logarithmic scale also suggests exponential growth. Thus, at least for the past 30 years up to the present, it is safe to conclude that some form of Moore's Law has existed for solar photovoltaics. Two main factors are driving this growth: cell manufacturers are using less and less material to create their cells and the cells themselves are becoming more efficient, meaning they are able to capture a greater percentage of the sun's energy to which they are exposed (Naam 2011).

Of course, there are limits to how much costs can decrease. So far, it seems that installation costs have decreased at a similar rate to that of the cost of producing the PV cells, although there is no guarantee that this trend will continue. Indeed, there is no guarantee that the exponential growth trend will continue in the future, although it seems a good bet that it will for at least the next decade and the decreases from 2009 and 2010 actually seem to be ahead of the current trend. Regardless, solar energy will, in the future, perhaps the very near future, reach market parity with fossil-fuel energy (*Ibid*). A

forward-looking city would do well to prepare for that moment with investments in solar energy now, in addition to the obvious sustainability benefits from switching to a renewable energy source.

Unsurprisingly, San Francisco has recognized the medium- to long-term economic trends, as well as sustainability considerations, and made significant investments in solar energy accordingly. GoSolarSF, an incentive program for individuals, businesses, and non-profits, may be San Francisco's most successful solar initiative and may serve as a model for other cities.

GoSolarSF works by awarding first-come-first-served incentives to households, businesses, or non-profits that plan to install solar panels (City of San Francisco 2011a). Government entities are not eligible. This is because, in San Francisco, installing solar power for municipal use is not a cost-effective way to reduce greenhouse-gas emissions given that municipal energy is already generated from carbon-neutral hydroelectricity at the Hetch Hetchy Reservoir. Personal and commercial use of solar energy, however, is an effective means of reducing emissions, because Pacific Gas & Electric's (PG&E) electricity, which is used by a majority of the rest of the city, is generated mostly from fossil fuels. Thus, GoSolarSF focuses on the energy use that most effectively achieves San Francisco's sustainability and climate goals rather than subsidizing projects regardless of merit (SPUR 2011).

All individuals are eligible for the \$2,000<sup>†</sup> basic incentive and an additional \$750 city installer incentive for using a locally-owned installation business, as defined by the San Francisco Human Rights Commission. Certified installers with more than three full-time employees must participate in the TrainGreenSF program or another program that hires and trains local youth for green jobs. In addition, individuals living in the historically disadvantaged 94107 and 94124 zip codes are eligible for a \$3,000 environmental justice incentive instead of the basic incentive, and low-income individuals are eligible for an additional \$7,000 low-income incentive. Under no circumstances may incentives (including federal and state incentives) total more than the cost of installing the panels. These extra incentives effectively fuse San Francisco's dual goals of environmental sustainability and social responsibility (City of San Francisco 2011a).

Businesses and non-profits have a more straightforward incentive system, although their incentives are measured per kW (\$1,500/kW) up to some limit (\$10,000 for businesses, \$120,000 for non-profits), rather than lump-sum like the individual incentives. Multi-unit, residential non-profit organizations or for-profit organizations that offer more than 75% of their units as affordable housing are eligible for higher incentives per kW (\$3,500), although their cap (\$60,000) is lower than regular non-profits (*Ibid*).

There are two main steps to claiming incentives under GoSolarSF: reserving the incentive and receiving the incentive. To reserve an incentive, one must fill out or provide a number of forms regarding the solar project and low-income or environmental justice status, if applicable. Many of the forms can simply be copies of those used for other federal or state incentives to reduce redundancy. Within 30 days of receiving a reservation letter with all the necessary forms, the San Francisco Public Utility Commission (SFPUC), which administers GoSolarSF, will accept or reject the application. After acceptance, the applicant has nine months to complete the project. The promised funds are reserved for those nine months and can be released once the solar project is complete. To certify that a project is complete, SFPUC needs a few more forms and assurance from PG&E that the solar panels are connected to the grid. In addition, an IRS form must be filled because incentives can count as income for tax purposes. One application is accepted per meter, meaning that a PV system can receive multiple GoSolarSF incentives if it is connected to multiple different meters. There is a handy checklist at the end of the application, which simplifies the process of checking the application for completeness, as is explicitly recommended by the SFPUC (*Ibid*).

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<sup>†</sup> All dollar amounts in this section are based on the 2011-2012 GoSolarSF application and are likely to change in future manifestations of the program.

GoSolarSF has had a number of appreciable effects on San Francisco. In 2007, GoSolarSF convinced Suntech to locate its North American headquarters in San Francisco, and since then numerous other solar companies, including the locally-owned firm Luminant, the Canadian firm Tioga, and even firms from China and Germany, have chosen to headquarter in San Francisco as well (Cotter & Shaw 2011, Ting & Hocschild 2011). The Mayor's Office of Economic Development has estimated that over 450 solar jobs have been created as a result of GoSolarSF. Assessor-recorder and 2011 mayoral candidate Phil Ting, who served on the San Francisco Solar Task Force that created GoSolarSF, further claims that the incentive program quadrupled the number of solar roofs in San Francisco and raised the values of the homes on which they were installed, increasing city revenue by \$2,000 for each house sold because of higher property taxes on the now-more-valuable homes (Ting 2011).

Despite GoSolarSF's success, there have been partially successful attempts to scale the program back. Ed Harrington, the General Manager of the SFPUC, cut GoSolarSF by 40% due to budgetary constraints. His rationale was that other programs would be too costly to cut, energy efficiency reduces emissions more efficiently, and demand for the program was waning, as evidenced by a leftover \$1.4 million from the 2010-2011 budget. Furthermore, he stated that the \$15 million spent over three years only created 23 low-income jobs (Harrington 2011). Ting disagrees with the characterization of the extra \$1.4 million as evidence of a decrease in demand for the program; instead, he explains the surplus as the result of a large solar project falling through at the last minute (Ting 2011). Ting also claims that Harrington's "facts are off" when it comes to employment. Indeed, it would seem incompatible with any economic model, even non-Keynesian models, that \$15 million in spending would create only 23 jobs. Ting suggests that Harrington must have been basing his calculations on only the most narrow of criteria to reach that number. The idea that only 23 low-income workers would still be employed in installation is valid enough: with only a nine month window to complete a project, installation jobs cannot be expected to last for long (Ting & Hocschild 2011). However, measuring GoSolarSF's economic impacts on this number alone discounts all of the other jobs created directly in the solar firms that increased production to keep up with demand or moved their headquarters to San Francisco and indirectly through energy savings to businesses and extra spending money for workers, families with lower electricity bills, etc.

The \$1.4 million left over from 2010-2011 has been rolled over to the 2011-2012 budget, increasing it from \$3 million to \$4.4 million (it was \$5 million in years prior). Still, the incentives for an average family, which before were widely reported as about \$6,000 on average, have decreased to a basic incentive of \$2,000 plus the \$750 City Installer Incentive. Although this is still a significant incentive, restoring funding would certainly hasten the arrival of solar's market parity with fossil fuels in the San Francisco markets, which is a reasonable goal for a city that has spent considerable resources portraying itself as a solar vanguard (City of San Francisco 2011a).

Another interesting semi-controversy about GoSolarSF involves the Hetch Hetchy Reservoir. GoSolarSF is funded by the sale of excess hydroelectric power created at the dam site. There have been movements, however, to close Hetch Hetchy and return the Yosemite valley to its natural state. There was a lot of controversy over the flooding of Hetch Hetchy valley when the dam was first created in the 1920's, but the area has been a reservoir for all the time since. Still, some activists with the nonprofit group Restore Hetch Hetchy want to drain the reservoir and restore the valley to its "natural" state. The unintended consequence of this action, besides concerns with potable water supplies and hydroelectric energy, would be to damage renewable energy initiatives, as GoSolarSF and other programs, like retrofits, are funded from Hetch Hetchy's activity (Bowe 2011).

Besides GoSolarSF, San Francisco has a number of other notable solar initiatives. There are numerous smaller projects, some of which were funded by the American Recovery and Reinvestment Act of 2009 (San Francisco Solar Map 2011). In addition, there is a large municipal solar project at Sunset Reservoir that cost about \$40 million and provides 5 MW of power. In comparison, GoSolarSF provided 5

MW for only \$10 million (Ting 2011). Although both initiatives have benefited San Francisco, this comparison further shows how GoSolarSF's targeted approach reaps great dividends.

### Summary and Recommendations

San Francisco's sustainability and environmental plans are meticulously organized and relatively easy for the public to understand, with concrete actions that can be easily monitored. Although the 1996 Sustainability Plan differed in some important manners from the 2008 Environmental Plan, overall planning for the city remains strong and organized. San Francisco is already slightly ahead of plan on some initiatives, like Zero Waste, or right on track, as it is for building standards. However, the lack of a general, comprehensive green jobs and business plan outside of the environmental justice plan impedes effective policy-making. Additionally, San Francisco still needs to work out improved funding mechanisms or other alternative avenues for some of its more ambitious programs that are not feasible under standard conditions, such as tidal power. Taken as a whole, however, San Francisco's planning is rivaled by that of few other North American cities.

GoSolarSF is an innovative solar credit program that can serve as a model for other cities wishing to emulate San Francisco's sustainable success. The credit is relatively generous and will be an even more powerful incentive as the cost of PV solar decreases according to Moore's law and reaches price parity with that of fossil fuels. San Francisco also contributed to its environmental justice goals by restructuring the program to take the concerns of lower-income individuals into account. Although affected by budget cuts, GoSolarSF still continues to incentivize solar installations. If full funding is restored in the near future, the incentive program will be better able to serve as a cost-effective way to meet San Francisco's sustainability goals and boost the economy at the same time. Initiatives such as GoSolarSF make San Francisco a global leader in solar initiatives, and other cities would do well to take notes on its successes.

Although San Francisco is well ahead of its potential competition, there is still room for improvement. The official plans themselves can be amended based on the success of past plans and plans in other cities. The report card greatly facilitated accountability in the older report but was absent in the Environmental Plan; a similar report card to the Sustainability Plan should be included in the next addition of either plan — the Sustainability Indicators and Implementation sections of New York City's PlaNYC can serve as a model. Additionally, a separate section addressing economic and financial considerations and green jobs within the plan would be helpful. Moreover, the city must take feasibility into greater consideration, perhaps by collaborating more closely with independent analysts and/or the private sector, in order to turn its ambitions into realities.

Portability could possibly be a problem with using San Francisco as a model for other cities to follow. Although cities tend to lean liberal, very few are as deep blue as San Francisco. Unfortunately, sustainability has been caught up in the polarized duopoly of America's political system, and greening efforts have become perceived as a "liberal," "progressive," or "leftist" concern. Regardless of the accuracy or inaccuracy of such a classification, unless sustainability is somehow extricated from the left-right paradigm, political resistance to sustainable initiatives is likely to factor much more heavily in most other cities than in San Francisco. This increased resistance could make some initiatives that were feasible in San Francisco, such as community choice aggregation, infeasible elsewhere. In addition, geology and geography affect the ability of certain cities to promote alternative energy. Cities in structural basins, such as Nashville, or in otherwise non-windy areas may not be able to replicate San Francisco's wind projects, and those not on the coasts cannot hope to take advantage of tidal power (although other forms of hydroelectric power may be available). Furthermore, cities such as Seattle that do not receive sufficient sunlight may not be able to replicate San Francisco's solar initiatives.

San Francisco has attained an unusual level of success in achieving its sustainability goals for an American city as a result of both factors unique to San Francisco and also factors that can be adopted

elsewhere. In some areas, San Francisco can still stand to learn from other cities' experiences and its own past experience. Overall, however, San Francisco's portable initiatives, especially solar incentive programs like GoSolarSF, can serve as models for the rest of North America, and, indeed, the world.

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## Recycling and Reuse in Santa Barbara

By John Gibson, Olivia Knoll, Rachel Levy, Jasmine Reid

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Santa Barbara is located in Southern California nestled between the Pacific Ocean and the steep Santa Ynez Mountains. Although the city has a small population of just under 90,000, its pristine location between the steep Santa Ynez Mountains and the Pacific have caused Santa Barbara to be a sought after tourist destination. In fact, the service sector is the leading industry in the city, accounting for 35% of total employment. The region has been touted as the “American Riviera” due to its Mediterranean climate, and the sustainability measures the city has taken are closely tied to its geography and leading industries. (National Geographic, 2013) Thus, one of the main challenges Santa Barbara currently faces is how to manage sustainably the tourism industry.

Santa Barbara is emerging as an American model for sustainability and green practices. The local government is highly involved in the city’s greening efforts, and it partners with private efforts rather than competing with them. The city primarily uses incentives for its residents to participate in innovative sustainability programs. Successful measures to tackle this challenge have included investments in green transportation for both tourists and locals; small, sustainable businesses that have maintained the integrity of the city; and recycling measures that have facilitated efficient, environmentally friendly waste management (Santa Barbara Stats, 2013). As a medium sized urban area, the city has put considerable emphasis on the use of sustainable public transportation, especially electric and clean diesel buses, for both residents and tourists to the city. A partnership with a local energy company has brought a low-cost solar panel leasing program to homeowners, which benefits both the environment and residents’ wallets (Community Environmental Council, 2013). Additionally, the city of Santa Barbara has sustainable waste management programs that range from voluntary recycling pickup services to mandated waste disposal methods. In our opinion, the city’s broad approach to waste reduction is its best practice.

This study will outline the overall plans of the city and the various practices implemented that are currently helping it grow as a sustainable city, including its efforts in green buildings, energy, transportation, green spaces, and food/agriculture. Then it will discuss in more detail Santa Barbara’s innovative recycling and food scraps program and evaluate the strengths and weaknesses of the recycling program and its portability to other cities.

### *Santa Barbara’s Sustainability Practices*

Santa Barbara offers a wide variety of practices in order to reduce its environmental footprint. The comprehensive “Sustainability Action Plan,” developed in 2010, encompasses nearly all areas of sustainability. The goal of this plan is to reduce greenhouse gases (specifically carbon dioxide) 15% by the year 2020 and 90% by the year 2050 (Santa Barbara County Government, 2010b). The plan is a broad one; it will be implemented by creating more sustainable energy, buildings, transportation, businesses, green spaces, food, and reuse and recycling programs. This sustainability plan, along with many other individual plans made by the private sector, are what creates Santa Barbara’s reputation as a sustainable city.

One of the most important areas of sustainability initiatives for any city is the reduction of carbon-dioxide emissions, and the government of Santa Barbara has taken numerous measures to utilize alternative energy sources. One of their larger projects includes the support of power purchase agreements and renewable power generating systems to promote the use of renewable energy at various government-owned facilities. One Santa Barbara program specifically focuses on increasing the use of solar energy used by the city's residents. The Solarize Santa Barbara Program, in partnership with the Community Environmental Council, aims to provide low-cost solar energy to homeowners through a leasing model. In this model, homeowners lease solar panels and use the energy they create. For most customers, their energy bills are significantly lower with the solar panels, which help to offset the costs of leasing. Adding solar panels also increases the value of their homes (Community Environmental Council, 2013).

Additionally, Santa Barbara has taken actions on landfilled gas to convert it into an energy source. By using a series of wells with a vacuum system, the landfill gas is extracted and processed to be used to generate electricity. This process directly reduces greenhouse gas emissions, reduces air pollution by offsetting the use of non-renewable resources, benefits the local economy (from the sale of the gas), and reduces environmental compliance costs (County of Santa Barbara, 2010). Also, the city of Santa Barbara has partnered with the Community Environmental Council to help increase community awareness of energy efficiency and to build sustainable local energy practices.

Along with its sustainable energy initiatives, Santa Barbara has a significant green building effort of both residential and commercial buildings. This effort is managed by the city's major green building association, "Build Green Santa Barbara." A large group of contractors, architects, designers, builders, developers, subcontractors, suppliers, lenders, and real estate agents use and promote more efficient and sustainable resource allocations, designs, and construction methods. Even when compared with the general California standards, Build Green Santa Barbara implements some of the most sustainable and efficient methods in the areas of waste management, water efficiency, and health and air quality. Some of the unique techniques of Build Green include advanced framing and extra insulation (total energy savings of 2-4%), high efficiency water heaters, Energy Star certified household appliances, low pile carpets, and low toxic paints. Recycled plastic lumber, engineered wood, and laminated veneer lumber create a sustainable foundation. Furthermore, water is conserved in these building sites through rainwater harvesting and low-impact development on the surrounding wildlife and ecosystems (Build Green Santa Barbara, 2013). Moreover, several buildings, both residential and commercial, are now LEED certified in the area, and an astonishing seven buildings are Platinum LEED certified, a very impressive number given the city's small size (M Landman Communications and Consulting, 2013). In October 2013, UC Santa Barbara won the Green Building Super Hero Award because it had the first LEED-platinum certified laboratory and the first double platinum building (Mok, 2013). All residents of Santa Barbara--even its college population--are involved with building greening efforts.

Although Santa Barbara's success with green energy and buildings is impressive, the city has also made progress in its efforts to reduce transportation-related emissions. As mentioned before, the city's Sustainability Plan has the goal of reducing the city's carbon-dioxide emissions by 15 percent by the year 2020 (Appendix A-Sustainability Plan, 2010). One way the city has tackled this issue is through its implementation of the "Santa Barbara Car Free" plan. Under this system, people are able to travel through downtown Santa Barbara entirely car free, mainly by using electric shuttle buses. The buses can take pedestrians all along the waterfront and through the central area of Santa Barbara County. The plan is so efficient in Santa Barbara that it has even become a model for other cities such as Chattanooga, Tennessee (Chatfield-Taylor, 2013). The fair for these shuttles is only 50 cents, making it affordable and energy efficient (Santa Barbara Car Free, 2011). Even more promising is the Traffic Solutions Emergency Ride Home program provided by the Santa Barbara government. If passengers ride the public shuttle bus at least once a week, they are eligible for this program that provides backup

transportation should they need to get home very quickly but couldn't otherwise because they rode the bus. Customers can be reimbursed for their cab/rental car ride up to \$55 by simply submitting their receipt and a form (Santa Barbara MTD, 2013). This program helps to promote shuttle use by giving customers peace of mind that they can utilize public transportation without sacrificing convenience.

Along with this public shuttle, Santa Barbara encourages pedestrian traffic through various walking tours, and the region's shopping center tailored towards pedestrians. Additionally, bicycle usage is emphasized with clearly marked bike routes extending beyond the city. There is an abundance of bike racks throughout the city to make biking efficient and easy. One interesting development to promote bike usage in Santa Barbara is its downtown Bikestation. The Bikestation is a function of Bikeable Communities, a California non-profit organization, and has locations in various Californian cities (Bikestation, 2013b). It is a secure, enclosed bicycle parking facility that is open 24/7 for members. It is very attractive to bikers because of its restroom/shower facilities, lockers, and bicycle repair stations (Bikestation, 2013a). The Bikestation does for bicyclists what the Emergency Ride Home program does for public shuttle riders: it provides comfort and peace of mind while encouraging sustainable transportation use.

In general, American small businesses face a major challenge today in competing with larger, more established businesses that are able to use economies of scale to sell similar products at lower prices. However, a few strategies are being employed to increase the customer base in many locations, and Santa Barbara is no exception. For example, "buy local" campaigns are now commonplace, and they urge consumers to make certain purchases from local retail stores, farms, and even banks. Environmental responsibility and sustainability are often central in focus to these campaigns in Santa Barbara. Furthermore, there is concern that big businesses can quickly leave as well, causing turmoil for the local employees. Small businesses are more likely to stay and are well supported by community associations in Santa Barbara. For example, the city has a center solely designed for the development of small businesses called the Santa Barbara County Small Business Development Center (SBDC). This center provides individualized consulting and training programs to new small businesses. Also consultations are freely given to entrepreneurs looking to gauge whether a particular business idea might be successful (Small Business Development Center, 2013). Similarly, Santa Barbara has the Santa Barbara Entrepreneurship Center, and results have shown an incredible 87% success rate for small businesses that go through the incubator (Small Business Entrepreneurship Center, 2013). Moreover, Santa Barbara has a Green Business Association, which certifies businesses that have reduced waste, bought green products, and conserved energy and water down to specific levels. There are now 47 businesses in Santa Barbara County that have been certified thus far, and that number is rising rapidly; green certification is very highly respected by locals, so many business are adjusting their business models in attempt to achieve certification (Green Business Santa Barbara, 2010).

In regards to the superior sustainability practices formerly mentioned, Santa Barbara has relatively weak efforts to create green spaces, perhaps because the city's geography inherently includes plenty of natural spaces. However, the city maintains existing green spaces (over 8,000 acres of parks and open spaces) and it has introduced maintenance reforms such as the use of organic fertilizer, mulching, and water efficiency (City of Santa Barbara, 2013g). Santa Barbara offers many public beaches with volleyball nets; in fact, the city's beaches are a huge attraction for the tourism industry. Additionally, all parks include sidewalks for bicyclists and pedestrians (County of Santa Barbara, 2010).

One of Santa Barbara's community jewels is its community-supported agriculture (CSA) and farmers' market program. The Santa Barbara area hosts 14 CSA programs, ranging from small-scale organic farms to larger farms with community classes and workshops. Many of these programs have subscription services in which local residents pay weekly to have boxes of fresh seasonal produce delivered to their doorsteps. Additionally, most programs also incorporate urban outreach gardens or participate in local Santa Barbara farmers' markets (Edible Communities Publications, 2013a). All

farmers' markets in the Santa Barbara area fall under the umbrella of the Santa Barbara Certified Farmer's Market Association, which includes over 130 local growers and also helps maintain available green space for the markets (Santa Barbara Certified Farmer's Market, 2013). There are five farmers' market outposts scattered throughout the city. By investing in each location, residents of Santa Barbara have access to a farmer's market every day of the week!

In addition to several farmers' markets and CSA suppliers, Santa Barbara also hosts three local government-supported community food gardens. These community gardens primarily serve lower-income residents who are often excluded from farmers' markets and CSA subscriptions because of their higher costs. Alternatively, these gardens have raised plots available to lease for a low rate, and are funded with grants. They are handicapped-accessible and have free compost bins and storage sheds available on-site. In addition to hosting plots for individual families, the community gardens partner with local churches and schools to provide specialized gardening education (Santa Barbara County Government, 2013a). While the concept of community-supported agriculture is not unique to Santa Barbara, the city's residents certainly ensure that the programs are well supported.

Santa Barbara also provides a suite of recycling services to all of its residents and businesses, with a primary focus of maximizing the diversion of solid waste from landfills. The Electronic Waste Act requires any electronic equipment to be donated for reuse or recycling. These unused computers are donated to Computers for Families program, which teaches boys at the Los Prietos Boys Camp how to repair and upgrade computers, and then the computers are donated to needy families. This program not only implements a critical reuse program, but also employs at risk youth and provides them with a skill applicable in future jobs. The city also has a unique food scrap program that will be discussed below.

In summary, Santa Barbara has taken great strides to become a quintessentially sustainable city. It has many strong practices in green businesses, with its Small Business Association having a high success rate for entrepreneurs in the area. Additionally, Santa Barbara has many examples of green buildings, and the city is integrated with regional farms. Santa Barbara's farmers' markets and organic restaurants are catalogued in the *Edible Santa Barbara* magazine, making these options known to both tourists and residents (Edible Santa Barbara, 2013). However, Santa Barbara's sustainable energy efforts are relatively modest. Green energy, especially solar and wind technologies have great potential in the sunny oceanside region; yet, the city has failed to implement a widespread program. Also, Santa Barbara's efforts to create more green spaces has not been sizeable, although the city does have lots of natural spaces due to its close proximity to Pacific beaches. While Santa Barbara does not suffer for lack of greening initiatives, extending efforts to these areas could help propel the city to the national forefront of urban sustainability.

#### *Best Practice: Recycling and Foodscraps Program*

As previously mentioned, Santa Barbara's most successful greening initiative is its well-constructed reuse/recycle program. This broad initiative consists of two parts: an innovative waste pickup program and local policies that enforce responsible waste management. The local government provides basic waste and recycling programs found in cities all over the world, but unique to Santa Barbara is how greening efforts have been effectively and efficiently integrated. The exemplar of Santa Barbara's waste reduction efforts is its food scraps program, which collects compostable material such as soiled paper bags, compostable dishes, tea bags, cut flowers, and leftover food.

The process of recycling food scraps is quite similar to recycling more conventional materials. The food scraps are collected in yellow bins (just like blue recycling bins), and are picked up by Santa Barbara's contracted trash/recycling service provider, MarBorg. Once retrieved, the scraps are transported to a commercial composting facility nearby, where they are heated and decomposed over 4-6 months to create soil. This soil is sold to private homes and businesses and is also used in Santa Barbara's parks and playgrounds. While the food scraps program is only (as of this writing) available to

Santa Barbara's businesses, 150 businesses currently use this program, and plans have been made to extend the service to residential areas (City of Santa Barbara, 2013b). Additionally, the wide implementation of the food scraps program in restaurants helps Santa Barbara to sustainably manage its large tourist population.

As a product of the city's investment in its recycling program as a whole, homes and businesses in Santa Barbara have excellent recycling rates for an American city. Restaurant waste is cited as 40% food scraps, 40% recycling, and 20% trash, while single-family homes recycle 70% of all possible materials (City of Santa Barbara, 2013c). As if the environmental benefits were not incentive enough to participate in these greening programs, Santa Barbara has financial incentives as well. All recycling programs (standard recycling, food scraps, and green waste) cost 50% less than standard trash pickup services, but are still managed by the city's chosen waste contractor (City of Santa Barbara, 2013e). This makes saving money and going green easy for Santa Barbara's residents.

In addition to their voluntary sustainable waste pickup efforts, the city of Santa Barbara also enforces a handful of citywide policies aimed at curbing landfill usage. The newest policy is a citywide ban on single-use plastic bags, enacted in October 2013. This ordinance will prohibit plastic bags from being used in grocery or convenience stores, and such stores will charge 10 cents for each brown paper bag they provide to customers. Reusable bags and small plastic produce bags will be allowed (City of Santa Barbara, 2013d). In order to make this policy easier for businesses to correctly implement, stores will have a 6, 9, or 12-month grace period in which to deplete their supply of plastic bags and attain reusable or brown paper bags that meet specific bag compliance criteria. Brown paper bags (sold for 10 cents each) must be 100% recyclable, contain at least 40% post-consumer recycled material, and contain no old growth fiber (City of Santa Barbara, 2013f). This new ordinance is not only incredibly proactive in requiring such stringent environmental guidelines, but also sympathetic to Santa Barbara's business community.

Another key type of waste that is being addressed in Santa Barbara is electronic waste. "E-waste" is categorized as anything that has an electrical cord or runs on batteries. As the demand for new technology increases the amount of "e-waste" also goes up. Electronic waste presents more severe human and environmental health impacts, since they contain hazardous materials (City Trash and Recycling, 2013). The Electronic Waste Recycling Act (Senate Bill 50) was implemented in 2004 to decrease the presence of e-waste in landfills. This act makes it illegal to throw away electronic waste in dumpsters. It also ensures that consumers return their electronics to be recycled and guarantees safe and environmentally conscious disposal of the products (Electronic Hazard Waste, 2010). Because the waste cannot simply be discarded, several centers have been set up throughout the city. The city of Santa Barbara offers pickup of large items for a small price, but if the consumer is able to deliver the item to the recycling center it is often free (Electronics, 2013). There is an even more comprehensive program offered at University of California Santa Barbara that takes most of the work out of the consumers' hands. There the students have organized a program that has supplied several of the campuses buildings with recycling bins solely for "e-waste". The students themselves then transport the waste to recovery centers (Associated Students Recycling, 2013).

Finally, Santa Barbara has a handful of independent businesses that are marketing unique reusable products to the community. Demo2Design, a reuse center, salvages materials from construction sites and resells them as high-quality home improvement materials (Demo2Design, 2009). Demo2Design has also partnered with Santa Barbara City College's Construction Academy to produce "Custom Casitas" made of 100% salvaged building materials. These structures are sold to the public, and are commonly used as backyard garden sheds, playhouses, or guest rooms (Joy, 2013). The wide variety of recycling practices in Santa Barbara highlights the city's commitment to environmental conservation.

### *Conclusion*

Santa Barbara has a wide range of urban sustainability initiatives, particularly in the area of transportation and recycling, but also in sustainable buildings and food/agriculture. As previously mentioned, Santa Barbara disappoints in efforts to create green spaces; however, the city's geographical combination of beaches and mountains lends to plenty of natural green spaces in the area.

The overall success of the city for sustainability initiatives can be attributed to several factors. The local government's strong support for sustainability programs and its cooperation with private entities has been vital for the city's efforts, and people are willing to implement these practices because the government offers incentives, mainly monetary. Many of the initiatives address more than sustainability and environmental goals. For example, the reuse practices employ at-risk youth, and community gardens not only practice sustainable farming but also invest in local businesses and engage the community.

The city and public-private partnerships have also been important for Santa Barbara's most successful greening initiative: its programs related to reuse and recycling. This area consists chiefly of two distinct parts: an innovative waste pickup program and local policies that enforce responsible waste management. Uniquely, the food scraps program takes compostable material such as soiled paper bags, compostable dishes, tea bags, and leftover food and transforms these materials into soil for small businesses in the area. It is reasonable to suggest that other cities can implement the same policies. Santa Barbara's most portable practices would be their more general and widespread practices such as providing the food scraps program, creating incentives against producing waste and in favor of recycling, and adding an extra cost at stores that use plastic bags. These practices are simple, reasonable daily decisions any American could make.

Although some of Santa Barbara's achievements in the recycling field could be replicated, there are some limitations. As wonderfully innovative as the food scraps program is for Santa Barbara, the program would have a hard time being transported to other areas. One advantage that Santa Barbara has is that nearby Santa Maria, California, hosts the specialized composting center used for the food scraps programs. Cities without these centers would struggle to implement the food scraps program, as they would have nowhere to collect and process compost. Also, Santa Barbara's trash and recycling management company, MarBorg, willingly participates in efforts to cut down on waste. If a city's existing contracted waste management firm is not willing to provide these services or discounts for recycling, these recycling practices could not work.

Thus, central to the success of Santa Barbara's recycling program is collaboration among the city government, MarBorg, and private businesses. Without the direction of the government, the abilities of MarBorg, or the cooperation of restaurants and businesses, Santa Barbara could not be as successful in sustainability efforts as it presently is. However, because Santa Barbara is a small, close-knit community, it is able to easily implement these practices. These efforts might not be as successful in larger cities because of clashing opinions and budgets of local governments, private businesses, and citizens. However, for the community of Santa Barbara, these three entities have been able to cooperate successfully in creating a leader for urban sustainability.

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## Analysis of Green Practices and Community Gardening in Seattle

By McLain Wilkinson

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Of the cities leading the way in the "greening" of America, Seattle definitely deserves consideration for the greenest. Seattle has gained the reputation of being one of the most sustainable cities in the United States, boasting various innovative policies and technologies, all of which make Seattle more sustainable. With a metropolitan population of 2.7 million people, Seattle is easily the largest city in the northwest United States. Situated between the Puget Sound and Lake Washington, Seattle is surrounded by forests and mountains, allowing the city to have lots of ties to the nature encompassing it.

Seattle continues to improve its sustainable practices as outlined in the Seattle Comprehensive Plan, *Toward a Sustainable Seattle*. The city already uses over ninety percent alternative energy for electricity, promotes green and human-powered transit, and boasts excellent goals for urban design. In addition, Seattle has a strong sustainable food production method in community gardening. However, the city does have some shortcomings in its green initiatives, such as promoting green businesses and jobs, but these are relatively minor shortcomings in a model city. Of the many strong initiatives, community gardening is arguably the leading example of the city's sustainability efforts.

This paper will provide both an overview and an evaluation of the city's plan, including each of the city's initiatives in major areas where sustainability is a concern will be assessed. Naturally, the plan will have both strengths and weaknesses, and these will be identified. In the second section, Seattle's best green practice will be isolated and analyzed. The final section will include evaluations of the city's plan and other initiatives, outlining specific strengths and weaknesses of Seattle's sustainability initiatives. It will also include an analysis of the portability of Seattle's initiatives and suggestions for future sustainable policies.

### Toward a Sustainable Seattle: Overview and Analysis

In 2005, Seattle introduced its sustainability plan, *Toward a Sustainable Seattle*, and put the plan into action. The comprehensive plan, which is very goal oriented, covers a wide range of issues. *Toward a Sustainable Seattle* is guided by four core values: community, environmental stewardship, economic opportunity and security, and social equity. Seattle's success in upholding all four of these values is the city's main determinant of the plan's success or failure (City of Seattle 2005). The plan is divided into eleven main sections, each devoted to a specific aspect of city growth.

Although the plan is titled *Toward a Sustainable Seattle*, the plan is more a set of guidelines for city growth and policy in general, not necessarily for sustainability-related issues. However, the plan is very strong in advocating green practices, even though some of the city's strongest initiatives were omitted almost entirely from the plan. The strengths of Seattle's growth and sustainability plan lie in the urban design, transit, and energy aspects of the plan, while its weaknesses include green business and jobs. In the following paragraphs, Seattle's sustainability plan will be analyzed. The main focus of this section will be on Seattle's urban design, energy, transit, food production, waste management, and green jobs and business.

Section one of *Toward a Sustainable Seattle* focuses on urban design. Seattle is trying to employ an Urban Village Strategy in its planning and development of building stronger, more sustainable communities. The Urban Village Strategy allows Seattle to create distinct neighborhoods with diverse housing and employment growth and pedestrian oriented transit (City of Seattle 2005). These villages allow the population to grow uniformly throughout the city and decrease the need for cars and other greenhouse gas emitting vehicles. By creating an environment where almost all daily amenities are within walking distance, cars are unnecessary commodities. According to Natalie Singer, the developers of the Snoqualmie Ridge Village believe that the development cuts down on traffic, pollution, and the isolation of suburban sprawl. In addition, the village provides a higher quality of life than in traditional neighborhoods (Singer 2004).

Seattle citizens can rely on public transit to take them from village to village, greatly reducing carbon emissions and even clearing traffic on roadways. In addition, the villages allow Seattle to build on successful aspects of the urban character throughout the city. Seattle has designated four main types of villages throughout the city: urban centers, manufacturing/industrial centers, hub villages, and residential villages (City of Seattle 2005). These four categories of villages vary in density and main purpose, either residential, employment, or both. By clearly defining the many villages throughout Seattle, the city is able to monitor and shape growth in a way that advocates more sustainable practices.

Seattle addresses the issue of energy in the utilities section of *Toward a Sustainable Seattle*. Seattle is already a national leader in electricity production, with over ninety percent of its electricity produced by alternative energy, allowing Seattle to become the first official carbon-neutral city in America (Datko, Hess 2010). Seattle City Light is the city's publicly owned electric power utility, and this company produces a majority of the city's electricity. Almost all of this energy is produced from hydro plants outside the city (City of Seattle 2011a). Seattle is also interested in wind power, as the state of Washington is beginning to require acquisition of renewable resources such as wind. The city has contracted the Stateline Project in eastern Washington and Oregon to produce wind; this source is capable of producing 175 megawatts of power. Wind power is beginning to make up a larger portion of Seattle's energy production, lowering the city's reliance on hydro power (City of Seattle 2011a). With such innovative electricity production already in use, the utilities section in the sustainability plan is more focused on increasing reliability and providing low-cost energy to all of Seattle's residents. The energy section in Seattle's sustainability plan is one of the more concise elements of the plan, mainly because of Seattle's impressive energy production methods already in place.

A third major area of the city's sustainability efforts is the greening of public transit. Seattle focuses on both public and human-powered transit, both of which are addressed in the transportation element of the sustainability plan. The city states that its Urban Village Strategy will shape the city's transportation facilities (City of Seattle 2005). In addition, Seattle wants to implement street classifications by use in order to better control traffic. By identifying the primary function of roadways, the city can enhance the roadways to more efficiently serve its purpose (City of Seattle 2005). The city wants to increase transportation choices and reduce car use by making public and human-powered transit more appealing to Seattle's citizens. *Toward a Sustainable Seattle's* transportation element is more focused on general infrastructure initiatives rather than specific initiatives for its public transit fleet. However, the city has plans for both human-powered and public transit.

In human-powered transit, Seattle advocates both walking and bicycling. In the sustainability plan, the city wants to create infrastructure and roadways in a manner that caters directly to these types of transportation. In addition to advocating both of these types of transit in *Toward a Sustainable Seattle*, Seattle has separate plans for each, entitled the Seattle Bicycle Master Plan and the Seattle Pedestrian Master Plan. In the Pedestrian Master Plan, Seattle describes its initiatives to become America's Most Walkable City. The city plans to achieve this goal by making walking safer, more comfortable, and more convenient. The local government aims to create more green streets, or streets

that give priority to pedestrians and open space over other transportation by widening sidewalks and calming traffic (City of Seattle 2009b).

In the Bicycle Master Plan, the city details how Seattle will attempt to become the best community for biking in the United States. Six-thousand people in Seattle's workforce currently use bikes as a primary mode of transportation. The city has plans to have bicycle facilities on 62 percent of its arterial roadways and will have 230 miles of signed bike trails throughout the city (City of Seattle 2007). Seattle's initiatives in walking and biking are some of the most innovative in the United States. Although the comprehensive plan itself does not expand much on these two forms of transportation, the in-depth master plans for biking and walking are very effective at outlining how these forms of transportation will be improved and favored in the future.

In addition to advocating human-powered transit, Seattle promotes its state-of-the-art public transportation system. Not many specific initiatives are mentioned in the plan to make public transportation more sustainable, but the city boasts both hybrid-electric and biodiesel buses, both of which have fewer emissions than the standard diesel bus (City of Seattle 2011b). The city also has Bus Rapid Transit, which is designed to further reduce environmental impact and increase rider convenience. In this system, buses have more frequent stops (but at a greater distance between stops), have sensors allowing traffic lights to favor buses, and have more doors to allow passengers to enter and exit the bus more quickly.

In theory, Bus Rapid Transit would drastically decrease riding time and allow buses to navigate city streets much more quickly than the conventional bus system. However, this is not necessarily the case in Seattle. Despite all of the effort put into making the bus system more efficient, critics complain that the ride time on any given bus is nearly the same as on a regular bus (Constant 2010). It would be beneficial for the city to either implement better methods to significantly decrease bus rapid transit time or to focus on other ways to make bus transit more sustainable.

Seattle currently uses both hybrid diesel and electric trolley buses for its public transit. With the electric trolley bus fleet expiring in roughly three years, Seattle is currently looking into options about how to replace the fleet. The city will continue to use both the electric trolley and diesel-hybrid buses, both of which satisfy the city's criteria. (King County Metro 2011). Overall, Seattle's plans and current initiatives for transportation are far ahead of those of most North American cities, and the city will continue to improve upon its already innovative transit systems.

Although *Toward a Sustainable Seattle* does not have a section devoted specifically to food production and waste removal, the city of Seattle has exceptional initiatives in both of these areas. Many of Seattle's food-related initiatives involve promoting locally grown food. The Local Food Action Initiative strives to strengthen Seattle's food system in a sustainable and secure way. The program achieves these goals through assessment of ecological and environmental impacts of various food production methods, stimulation of demand for healthy food, and increase in availability for healthy foods (City of Seattle 2011d). In addition, the city has numerous public farmer's markets located throughout the city where citizens can go to purchase healthy, locally grown produce. Seattle is also a big advocate of growing one's own food through backyard and community gardening. The practice of community gardening will be discussed much more in-depth in the next section of the paper, as this practice is arguably Seattle's strongest.

In addressing the issue of waste, Seattle possesses a waste removal strategy that is crucial to making recycling and garbage disposal more sustainable. The city's Zero Waste Strategy is Seattle's plan to reduce specific wastes in various areas of the city. The program allows citizens to opt out of receiving phone books in addition to offering better recycling methods, puts a fee on disposable shopping bags, and prohibits Styrofoam containers at all fast food restaurants in the city (City of Seattle 2011c). Despite being left out of the comprehensive plan, Seattle's food and waste initiatives are very thorough and rival those of other leading American cities.

Probably Seattle's most lacking sustainability initiatives come in the area of green business and jobs. The city government has few stated goals or programs to create these jobs, and the ones that currently exist are not very successful. In an article on the website of Komo News, a local news network, the author discusses one of Seattle's recent unsuccessful attempts to create green jobs in the city. In 2010, Seattle won a twenty-million dollar grant to invest in weatherization in homes. The goal was to put 2,000 people to work retrofitting 2,000 homes. A year later, only three homes had been weatherized and only fourteen jobs were created. Seattle poorly planned this attempt to create green jobs and to retrofit buildings, making it difficult for homes and buildings to get the funding to weatherize (Ho 2011). The lack of green jobs initiatives in Seattle's plans remains a trivial issue compared to all of the city's strong initiatives. However, it is important that Seattle becomes more active in trying to promote green business and jobs throughout the city. Having exceptional and successful initiatives in green business and jobs would give Seattle very good sustainability practices in almost every major category.

In summary, Seattle's comprehensive plan, *Toward a Sustainable Seattle*, provides remarkable ideas and goals for sustainable initiatives. It has exceptional plans for urban design, transportation, and energy, while it has shortcomings in green business and jobs initiatives. The plan comes across as too goal-oriented, and many of Seattle's current green practices were omitted from the plan. The plan should be more focused on policy and specific goals. In addition, the plan is too focused on the built environment, even in elements of the plan not focused on infrastructure. This could be because the plan is intended to be a guide to manage Seattle's growth, so almost all of the issues mentioned in the plan are actually related to the city's built environment. However, given the current conditions, *Toward a Sustainable Seattle* serves its purpose well, and will continue to do so until it becomes time to make a new one.

#### Best Practice: P-Patches (Community Gardening)

Of all of Seattle's sustainability practices, community gardening is undeniably the city's best practice. A community garden is a space where neighbors come together to grow food and build community. These gardens are typically publicly owned, but gardeners will pay a small annual fee to use a plot. These gardens, called P-Patches in Seattle, are part of Seattle's initiatives to promote local food production. There are currently 85 P-Patches spread throughout Seattle, and each of these is of a different size and is maintained by citizens of Seattle. There are many benefits associated with community gardens. These gardens bring people together, teach people about healthy and organic foods, and provide food for the homeless (City of Seattle 2009a). The benefits of community gardens are numerous, and the city of Seattle is fortunate for this practice to have become so popular. The P-Patch program has grown drastically since its inception in the 1970s, becoming one of Seattle's sustainability icons.

The history of Seattle's P-Patches dates back to the 1970s at the Picardo family farm, the home of Seattle's first P-Patch. The Picardos were no longer financially able to maintain the farm, so they sold it to the city of Seattle, which used the land to create a community garden. The gardens were becoming popular in the green movement at the time. This first P-Patch was divided up into plots to be maintained by families at a nearby elementary school; the food would be donated to food banks and consumed by the families (City of Seattle 2009a). Seattle then authorized a community gardening program to make the city greener and to open up space. The new P-Patch Program grew from this original push to make the gardens city-maintained. (City of Seattle 2009a). By the end of the decade, Seattle and its P-Patch program had 16 gardens spread throughout neighborhoods in the city.

In 1979, the P-Patch Advisory Council was formed. This organization was put in charge of the P-Patches, and the program grew under its guidance. The city worked with the gardeners for land-tenure issues, and the city was able to provide new land and assistance if a garden had to be relocated. In 1995, the organization changed names yet again to Friends of P-Patch (Hess 2005). The organization continued

to get land donations and expand the P-Patch program during this time until 2003, when the organization became the P-Patch Trust, the current name of the P-Patch organization. At this time, the organization changed its governing format to a donor organization with a self-perpetuating board of directors (Hess 2005). Today, the P-Patch Trust works to acquire, build, preserve, and protect community gardens in Seattle's neighborhoods (P-Patch Trust 2011). Under the guidance of the P-Patch Trust, Seattle's community gardens are able to thrive today.

Seattle's P-Patches can be found all over the city today. With over 80 P-Patches currently in use, these gardens can be found in almost every one of Seattle's urban villages. The city of Seattle and the P-Patch Trust have tried to make the logistics of owning a plot and gardening as simple as possible. To get a plot and begin gardening, a citizen must put their name on the waitlist for a plot, specifying the size of the plot they want. The fees for the application and the annual fees for tending the plot are low, making community gardening appealing to people of all socioeconomic levels. Once the gardener gets off of the waitlist, he or she may begin gardening at any time (City of Seattle 2009a). Once the gardener has begun tending and maintaining the plot, he or she is free to use the vegetables grown however he or she likes. The gardeners are free to bring the vegetables back to their own households, share with other gardeners, or donate the produce to food banks.

In recent years, the city's P-Patches have donated seven to ten tons of produce to food banks in Seattle, showing that the gardens are truly capable of giving back to the community (Brown 1998). The flexibility provided by the P-Patches is probably what makes them so appealing to the citizens of Seattle. The gardens can be used in many different ways and serve many different functions. The P-Patch Trust wants the gardens to be for the community, so naturally the committee wants to cooperate with gardeners to work out the best strategy for management of the gardens. A plan for the gardens developed by the P-Patch Trust called for one staff person for every twelve gardens. The city has not yet hit this level of management, but Seattle's community garden administration is easily the most involved of any other cities in the United States (Hess 2005). Seattle's relationship with its gardeners has allowed the program to grow and expand and become the model gardening community it has become.

Seattle's P-Patches thrive in the city for many reasons. The gardens, having been in existence in Seattle for forty years, have been under management for just as long, and the P-Patch trust works in the best interest of the gardeners. Land tenure is another major reason why community gardening has been so successful in Seattle in particular. Seattle's gardens are located on public land or land held by the P-Patch trust, decreasing the number of land-ownership related issues (Hess 2005). P-Patches do not experience many issues with theft either. Even in low-income areas, theft of the vegetables has not been an issue. Most citizens respect the gardens and only use them for their intended purposes. However, the community's support for its gardens is probably the main reason why P-Patches have thrived today. Many citizens exemplify incredible dedication to their gardens. An article published in the *Seattle Times* shows one woman's dedication to the Interbay P-Patch, right after it had been forced to be relocated for the third time in 20 years. Thanks to her dedication, along with that of many other gardeners, the Interbay P-Patch, the second largest in Seattle, is flourishing with produce (Brown 1998).

Clearly, the portability of Seattle's P-Patch program in other cities is dependent on their government involvement, support from the P-Patch Trust, and the number of staff members committed to community gardens. In Seattle, the strong government involvement coupled with the public's support for community gardens is the main reason why Seattle's P-Patches have been as successful as they are today. Seattle should serve as an example for other North American cities looking to improve their own community gardens. Seattle's P-Patches serve as community centers, while acting as a sustainable food production method and achieving environmental justice through food donation. Seattle's success with community gardening encourages the city and its citizens to grow their own food, creating a sustainable food production environment that continues to spread throughout Seattle. In the future, Seattle hopes to expand the community gardens to city parks and rooftops. Increasing the city's green space would

both beautify the city and increase the number of people who would benefit from the P-Patches. As Seattle moves forward, the role of the P-Patch should continue to increase in the built environment, helping Seattle to become the greenest city in the United States.

### Conclusion

Overall, the city of Seattle has done an excellent job planning and creating a sustainable living environment for its citizens. Seattle's Comprehensive Plan, *Toward a Sustainable Seattle*, addresses most of the important sustainability issues with both goals and policies designed to improve the city's green initiatives. The strongest initiatives already in place--transportation, energy, and urban design--are among the best in North America, but the city still plans to improve even on these aspects of the built environment. The city is lacking initiatives to promote green business and jobs, and these initiatives should be better represented in the plan.

Many of Seattle's initiatives would not be difficult to emulate in other cities. Seattle's transportation initiatives are very portable; promoting human-powered and public transit is commonplace in almost every city. Seattle's food, waste, and urban design plans would be very feasible to carry over to other cities as well. However, Seattle's energy production methods would be more difficult for another city to imitate. Because of Seattle's location, the city is able to utilize natural resources like rivers for energy that other cities might not have access to.

Community gardening, the practice that sets Seattle apart from other green city leaders, flourishes in the city, and the city has done an excellent job to promote gardening as a source of food and a community building activity. Seattle's community gardens would be a successful addition for almost any city. The gardens are an excellent source of organic vegetables and increase neighborhood harmony; there are almost no downsides to this practice.

In general, Seattle's comprehensive plan is too focused on generic goals instead of specific policies and processes to improve the major sustainability issues. The plan could be improved drastically by suggesting legislature and specific practices to change or improve and how this could be done. Seattle's plan was written to outline growth through the year 2024. At this time, the city will most likely have another plan in place to define the city's growth toward a more sustainable Seattle. Drawing from other city's plans and initiatives and improving upon its own, Seattle will continue to be a leader in the green movement and will serve as a model for other North American cities working towards a sustainable America.

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## Making Transportation Greener and More Accessible in Seoul

By Min Cho, Alex Dai, Katherine Dodge, and Frank Tota

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Seoul, South Korea, has undergone rapid economic development since the 1960s, and it is currently extending such development to include the reduction of environmental impact. Located in the northwestern region of South Korea, the capital is a major global economic hub. It is the largest metropolitan area in the country, and with a population of about 10.5 million people it calls itself the “Soul of Asia.” Seoul’s industry is very strong, and the city is headquarters to many large companies, including Samsung, LG, Kia, and Hyundai (Seoul Population 2013). The city is making great strides in becoming one of the greenest metropolitan areas in the world. Due to the large and growing population, the city faces problems with air quality and high heat from the urban heat island effect; however, the city’s government has been proactive in realizing when to make changes to combat these problems, and the city has become a model for other developed cities in Asia and around the world in the field of sustainability (News Report, 2008).

A contributing factor to the city’s sustainability efforts is the country’s Green Growth Initiative plan, which funnels 2-3 percent of the country’s GDP into green initiatives. Among the city’s sustainability initiatives, the green spaces plan has been very successful by adding a large number of parks and other assorted green spaces to some of the busiest regions of the city. Likewise, there have been various sustainability initiatives in the energy sector. The green businesses and green buildings industries are still lacking compared to the other efforts the city has been making, but improvements are expected to happen over the coming years. The waste management system in Seoul is one of the best in the world because policies have been created to ingrain recycling into the local culture. A local food movement is in its early stages and has shown promise through a growing trend toward organic food and community gardening. Overall, the transportation industry is the strongest in the area of sustainability efforts. The government has become very committed to making public transportation accessible, affordable, and environmentally friendly.

This study will begin with an in-depth overview of all of the sustainability programs and efforts, including green spaces, green buildings, energy, recycling, the greening of businesses, waste management, and local food. In the third section, we examine in more detail Seoul’s efforts to develop and green its transportation sector. Finally, we will evaluate the success of its green transportation efforts and assess their applicability to other cities.

### Overview of Sustainability Efforts

The Korean national plan for green development and renewable energy has been instituted and includes the following foci: the current strong dependence of the Korean economy on fossil fuels and resource throughput, the framing of a green growth strategy as a way to avoid energy and resource dependence, the focusing on key technologies and industrial sectors as the next green ‘growth engines’ of the Korean economy, the continuity between this version of a green growth model and earlier developmental models in Korea, and the carbon emissions reduction and environmental benefits that flow from Korea’s green growth strategy (Vaillancourt 2008). Although there is an overarching sustainability plan for the nation as a whole, Seoul itself does not have a single comprehensive plan, but it does practice various sectoral policies in the transportation, green business, recycling, and energy

industries. The transportation industry has a three-part plan based on accessibility, affordability, and health and safety. The recycling industry has a similar three-part plan involving education of the community, incentive, and enforcement. The energy sector is also a strong part of Seoul's greening developments, whereas being a critical economic center of Asia, green businesses have been less apt to make changes to sacrifice profits and overall economic well-being. There is no plan within the food sector, but there is an urban farm belt in the mountainous region that surrounds Seoul, and there may be no need for a plan due to the abundance of local farming areas.

Seoul has made great strides in improving its green spaces. The government's goal has been to create a park-like environment first and to have the buildings as just a secondary attraction. Perhaps the most obvious change that has been completed is the restoration of the Cheonggyecheon River, a stream that runs through the heart of the city. In the 1950s, the stream was an eyesore due to heavy pollution, and citizens would often complain about the smell. In response, in 1958 the stream was covered up with concrete, and by the 1970s a four-lane highway had covered the streambed. This highway was an enormous contributor to Seoul's pollution, as heavy use and traffic were large issues. In 2003, authorities decided, as part of the city's rejuvenation, to uncover and restore the forgotten stream. Although the \$384 million dollar project was initially met with large opposition, the stream and adjoining park area have been very popular since the opening in 2005, with about 90,000 pedestrians visiting the region of the city every day (Revkin 2009). The removal of the three miles of highway has created a community space in the downtown of an urban area where people can go and relax in the grass and watch the stream. Various species of fish have been introduced and are flourishing, and the number of fish species has increased from 4 to 25; bird species have jumped from 6 to 36, and insect species have increased from 15 to 192. Small particle air pollution has decreased, and the city's average temperature has decreased by more than 3°C due to the reduction in the heat island effect (Revkin 2009). The city has made up for the decreased road space by expanding its public transportation complex, as discussed in more detail below. In addition to providing a recreational outlet for the city, the restored stream is used as an educational resource to learn about fish, plants, and water (Cheonggyecheon Restoration Project 2013). Although the project was originally an unpopular idea, the citizens of Seoul are now happy to have an urban green space where they can easily get away from the normal city landscape.

Besides this large project, Seoul also has other plans for adding green spaces in the otherwise urban area. Although Seoul had 1,953 parks as of 2008, two-thirds were located on the outskirts of the city, not in areas many citizens frequented. To address the problem, the government plans to expand green areas by 3.3 million square meters, mostly in neighborhoods and around schools. It will achieve the goal by taking down barrier walls and converting small abandoned plots into parks (A Clean and Attractive City: Environment of Seoul 2007). This initiative is also in addition to the 1.16 square meters in green space added by the Seoul Forest, a park in northeast Seoul which opened in June 2005. This was Seoul's attempt to mimic New York City's Central Park. The forest is open 24 hours, admission is free, and it is serviced by many public transportation modes. It is split into five different theme areas: Cultural Art Park, Ecological Forest, Nature Experiencing Studying Field, Wetlands Ecological Field, and Han River Waterside Park. This green space has over 400,000 trees and 100 different animals and includes amenities like a butterfly green hours, bike paths, and an insect botanical garden (Seoul Forest 2013).

Although all of the aforementioned programs have been widely successful, there are still some initiatives that are not working out as planned. Nodaeul-seom, an artificial island in the middle of the centrally-located Han River, was supposed to be used as a dual-purpose free family farm in the summer and sledding ground in the winter (Ladner 2013). In the summer months, families can choose plots to grow vegetables and fruits; in the winter, there is a sledding area for families to enjoy the snow. However, the project is seen mainly as a large failure; in the summer many plots are planted and abandoned, and in the winter perhaps only one or two families enjoy the sledding opportunities. The root of the problem is widely unknown; although some people cite lack of knowledge as reason for the

unpopularity, even families who register for plots fail to visit the island frequently (Sang-soo, 2013).

Overall, the majority of Seoul's green space projects have been flourishing. The city recognizes the need for nature even in an urban setting. Despite the failure of one project, Seoul has been seeing great success and citizens are enjoying the benefits.

With respect to initiatives involving the greening of buildings, there is no overarching planning effort, but there is some progress. For instance, in 2000, the Korean Green Building Council developed the Korean Green Building Certification Criteria (KGBCC), the equivalent of U.S. Green Building Council's Leadership and Energy Environmental Design (LEED). The KGBCC includes six criteria – land use and transportation, energy efficiency, water efficiency, environmental impact, indoor environment, and supplementary articles – which are then each divided into several categories. Some of the categories include “distance to public transportation,” “reduction of food waste,” and “green space area ratio.” Each category is given points and out of one hundred and twenty possible points, and a minimum of sixty-five points or above is required for green building certification (KGBCC 2000). Other than establishing criteria, the Korean government is promoting this certification by requiring all new “government, education and commercial buildings” to receive this certification (Burket 2012). In response to the program, the number of green buildings has grown. In 2004, there was only one KGBCC certified building, but the number increased to thirty-eight by 2012. In addition, total floor area of green buildings has increased from 147,000 square meters in 2004 to 2.421 million square meters in 2012. (Energy Korea 2013).

In 2002 Seoul also initiated the “green roof project” by redesigning roofs as community lounges or gardens. By 2012 the program had yielded “243,000 square meters of green space atop some 550 commercial, public-purpose and residential buildings” (Lee 2012). Green roofs are not only aesthetically pleasing but are also known to “improve air quality, conserve energy, and reduce the urban heat island effect” (Lee 2012). In October, 2012, Seoul opened its new Seoul City Hall, which was the largest building to use renewable sources in South Korea. The building is also ecofriendly because about forty-two percent of the energy comes from geothermal sources. The building also featured an Eco Plaza, which has large walls with plants. These plants help control room temperature during the summer and also improve air quality.

As with the green building sector, there is also no overall plan for green businesses in Seoul. However, the Seoul Metropolitan Government has several individual plans to promote green and/or local businesses. In 2012, Seoul planned to establish an \$8 million fund to help small or medium sized businesses with green initiatives such as creating ecofriendly tires (Kim 2012). In addition, in September, 2013, 1,600 small- and medium-sized businesses took the initiative of participating energy conservation and greenhouse gas reduction activities. The Seoul city government provided incentives for these companies by allowing them to promote themselves on the Seoul city website (Energy Korea 2013). The city government also plans to devise tax policies that favor small- and medium-sized enterprises, and it was considering lowering “inheritance taxes” of small companies that pass on the business to the next generation (Park 2013). On a national scale, the government also promotes small businesses by allowing them to participate in government-led projects such as exporting military equipment (Santosa 2013). Although Seoul has several plans to help small businesses, it still has a lot of room for improvement. The South Korean economy is export-driven, and the economy is dominated by big corporations such as Samsung, LG, Kia, and Hyundai, known as *chaebols*, which were supported by the US government directly after the Korean War. Therefore, maintaining and helping green or local businesses is a sector that needs improvement.

With respect to energy, Korea has joined international efforts to reduce greenhouse gases (GHGs) by signing the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro, Brazil, in 1993. Although some countries have favored the phase-out of nuclear energy in recent years, the Korean government continues to maintain a traditional energy policy paradigm, and it has been expanding nuclear energy continuously for the past several decades. South Korea now ranks sixth

in the world for generating capacity from nuclear power, and a total of 36 nuclear units will be in operation by 2030 (Vaillancourt 2008). There has, however, been much contention between the public and the government with respect to nuclear power. The government's longstanding attempts to build nuclear waste disposal facilities have provoked resistance from citizens, and under the pressure of environmental movements and climate conventions such as the G20 Summit, the South Korean Government has taken a step towards change in its energy policy.

Seoul relies heavily on a relatively small number of power plants for all of its energy needs, and thus it can feel major effects when there are disturbances in the weather and in the energy supply chains. The late-summer heat wave in Seoul on September 15, 2011, caused a deficiency in energy reserves so severe that the government had to institute rolling blackouts in the city. In response, the Seoul Metropolitan Government worked toward becoming more energy self-sufficient, mainly by increasing the percentage of renewable energy in the overall energy supply and by encouraging energy efficiency on a voluntary basis. The government has also launched a campaign to halt the expansion of all nuclear power plants. The campaign started in May, 2012, and it has two main goals: to reduce energy consumption equivalent to energy yields produced by a nuclear power plant by 2014, and to achieve a "self" or local consumption rate, mainly from solar and energy efficiency initiatives, of up to 20 percent by 2020 (Hong 2013). The government plans to transform Seoul into a "Solar City" by expanding PV (photovoltaic) power stations from 60 MW in 2012 to 320 MW by 2014 and by providing a solar map to its citizens. In addition, Seoul recently announced its own feed-in tariff program or FIT program supporting small PV systems with less than 50 kW PV by paying subsidies of 50 KRW (South Korean Won, equivalent to approximately 5 US cents) per 1 kW. According to the FIT program, a subsidy will be paid for 5 years from the start of commercial operation with PV system operators receiving additional assistance depending on energy yields. In addition, a mini PV system concept has been introduced that allows installations with micro inverters on apartment balconies or on rooftops. The system is available in two power classes, 160 MW and 250 MW (Hong 2013).

With regards to food, although the movement is nascent, Seoul residents have made a promising effort to develop urban agriculture and community gardening. With the globalization of trade, the country's food self-support level went from more than 80 percent in the 1970s to slightly more than 50 percent in 2009 (Lee 2012). However, with recent concerns over animal diseases from the U.S. and China and worries over radiation effects on food from neighboring Japan, South Koreans are more wary of the food they eat, and these concerns have spurred a new local food movement focused on organic food. Unfortunately, much work is left to be done. Only 1.5 percent of Seoul is currently used for agriculture, and nearby farm villages have been producing less as their populations have aged. The movement has also been hindered by "disorganization and consumers' low awareness of the issue," according to Kim Jong-duk, a professor at Kyungnam University and a member of the movement (Nam 2011).

However progress is still noticeable. The country's consumer cooperatives that sell local organic foods are growing. For example, the membership of one such cooperative, Hansalim, grew by more than 20 percent to 250,900 from 2010 to 2011 (Nam 2011). In 2012, there were 170 public and privately owned farms and 55 rooftop gardens in the city. Farms run by the city are prohibited from using chemical fertilizer and synthetic pesticides, and the city instead provides free organic fertilizer and seeds and pays half of the rent fee. In June 2012, mayor Park Won-soon declared the beginning of an urban farming era, allotting 2.4 billion won (\$2.2 million) to urban farming initiatives and projects, a substantial increase over the 200 million won (\$0.2 million) that had been allotted in 2011 (Lee and Kim 2012). The city ultimately hopes to provide each household with a 3.3 square-meter vegetable patch. According to Song Im-bong, a director at Seoul Metropolitan Government's urban farming department, "The goal is to have every household be able to enjoy the joy of farming, which will also help build an urban community and add greenery. It will also help improve the quality of life and create relevant business and jobs" (Lee and Kim 2012). The patches will primarily be installed in vacant lots and public building rooftops.

In some neighborhoods, like Sangam, guerilla gardening over the last few years spurred districts to support urban agriculture and community gardening before the city government's own initiatives (Kim 2013). A farmers' market, open every Saturday, also opened in June 2012 in Gwanghwamun Plaza, a popular public space in the heart of the city. The movement has also encouraged residents to compost their food waste to use in their gardens. Though the movement is still in its infancy, members of the movement believe it will provide revenue to farmers, provide fresher food to city residents and improve community cohesion.

With regards to waste management in Seoul, there is strict and, as a result, effective policy. Rapid industrialization in the 1960s resulted in an economic boom for South Korea but also translated to large amounts of waste and negative environmental conditions. In 1995, the country implemented a volume-based waste fee system that required every household purchase specific plastic bags for waste disposal (Tong 2011). As recycling is free, people have a financial incentive to recycle in lieu of throwing away their garbage. As a result of the system, the Ministry of Environment reported a noticeable drop in waste per person nationwide (1.33 kg per day in 1994 to 0.99 kg per day in 2006) and a significant rise in overall recycling (8,927 tons per day in 1994 to 27,900 tons per day in 2006) (Tong 2011).

In Seoul, as in every part of the country, general household waste is disposed of in specific biodegradable plastic bags. These bags, purchasable from convenience stores and grocery stores, range from 10-liter bags costing 310 won (\$0.27) to 100-liter bags costing 3,060 won (\$2.69) (Lee 2012). The garbage in these bags does not include food waste, which is disposed of separately. To throw away oversized waste like old furniture, people must buy special stickers to affix to the objects and leave them at designated centers. Paper, plastic, metal, and glass are recyclable and sorted out before waste collectors take them to recycling centers. The government has ordered South Korean-made recyclable products be clearly labeled as such to aid the process. To reduce its environmental impact further, the national government has also banned certain packaging materials that are hard to recycle, such as polyvinyl chloride lamination (Ng 2013).

Public and private enterprises employ the waste collectors in Seoul, who regularly pick up garbage and recyclables in designated locations in the city. Fines are in place for improper waste disposal, and enforcement includes security cameras (Lee 2012). Other enforcement practices include a reward system for reporting unlawful disposal and a refund system if residents return purchased bags to stores (Ng 2013). In some apartment blocks, waste companies pay residents to leave their recyclables in areas where trucks come by to collect them. Many communities use this money used toward helping charities and planting trees (BBC News 2008). As a result, the city has not only been able to reduce its overall waste, but also use it as a valuable resource.

In 2010, Seoul recycled 66 percent of its residential waste (the country as a whole is recycling 100 percent of all recyclable items), disposed 14 percent of it into landfills and incinerated 20 percent of it (Lee 2012). Many of the recycled goods, including plastics and metals, are processed and ultimately sold to manufacturers for future use. In Seoul, four incinerators recover heat and energy while having minimal negative impacts on the environment because they are equipped with technologies including wet scrubbers. Producers can also make bricks out of residue from the incineration (Ministry of the Environment 2007). Nationwide, waste-to-energy incineration facilities like these are expanding while landfill sites are closing.

The waste charge system implemented in 1993 requires manufacturers and importers to pay a portion of the cost of disposing difficult-to-recycle and hazardous products (Ng 2013). This incentivizes the firms to use more eco-friendly materials while aiding the overall waste management system. Another important initiative is South Korea's Extended Producer Responsibility (EPR) system, which holds manufacturers accountable for the complete lifecycles of their products (United Nations Environment Programme). The EPR system, implemented in 2003, requires that producers pay for the recycling of their products and meet certain recycling targets set by the Ministry of Environment. Among companies

in Korea, Sony is a standout in terms of following this system. The Japanese company's "Road to Zero" goal is to have a zero environmental footprint by 2050 and to increase waste recycling to more than 99 percent. According to Hong Ji-eun, a senior Sony Korea spokeswoman, "At Sony headquarters and global branches, we will take back any of our products and recycle them in the most responsible manner" (Kim 2012).

In South Korea, where several small dishes are the norm for meals, there are also new measures to reduce the significant amount of food waste it produces. As of 2013, residents separate food waste from regular household waste for other purposes including fertilizer and animal feed. On January 1, 2013, the government banned dumping food waste water into the sea, which increased the costs of waste treatment and caused disputes between the government and private firms without adequate facilities. In June, a new weight-based system was unveiled that required residents dispose of their food waste in any of three ways: in designated wastebaskets, in specific purchased plastic bags or in wastebaskets with radio frequency identification (RFID) tags that connect the amount of waste to residents' names and residencies (Nam et al. 2013). Aside from composting the waste, several waste management centers have used it as fuel. Each day, the Dongdaemun Environmental Resources Center in Seoul converts 98 tons of food waste into biogas, which burns to create electricity. The food waste creates an economic impact worth 2.7 billion won (\$2.5 million), generating 600,000 kilowatts of electricity annually while reducing 24,402 tons of carbon dioxide emissions (Tong 2011). Still, issues with waste disposal and treatment still exist. The RFID tags, while efficient and effective in reducing food waste per person, are also costly and sometimes prone to malfunction. At the same time, in some districts, each town has specific waste disposal days each week. Due to inadequate publicity, several residents are unaware of which day to dispose of their waste. As a result, they leave bags on the street at inappropriate times, resulting in the smelly bags taking up space for extended periods of time (Nam et al. 2013).

Despite setbacks in the systems, with Seoul leading the way, the nation has been successful. From 2003 to 2008, 6.067 million tons of waste were recycled, an economic benefit valued at 1.69 trillion won (\$1.6 billion) (United Nations Environment Program 2013). Waste management continues to be an important part of South Korea's many green initiatives. The national government allocated 930 billion won to related initiatives from 2009 to 2012, which has also created an estimated 16,196 new jobs (Ng 2013).

In summary, Seoul has made significant progress with respect to green spaces, green buildings, and solid waste and recycling. Its efforts for the greening of businesses and for the development of sustainable local food systems are more limited. Furthermore, on 15 August 2008, at a national address on the 60th anniversary of the Republic of Korea, President Lee Myung-Bak announced a "low-carbon, green growth" energy strategy as a new vision to guide the nation's long-term development. Of the many sustainability initiatives in the city, we suggest that the transportation sector is the leading area. Its system is both diverse and effective, meaning nearly everybody in the Seoul metro area has access to at least one aspect of it.

#### The Transition of Transportation in Seoul

Seoul's commitment to revamping its transportation sector has produced positive effects on emissions, and the changes have also shown great ingenuity. The city government has developed a three-part initiative in this field: accessibility, affordability, and health and safety. Transportation in Seoul is based on many organizational forms: state-controlled, publicly owned models; privately owned, for-profit organizations; and not for profit organizations. After the turn of the twenty-first century, Seoul has managed to integrate these different organizational models, even between different modes of transportation, to increase accessibility (Marshall 2012). Affordability has been equally important, and no single mode of transportation costing more than the equivalent of \$5.00. The final aspect, health and

safety, has been achieved through the restructuring of particular city areas and shifting to cleaner transportation technology. The Seoul initiative is summed up by answering the remark by Kim Gyeong Chul, former head of the Seoul Metropolitan government, when he said, “[A]re the organizations going to serve the people, or the people the organizations” (Marshall 2012). In the transportation industry, clearly the answer is that the organizations are serving the people, a goal that includes environmental quality issues as well. Within the sectoral plan, the overall goals put forth by Seoul’s current mayor, Oh Se-hoon, are to reduce carbon emissions by 40 percent, increase renewable energy by 20 percent, and reduce energy use by 20 percent before 2030 (Sheldrick 2010).

With respect to the first of the three goals, accessibility has been increased over the years by generating extensive, varying public transportation systems and by working to integrate these systems. Seoul has the largest metropolitan transit system in the world in terms of covering the most distance, a color-coded bus system for different routes to make planning easier for its citizens, above-ground trains, 17 water taxi stations for taxiing along the Hangang river, and a plethora of bikes for common use (EMBARQ 2013). The integration of these five major systems makes it easier for residents to use only public transportation to reach their destinations in the city. Seoul is also slowly working to integrate the modes of transport by generating reusable passes that work for both the Metro and bus systems (EMBARQ 2013). Additionally, as satellite towns continue to develop, the mayor has decided to increase the number of rail lines, including above-ground trains and the Metro system, so that citizens have easier access to the city and rely less on single occupancy modes of transport, which have been known to have a large carbon footprint (Sheldrick 2010).

Seoul’s success in transportation thus far cannot be attributed to accessibility alone. Oh Se-hoon and others understood that even if the modes of transport become efficient and easy to use, they will not get used if they are too expensive. The solution to this issue was clear – make public transportation affordable – which the city has accomplished. The bus and metro system only cost the equivalent of U.S. \$1.00 to use, and the most expensive method of transportation is the water taxi, but even it only costs the equivalent of U.S. \$4.50 (EMBARQ 2013). The crown jewel of affordability of public transportation is the bicycling system; it costs only the equivalent of U.S. \$3.00 for use during an entire week and only \$5.00 for use during an entire month (EMBARQ 2013). In fact, these means of affordability also attribute to accessibility in a way, by making citizens want to access public transportation in the first place.

The last portion of the three-part transportation plan is health and safety. Seoul is beginning to shift from a car-centric downtown area and overall environment to one promoting public transportation, which is much greener in terms of emissions. A big portion of improving public health has included air quality, and so revamping public transportation fleet, especially buses and taxis, was an important health initiative. In 2008, the city’s taxi fleet was converted to liquefied petroleum gas instead of petrol, which is a much cleaner form of energy to use in public transportation (Choe 2010). In 2010, buses were switched from diesel to compressed natural gas, and by 2020 the city plans to replace all 9,000 buses and 72,000 taxis with electric or hybrid vehicles (Choe 2010). However, this is only one part of the solution; incentives to citizens and companies to get on board with this movement are also being made. Two examples are subsidies to transportation companies to encourage them to switch to green vehicles and discounts for from parking fees and congestion charges for green vehicles (Choe 2010).

Finally, the city is also modifying infrastructure to accommodate bicycling. Seoul is expanding the number of bike lanes throughout the city to make this form of public transportation much safer, taking away car and other lanes to create bike lanes. The initiative includes 17 main cycle paths totaling 200 kilometers and the goal, according to South Korean official Oh Gwang-hyun, is to have 30 percent of the total population in South Korea, which certainly include Seoul, to use bicycles as their mode of public transportation (Martin 2008).

## Conclusion

Even without an overall sustainability plan, Seoul has proven more than capable of achieving results across multiple sectors. Aside from transportation, one of the biggest improvements Seoul has made, which has also spurred further changes, is the uncovering of the Cheonggyecheon River, and the results have remarkably transformed the downtown metropolitan area. Following this success were many other successful green space programs focusing on parks, forests, wetlands, and many other regions. There have also been substantial initiatives in the energy and waste sectors. The Korean government is taking strides in improving its energy systems and in making new and improved policies in the field of green energy. Efficient waste management is a South Korean goal in general, and with the nation's well-adopted volume-based waste fee system, waste charge system and extended producer responsibility system among others, waste management is a crown jewel of Seoul's sustainability efforts.

However, some areas of urban sustainability initiatives are less developed in Seoul. Although the city is increasingly improving its efforts on greening buildings by establishing KGBC standards and initiating green roof projects, the green business sector still lacks successful policies in helping small and medium sized businesses. The focus on local food, like small and medium-sized businesses, has also been minimal. In this case, however, interest in local food is slowly growing, and with Seoul's increasing funding towards the movement, community gardens and urban farms will likely become more prevalent later on across the city.

As the city's best practice, transportation in Seoul serves as a model for other cities. The affordability of the different transport systems which Seoul has managed to provide may be limited by political and financial barriers in some cities, but the accessibility and health and safety aspects of the transportation system reforms may be relatively portable to other cities. For example, many other cities are quite capable, like Seoul, of connecting outlying regions with the city center. This is a result of the largest metro system in the world and a conscious effort to create these transportation connections between the communities of Seoul. Many other cities have already begun shifting public transportation toward hybrid technology or compressed natural gas. Perhaps most unique to Seoul, but equally effective and worth noting, is the explicit goal of having the transportation sector serve the people rather than the profits of business enterprises. In this sense, the most desirable aspect of Seoul's sustainability initiatives is not something that can be bought; it must be cultivated by local industries and organizations dedicated to its people and the preservation of the environment.

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## Shenzhen: From a Fishing Village to a Greening Metropolis

By Sicheng Ma

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Shenzhen is a major city in the south of Southern China's Guangdong Province, situated immediately north of Hong Kong. Located in the subtropical part of China, Shenzhen has a warm and monsoon-influenced climate. Winters are mild and relatively dry, and summers are humid and hot. Shenzhen used to be a fishing village. Taking advantage of being a coastal city, the central government has chosen Shenzhen to be one of the first successful Special Economic Zones and these regions have economic and other laws that are more free-market-oriented than the country's typical or national laws. With approximately 13 million permanent residents, Shenzhen is going through a fast developing period. Shenzhen's GDP reached around 1 trillion RMB (159 billion USD) in 2011 (Shenzhen News, 2012). Although the city is developing rapidly, pollution problems have dragged the development of the city. Since the development of Shenzhen is restricted by the cities around it, green development to make full use of the land is especially important. Thus, the Shenzhen government has realized the importance of developing sustainable practices and has carried out various initiatives for different sectors.

In different sectors, the level of initiatives that been carried out varies. Although the city's initiatives for food and green buildings are substantial, its most outstanding area of sustainability is in the transportation sector. However, minor progress has been made in other areas, including the small business sector, water infrastructure and recycling and reuse.

In this paper, I will first provide a broad picture and discuss green initiatives in six fields in general, and then I will describe the best practice in the city. I will not only offer the details and analysis of the best practice, but also provide the weakness and possible future improvements. At the end, there will be a summary that reviews the whole paper and evaluates the best practice and other possible initiatives in the future.

### Survey of the Sustainability Initiatives

Although Shenzhen has a planning process and plans, the emphasis on sustainability initiatives may differ from those in Western cities. Shenzhen has invested significant resources in the greening of buildings and in constructing a large network of public transportation, but many of the other areas of sustainability initiatives found in Western cities are not very prominent. Specifically, the city has few initiatives for urban parks, food systems, small business development, and recycling and reuse. This section will discuss initiatives in all six areas (transportation, small business and finance, recycling and reuse sector, buildings and energy, food, and space and infrastructure).

Shenzhen, spurred by its eleventh five-year plan from 2006 to 2010, has successfully constructed a relatively complete and well-functioning public transportation system. By the end of 2015, Shenzhen will be expected to form the green transportation network and cut carbon emissions by 15% compared to 2010 (Bloomberg, 2012). At present, 60% of the transportation is public transportation, and routines have extensively spread out in Shenzhen. During the construction process, the government especially puts emphasis on the building of green transportation, such as replacing buses that use diesel fuels with green buses powered by hybrid-electric and compressed natural gas (CNG). Of the total bus fleet of 12,000 buses, more than 2600 hybrid electric buses are currently in use, and more than 4,000 hybrid electric buses and electric battery buses coupled with easily accessible charging stations will be

put in use by the end of 2012 (City Transportation Communication, 2011). Compared to 7.7 percent of transportation contribution in the past, the transportation contribution of Shenzhen Metro reached 20% after the second-term routes opened to traffic (Securities Times, 2011). The new routines have helped buffer the road pressure bought by private cars. The Shenzhen government is also in the initial phase of a bicycle program. It has placed 350 public bicycles for the public for 24-hour rental service and is accelerating the construction of 500 km bike lanes to give full play to the bicycle travel (Nanfang Daily, 2010).

The BYD Company, a major car-manufacture in Shenzhen, has also put their newly-designed electric cars into the market, including 300 hybrid electric taxis (Sina, 2011). The Shenzhen government also has positively explored initiatives such as carrying out “Car free day,” designed a 3D express coach powered by a combination of electricity and solar energy, and applied an even-odd license plate method, which limits driving to certain days of the week.

Shenzhen also focuses on the construction of green buildings and solar energy. Shenzhen targets a 100% achievement rate of green buildings for government-funded new buildings and 50% for public buildings (China Construction News, 2012). Authorized to evaluate and grant one-star and two-star green building label (out of three stars), eighty green demonstration projects have been set up. Among those buildings, Shenzhen Stock Exchange building is designed to be one of the first 3-star green rated buildings in China. Shenzhen Vanke Center is well-known to be the first building in Shenzhen aiming for LEED Platinum. As a forerunner in developing the eco-city concept, the sustainable buildings in Shenzhen integrate many green elements into the buildings such as rooftop space, rainwater collectors, and micro-climate systems.

In addition to making great efforts on the construction of green buildings, Shenzhen also successfully promotes solar water heating in residential areas. Since 2006, buildings having less than 12 floors in Shenzhen are mandated by the government to have heating facilities installed in all households and buildings with 12 floors or more must have their rooftops covered with solar panels (Shenzhen News, 2011). The city government is working towards the goal that by 2012 more than half of the new buildings in the city will install solar water heating systems, and 20% of the new buildings will use solar power to generate electricity. Shenzhen is striving to become a national leader in the construction of green buildings and utilization of solar power in the construction.

Besides paying attention to transportation and green buildings, Shenzhen government is working on space and infrastructure. Since Shenzhen consists of five sections divided by the huge green belts, 75 new parks will be built according to local environmental conditions over the next five years based on different geographical characteristics of these five sections (Shenzhen Walking, 2011). Second, Shenzhen urban planning bureaus are faced with the need for redevelopment plans that incorporate higher-quality information on the social and economic assets of existing communities. As a result, the city planning leadership is reconsidering the regime of city development; a current initiative carried out by the Shenzhen Urban Planning Bureau, the “Urban Design Action Plan,” is a response to the needs. The Planning Bureau is creating a database of potential urban design interventions by engaging other government bureaus, real estate developers, urban design professionals, and the general public and attempts to explore advanced technological method to help resolve urban developmental issues. (Urban Research Bureau, 2012).

Considering the greening of food in Shenzhen, the Chinese government supports urban self-sufficiency in food production, and Shenzhen also has its own well-functioning agriculture system. Many farms are located within 10 km of the city center involving in a two-tier structure where the first tier produces perishable items and second produces hardier vegetables such as potatoes and onions, thus allowing fresh vegetables to be sold in city markets just a few short hours after picking. Since August 2011, the first farmers' market in Shenzhen has begun to sell dozens of safe organic food directly to the community residents. This activity is a response to the trend that more people look forward to eat the

green original ecological food, and government officials expect to explore a new model for green food selling. In addition to city farms and newly-emerged farmers market, Shenzhen has developed its own eco-friendly mulberry-dyke fish-pond system (Shenzhen Baoli Recycling Company, 2012). The Shenzhen government invested 8.82 billion yuan in 39 agricultural projects and plans to expand the largest wholesale market in Shenzhen, Buji Farm Produce Wholesale Market (World News, 2011).

Concerning the small business sector, Shenzhen government has not emphasized green and local business development. In recent years, more than 30% of the small enterprises face the dilemma of closing down. Because China's main enterprises are controlled and operated directly by the central government, the small business sectors run by individuals have a lack of funds and support. The government, however, has noticed this situation and has some corresponding policies such as expand financing channel and increase bank lending for small and micro-sized enterprises to support their development (Xinhua News Agency, 2011).

Referring to recycling and reuse sectors, Shenzhen is one of the few cities that have sanitary landfill plants. More than 90% of the waste, however, has been treated and disposed by landfill and incineration, and the space for landfill treatment will run out in five years, Shenzhen government has realized that a greener treatment of waste is waiting for attention. Recently, Shenzhen Solid Waste Exchange Center has been set up to explore efficient and green ways to transform industrial waste to raw material of products and Shenzhen Special Economic Zone Environmental Protection Regulation was enforced on January 1, 2010. After persistent efforts, Shenzhen has become the first model city for reuse of construction waste in China (Shenzhen Numerical Control and Information, 2012).

In general, Shenzhen focuses on the greening of transit and buildings. It also has initiatives for food and infrastructure and space. Recycle and reuse sectors and small business sector and finance, however, are awaiting more attention from the government.

#### Best Practice: The Greening of the City's Buses

Although the efforts for transportation and buildings in Shenzhen are especially outstanding, I will focus on transportation as the area of the city's strongest sustainability initiatives. The city has an extensive rail transportation network, which is linked to the bus system. This section will focus on the city's efforts to green and develop its bus system. The details for the stepwise transition from diesel buses to the clean buses will be discussed closely.

Shenzhen has an extensive bus network in which 12,000 public buses are currently in use (China Technology, 2011). Most of the buses are of a traditional diesel design without particulate traps. As a result, residents in the city are exposed to the carcinogens associated with diesel exhaust. To reduce the air pollution and greenhouse gases associated with conventional diesel buses, the federal government has supported the city's initiatives with subsidies.

The initiatives first occurred in the area of hybrid-electric buses and the acts were quite successful in reducing the carbon emissions. The first batch of hybrid-electric buses was introduced to Shenzhen in May 2005. Since the first purchase of seven hybrid-electric buses in 2005, a total number of 25 hybrid-electric buses have been added (Nanfang Daily, 2009). Although the number is small in comparison with the hybrid-electric fleets of some American cities, it is the largest line of hybrid buses in China. Furthermore, in 2009 the central government chose Shenzhen as the one of the first ten pilot cities for a green energy transportation promotion project. This project aimed at subsidizing more than one thousand green vehicles, especially city buses, and it provided a subsidy of \$7,000 for hybrid-electric buses. A total of 36.4 Km with 23 stations is open to public with the service provided for 100,000 residents (Nanfang Daily, 2009). The hybrid electric vehicle saves more than 15% fuel compared to diesel fuel buses. The reduced carbon emissions have satisfied the Europe III emission standard, which is most widely used standard in European countries. The total hybrid electric buses are estimated to save cut 84000 tons of carbon dioxide emissions (China Technology, 2011).

In addition to hybrid-electric buses, the city has also pioneered electric buses, which the federal government also supported with an \$8,000 subsidy per bus (Renmin News, 2012). With zero carbon emission, the BYD K9 is the first kind of bus in China using a battery, which can half-charged within half an hour. The cost of electricity is approximately one-third that of diesel fuel. The design also considers the access of children and the elderly, so the inner aisle is built completely flat for passengers to pass freely through. The city government also constructed four charging stations and 180 charging piles at the same time. The government also passed related acts to further the use of electric buses. The Shenzhen Development and Reform Commission announced that Shenzhen is formulating measures to impose fees on emissions from gasoline cars while rewarding alternative energy vehicle drivers based on distance traveled. Other incentive policies include allowing pure electric drivers to use the public bus lane during rush hour, insurance privileges, and free annual maintenance checks. (Business Wire, 2012)

In this interval, the government also explored the natural gas buses. In 2009, the first purchase of 15 natural gas buses occurred, and later 300 buses were all put into use (Nanfang Daily, 2012). With one tank of natural gas, buses are able to run for two days, and the emission of carbon monoxide also decreased more than 80 percent. In order to ensure the service of natural gas buses, a large-scale gas refilling station has been set up to provide gases for all natural gas buses and a second station has been under construction to help promote the natural gas buses.

In the future, the Shenzhen government plans to build 40 new charging stations in 2012. It is expected that six thousand green buses, half of the public buses, will be put in use in 2015 (Global Sources, 2012). The remaining diesel buses will be eliminated gradually and finally be completely replaced by the clean buses.

Although the green energy buses have many advantages, there are also some weaknesses. First, although the electric buses are longer than common buses, the available space for passengers is limited. Only 18 seats are offered in the bus, compared to other buses with almost 60 seats. It is also inconvenient for bus attendants to sell tickets and manage the compartments. Second, the buses are divided into three sections, where fresh air is not sufficient. Because the energy for the bus to run is limited even after the buses are fully charged, the air conditioners in the buses are not turned on. Third, the equipped charging stations are now only charging at night, so the utilization is relatively low. If the charging stations are used in the daytime, it will burden the electricity supply system and costs would rise. Fourth, the charging piles cannot really satisfy the charge needs of the electric buses and the buses need to return to the electric charging stations which will take up a lot of time. Fifth, after charging, the electric buses can run for only six hours and compared to a normal runtime of 12 hours.

The future of the electric buses, in my opinion, should focus on quality rather than quantity in order to achieve sustainability, and the corresponding complementary equipment should be built and perfected as soon as possible to ensure the service of electric buses. The government may also initiate other greening efforts not only focusing on buses, but also on metros, taxis and other transportation.

In summary, the Shenzhen government has advanced the greening of its public transportation by promoting hybrid electric buses, natural gas buses, and pure electric buses. To advance the city's greening efforts, the government may modify the structure and improve the efficiency of green buses.

## Conclusion

In conclusion, Shenzhen exhibits substantial progress in some green initiatives, but it shows little attention in other areas. For example, Shenzhen has integrated green elements into many buildings, including solar energy for hot water heating. For food, Shenzhen has set up farmers' markets and made other efforts to connect regional farms with urban consumers. Because the small business sector is facing a tough financial situation, the government has urged the bank to grant more loans to these small enterprises to help their growth, but the city government does not yet offer any green business initiatives and programs. Concerning the recycling and reuse sectors, Shenzhen is one of the few cities in

China that has sanitary landfill plants, and the city government has set up corresponding institutes to make efforts on transferring waste to recycled products, but to date the city does not offer curb-side recycling. The city has also aided the construction of green parks as to increase the green coverage in the city.

Of the many urban greening initiatives, the transportation sector is the strongest. The city has an extensive subway system, and it has built a public bicycle rental system. With respect to buses, the city has developed a plan to replace its older diesel buses with green buses. By experimenting with hybrid-electric buses, natural gas buses, and pure electric buses, the city has developed a model of a diverse green transportation system that does not rely on any single form. The gradual development can help the greening efforts be more complete and comprehensive.

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## Transportation and Sustainability in Singapore

By Lizie Bogan II, Leah Chisholm, Bea Cochran, Hillary Good, and Jeremy Price

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Singapore, a small island nation in Southeast Asia, is home to 5.3 million people and consists of 63 islands. The city-state has a tropical rainforest climate with no distinct seasons and consistent humidity throughout the year. It is an extremely small island-country, with a size of only 254 square miles. Given the high population density of over 7,257 residents per square kilometers, it is not surprising that only five percent of the country is set aside for nature reserves (Singapore Department of Statistics, 2012). Likewise, it is also not surprising that the country has become increasingly interested in environmental issues. Because Singapore is a wealthy, high-tech nation, it has the resources to engage in substantial sustainability initiatives. Furthermore, the country's strict, authoritarian government together with its small size has the political capacity to overcome any opposition to environmental reforms.

Using this authoritarian leadership, Singapore's government engages in practices geared towards increasing sustainability throughout the country. Through various initiatives and plans, the nation focuses on increasing environmental efficiency through diverse sustainability initiatives, such as recycling, green spaces, sustainable food practices, green buildings, and transportation. Although Singapore has made significant achievements in many areas of urban sustainability policy, its most well developed area is the implementation of transportation regulation. Through the strict regulation for car ownership and the high quality public transit, Singapore presents a mode of one of the most environmentally advanced transportation systems in the world.

This case study will begin with an analysis of the city's sustainable practices involving buildings, green spaces, waste management, businesses, food production, and transportation. We will then analyze in detail the best green practice of the city: its exemplary transportation system. The report will conclude with an evaluation of Singapore's overall plan for environmentalism and brief discussion of the potential portability of these methods to improve the global pursuit of sustainability.

### Overview of Sustainability Policies and Programs

The country of Singapore has a complete sustainability plan, the Singapore Green Plan, which provides goals for green business development, waste, green spaces, water and air quality, public health, and educational programs. Singapore's government allows for the Green Plan to be effective in improving the sustainability and greening of the country. The Green Plan is a national holistic framework for the greening of stated areas over the next few decades. In addition, we have identified initiatives in green buildings and food, through the Green Mark system and the creation of more farms, respectively. Our discussion will focus on green businesses, green buildings, food, waste, and transportation.

The businesses of Singapore are showing great interest and initiative in going green, and companies like Green Future Solutions are leading the charge. With environmentalism at the forefront of its vision, this firm provides consulting services for small and medium-sized enterprises (SMEs) so that they can "reduce costs, increase revenue, and become... more sustainable business[es]" (Tay, 2012). Company representatives also speak regularly at events to advocate for green policies, and in 2008 the

business launched the *Green Business Times*, an online publication encouraging other businesses to go green and giving them the information and tools to do so. Thus far, many growing companies such as Green Cleaners and The Body Shop are successfully utilizing green practices. Furthermore, in October of 2011, the Singapore Business Federation (SBF) signed three agreements to provide businesses and industries with superior opportunities for financing, networking, and technological innovation for green and clean-tech initiatives. The hope is to facilitate green growth via market access in Europe and the Asia Pacific, and indeed, Singapore's influence is spreading. In fact, Southeast Asian countries such as Malaysia, Indonesia, and Vietnam will soon benefit from the Singapore Green Labeling Scheme (SGLS), a 20-year-old program used to indicate to consumers that certified products meet minimum environmental standards. Not only does this promote global environmental awareness, but it also offers benefits for environmentally-conscious businesses. For example, Liew Kah Mun, the chief executive of the aluminum product manufacturing company Archicom, has stated, "Getting our products certified under the Singapore Green Labeling Scheme was a decision that opened up many new markets and opportunities for us" (Marusiak, 2012). Clearly, Singapore's businesses are doing their part to promote environmental sustainability (Chua, 2012; Marusiak, 2011; Marusiak, 2012; Prasad, Tay, 2012; Tay, 2012.)

Singapore is one of Asia's environmentally-friendly building leaders, thanks to the both public and private sectors taking part in the greening of Singapore's buildings. The Singaporean government has increasingly pressured businesses and firms to build sustainably through incentives and regulatory laws. Furthermore, the government takes the initiative to fund academic research and the development of green technologies to encourage green development. For example, in 2005 the government launched the Green Mark system, which mandates that all developments meet Green Mark standards; the Green Mark system extends to both the private and public sectors (SGBC, n.d.). Also, legislators are becoming increasingly stringent on green building projects. The Singapore Sustainable Blueprint wants to increase building efficiency by 35 percent by 2030. By 2030, 80 percent of Singapore buildings must be more resource-efficient and must attain a Green Mark by 2030 (Marusiak, 2011). Many of the new developments use, as required by law, more green features. For example, architectural designs that optimize sunlight, rooftop gardens and green materials are used to slow down urban decay and increase environmental-friendly practices. Singapore's skyline is now spotted with rooftop gardens that maximize heating and cooling of the buildings (Sustainable Singapore, 2012). Through these practices, the government aims to make Singapore have the highest standard of green living in Asia. Singapore's unique combination of government-driven sustainability efforts and a renewed gusto to the cause allows for the realization of the greening of this Asian metropolis.

Another important area in which Singapore focuses its efforts is food production. Singapore has yet to face the consequences of the world's diminishing food supply. As the world's economy has slowly declined, Singapore has kept its stability by farming, fishing, and having foods imported (Singapore Pumps 2012). Although Singapore has over two hundred farms and its booming fishing industry, the country imports about ninety percent of its food (Singapore Pumps 2012). Plans have already been put into place to meet the future needs of Singapore as the ability to find food decreases over time. In order to maintain a sufficient amount of food for its citizens and still have enough goods to trade, Singapore will have to increase the number of farms (Xinhua, 2012). In addition, as Southeast Asia experiences more droughts and unstable farming conditions, the food safety authority has launched establishments in other countries to counteract the problem through the importation of meats to Singapore. Singapore has plans for creating an engineering program to promote the growth of fish, to grow and develop adaptable plants, to maximize the number of underground and vertical farms, and to revive unusable farmlands through technology. Overall Singapore has a secure food supply, but as global climate change and population increases affect the imported food supply, the country will have to make certain changes

in order to sustain its citizens in a nutritious but affordable manner (Meeting Future Food Demands for Singapore, n.d.).

Similarly, Singapore has taken many efforts to increase green space in the city for citizens and buildings. Due to its location and the rise in businesses and more urbanization, Singapore has lost most of its green spaces. “By developing their industries and housing their people, they degrade the natural environment. After achieving the prosperity they want, they can then look after the remaining green spaces” (Marusiak, 2012). In order to preserve a little bit of greenery, they have created “Gardens by the Bay.” The gardens take up two hundred and fifty acres and generate electricity, work as air vents, and collect rainwater. Of the eighteen fifty-meter “supertrees” in the garden, eleven gather sunlight and have batteries and converters that convert the energy received into solar power. Inside the Gardens there also are lakes, real green spaces, bridges, and plants. With biomes that contain over 220,000 plants from every continent, this garden is the hub of Singapore’s green space. It will give the city a more park-like feel and reduce the sense of urbanization and business. The goal of this project was to “be a contrast to the country’s extremely dense urban environment, forming part of the government’s overall strategy to transform Singapore into a ‘city in a garden’” (Solar-powered ‘supertrees’. 2012). The Singapore government’s heavy hand in greening the city has greatly benefitted the environment and its dwellers.

Further government efforts were shown in 2006, when the Ministry of Environment and Water Resources created and adopted a policy towards increasing sustainability and waste management throughout the country. This policy, entitled Singapore Green Plan 2012 (SGP 2012) states a list of targets and strategies to combat the country’s issues of pollution, resource conservation, and energy efficiency. The Green Plan takes an action-orientated approach, with a main goal of reducing recycling by 60% by the end of 2012 (Tay, 2012). Just a few years ago, Singapore was heading down the path of landfills and incineration plants as a solution to waste, but since the Green Plan initiative, Singapore has increased its recycling rate to 59%. As a result of the SGP 2012, Singapore has improved not only its waste management but also its air quality and water distribution; however, some of the most commendable improvements result from their recycling efforts. At the start of the Green Plan, Singapore’s goals for recycling centered on reducing the amount of waste sent to landfills and incineration plants (MEWR, 2006). The government aimed to habituate the act of recycling by increasing publicity and incentives for recycling. By funding recycling programs and raising awareness of recycling efforts, Singapore has managed to raise the participation from its citizens. Participation has also increased from the addition of recycling bins in public places and by the relocation of bins to convenient and accessible centralized areas. Singapore’s recycling programs have also promoted the exploration of new technologies to reduce waste and improve the quality of recycled goods, which in turn promotes the use of recycled goods. The Ministry of the Environment also works in conjunction with schools to promote recycling through education and incentives such as Green Week and weekly recycling competitions (Cooper, 2012). Although many of these efforts emphasize and focus on consumer responsibility and the domestic management of waste, Singapore’s government has guidelines regarding regulation of industry-created waste as well (MEWR, 2006). Singapore’s Green Plan strategy for waste management and recycling has been effective in increasing the sustainability of the country, and it will continue to be a model.

Lastly, Singapore’s transportation system clearly depicts the efforts that have been put into making the city more sustainable. The city has one of the best public transportation systems in the world. A combination of public and private transportation companies, government restriction on personal vehicles, and a well-designed city make green transport extraordinarily convenient in Singapore. The city-state’s main method of green transportation is mass rapid transit, controlled by a duopoly of SBS Transit Limited and SMRT Corporation (Industry and Regulatory Framework 2012.). Both of these companies also compete in other types of transportation, such as taxis and busses. The MRT

has a number of lines that run the width and length of the island, and more expansions are in the process of being built (Singapore Department of Statistics 2012).

For those who do not wish to ride the buses, MRT system, or simply have destinations outside the public lines, there are also more than 24,000 taxis (Wikipedia 2012) in Singapore that can be hired for a low cost. The Singaporean government has enacted a number of cost-based methods to reduce personal vehicle usage in the city to take public transportation systems a more lucrative option. In conjunction with buying a vehicle (which has high import costs), one must get a 10-year license called a Certificate of Entitlement. These certificates can cost up to and beyond S\$70,000 for small cars (Ng 2012). The certificates only last for 10 years, and the cars used with the certificates are generally not reused (as they would need to last for the next ten years or have to buy a new car + COE). There are also Electric Road Pricing [ERP], which is designed to charge riders for being on the roads at peak hours and reduce congestion in key areas.

Although the world's environmental and population pressures are growing, there is still hope that societies everywhere recognize the issue and start taking steps toward sustainability, and Singapore serves as an excellent example of proactive problem-solving, as seen especially in its transportation policies. With the ever-expanding mass rapid transit system and restrictions on personal vehicle ownership, Singapore makes transportation efficient and easy while minimizing negative environmental impact caused by harmful emissions. However, not all of the city-state's policies are golden, as shown by the food production efforts. Despite various measures to take advantage of local fishing and farming, Singapore still imports roughly ninety percent of its food, a figure that illuminates Singapore's alarming inability to produce sustenance for its own people. Clearly, the city-state has some work to do and improvements to make. But in the end, its positive example will serve as inspiration for other countries and societies to propel the entire world toward a brighter, greener, and cleaner future.

### The Transportation System

To encourage the use of public transportation, Singapore's strict government implemented many laws and regulations on car ownership and use. The government wants to keep the car population at minimum levels in order to keep road construction at sustainable levels (Ministry of Transportation, 2012). Singapore's unique Vehicle Quota System (VQS), established in 1990, successfully controls automobile population growth. The VQS establishes a maximum number of vehicles that can be registered annually in order to create a sustainable long-term use of vehicles and roads. To be eligible to enter the VQS, individuals must first bid for a Certificate of Entitlement (COE) that entitles a person to own a car for 10 years. Bidding for a COE is open to the public, and the highest bidder earns a COE. This bidding system ensures the government that an individual will be able to finance a car for the 10 years. The VQS system is highly effective in maintaining a sustainable vehicle growth: the growth rate has decreased from 3 percent to 0.5 percent in the past three years (Ministry of Transportation, 2012). Another aspect of controlling sustainability on Singapore's roads is its electronic road pricing system. The government uses this system to manage both traffic congestion as well as a barrier to discourage private transportation. In addition to road barriers, the government is focusing on creating more space in the city for pedestrians, bicyclists, and public transport, leaving less space for privately owned vehicles to drive in the city (Barter, 2005).

Due to the lack of personal vehicles, Singapore's government emphasizes the funding for and the quality of their public transportation systems. One of Singapore's most unique and expansive public transportation systems is its Mass Rapid Transit (MRT) System and supporting light-rail system. The system opened in 1987, and since then it has expanded both the number of lines and stops. Over \$20 billion has been invested into the rail system since its inception, with billions more in renovations and expansions already in progress. The system currently has four active lines: North-South, East-West, North-East, and Circle. The upcoming Downtown line is under construction and will open in 2013, and

the Thomson line is expected to be opened by 2019.

Because the system is fast, convenient, cheap, and relatively ubiquitous, it has a high ridership—out of a total population of 5,312,400 people, approximately 2.406 million ride the rail system daily. Thus, the rail system obviates the need for cars for a large number of Singaporeans, thereby reducing the high amount of carbon emissions and the congestion from the cars. Fares for these riders are determined by the distance the commuters travel as well as which rail they travel. However, the rails tend to be cost efficient for citizens, with the more populous rails being the cheaper routes. Costs usually do not exceed \$2.30 for 30 km. In addition to cost convenience, the rails are also time expedient. Stops have a wait time between three and eight minutes and run between 5:30 AM and 1 AM. Singapore's rail systems also aim to increase green space and air quality. All of the MRT is elevated or underground to avoid competition for sacred land space, and all of the carts receive power through 750-volt DC third rail.

In addition to rail, Singapore's public transportation system continues to provide efficiency and affordability for most of its citizens with an excellent bus system that goes through all part of the city and even to the suburbs. The buses are all government funded and easily accessible in terms of location and price. With such an advanced public transportation system and an abundant number of buses, the city is currently aiming to make the bus system more ecofriendly. One of the main modifications is the conversion to fuel cell buses. Singapore has collaborated with the Chinese bus manufacturing company Higer, SBS Transit, and the Nanyang Technological University in order to increase the use of fuel cell buses in an attempt to lower carbon emissions to zero (Green Light for The World's First Hydrogen-Electric Bus in Singapore, 2010).

In 2010, Singapore's government introduced a one-year trial for increasing the use of buses that do not use fossil fuels. This initiative brought about the Greenlite buses, which are hydrogen-electric and emit water rather than carbon. The Greenlite buses use hydrogen fuel cells and lithium-ion batteries. They contain a converter that changes the hydrogen into the electricity that runs the buses. Another advantage of the converter is that it charges the batteries whenever necessary. Due to the Greenlite buses, the fuel consumption in Singapore has been greatly reduced. This decrease in the use of fuel has also led to a thirty percent decrease in the money needed for public transportation (Green Light for The World's First Hydrogen-Electric Bus in Singapore, 2010).

Singapore's taxi system further exemplifies the commitment to green practices demonstrated throughout its transportation system. With over 25,000 taxis on the road making about 588,632 trips per day, Singapore effectively reduces the need for personal car ownership, thereby lowering the number of total cars on the road. With fewer cars on the street come fewer emissions and less negative environmental impact. In addition, more and more Singapore taxi companies have been making the transition from diesel fuel to compressed natural gas, or CNG. This practice benefits both humanity and Mother Nature alike, for diesel emissions contain carcinogens and toxins that harm both people and the environment. In fact, diesel exhaust accounts for more than one quarter of hazardous air pollution and is responsible for a disproportionately high percentage of the sickness and death caused by air pollution, which is often brought on by bladder or lung cancer. But with much less harmful CNG on the rise, these problems will begin to fade into the past. All and all, Singapore's taxi system shows mindfulness toward sustaining both the health of the environment and the well-being of Singapore's people. (EnerSea.com, 2010; Taxi Singapore, 2012; Wikipedia, 2012.)

Singapore has two features that enable it to have one of the world's most advanced and greenest transportation systems: its authoritarian government, which can over-ride any consumer and business interests that reject green initiatives, and its high population density. As a result, it has a very advanced rail and bus system, and it also has a complex system for vehicle pricing that reduces the number of vehicles on the road and the use of congested areas. Finally, the city-state has also shifted

taxis to CNG, which reduces air pollution. Such practices have made Singapore an exemplary leader in eco-friendly transportation.

### Conclusion

In the past, the high population density of Singapore has led to numerous environmental issues with carbon emission, water conservation, pollution, and energy efficiency. However, through government control and initiatives, the city has become Asia's leader in environmental practices. The government's heavy involvement has been successful in attaining environment-friendly methods within distinct areas of environmentalism through programs such as the Singapore Green Plan recycling program, Singapore Green Labeling Scheme and Green Mark system for green businesses, the Gardens by the Bay initiative for green spaces, and the combination of efforts for food and transportation efficiency.

Although all of the above government efforts have greatly increased sustainability throughout the city, Singapore's attempt to decrease pollution and congestion due to transportation has not only been the most efficient, but also the most unique. While their methods are strong due to the green efficiency and the lack of opposition from the populace, their weaknesses center on the lack of resilience and lack of portability of the transportation system. The existence of strict regulations on car ownership similar to Singapore's regulations would be hard for democratically governed nations to impose; however, the government involvement in light rail systems and bus transit is exemplary and can be adopted by various cities.

Singapore has adopted new technology to encourage energy conservation of their buses and their businesses, as well to encourage recycling habits. Through a combination of advanced technology and government intervention, Singapore has been able to supply the means to enforce sustainability. Singapore was once heading down a path of despair, but recent regulations and government encouragements have transformed this highly dense city into a world environmental leader.

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## Green Spaces in Sydney

By Sandro Giacometti, Mihir Parthasarathy, Marlee Peck, Christina Petrovich, Tyler Rigsby, and Dansby Swanson

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Sydney has consistently been recognized as one of the world's "most livable cities" (Economist Intelligence Unit 2012). One of the factors contributing to this designation is its mild climate. Sydney lies on the southeast coast of the Tasman Sea, where the weather can range from an average of 72 degrees Fahrenheit in the summer to 55 degrees Fahrenheit in the winter. The region receives sun for 342 days of the year and is relatively dry (City of Sydney 2012). Sydney does not have the extreme weather conditions that spur other cities toward sustainability initiatives. Sydney is not only the most populous city in Australia, but it is also experiencing rapid population growth. The population has grown 38% between 2000 and 2010 and is estimated to continue growing at such a rate (Discover Sydney 2012). Because of the high density of people and commercial enterprises, Sydney has surpassed its carbon-dioxide emissions goals, and thus the city has increasingly sought to implement sustainability programs to reduce the city's environmental impact (City of Sydney 2011).

In order to become more sustainable, the city is beginning to implement policies in a wide range of sectors. These improvements are part of the Sydney 2030 Movement, which has set sustainability goals for the year 2030. These policies include plans to improve buildings, businesses, food and agriculture, green spaces, recycling, and transportation. Additionally, the government is funding projects to improve the existing infrastructure and transportation. Sydney has a clear, precise path to increase the sustainability of their city over time. Although many of the city's sustainability initiatives have a long way to go, if the city continues improving at such a rate, there is no reason that they cannot reach their sustainability goals by 2030. Among its many sustainability initiatives, the green space programs are especially noteworthy.

The first part of this case study will discuss Sydney's sustainability initiatives in a multitude of areas including transportation, green buildings, recycling, green spaces, green businesses and food. We will then discuss Sydney's best practice, its use of green spaces. Finally the conclusion will review and assess the city's general sustainability efforts, including their strengths and weaknesses as well as evaluate the best practice and the probability of its use in other cities.

### Overview of Sustainability Plans and Programs

Sydney has a main plan with sustainability goals set for the year 2030. However, many different organizations are responsible for implementing the goals. Initiatives in the areas of green spaces, food, and green buildings have been more successful than others. While strides are being made to encourage recycling and improve transportation, these two areas are not as advanced. This portion of the paper will outline the sustainable efforts of Sydney, which include green buildings, green businesses, green food plans, green spaces, recycling initiatives, and transportation improvements.

One of the city's most promising initiatives is the greening of buildings and surrounding grounds. By 2030, Sydney envisions incorporating wastewater-recycling plants combined with rainwater capture, green rooftops, and solar powered lighting in public and residential spaces (City of Sydney, 2012). Being

a recent effort to change building practices, many buildings do not exhibit said sustainability practices but with Sydney's 2030 vision, we can expect this to change.

Currently, there are not many green buildings but two residential complexes, the Glebe House and the Chippendale House, exhibit Sydney's push for resource efficient buildings. The Glebe House takes full advantage of the energy from the sun by demonstrating the use of solar panels in order to generate electricity, which is one aspect of Sydney's vision. The Glebe house uses a photovoltaic array of solar panels to provide energy to the entire house. These panels are easily attachable to any residential structure and are growing in popularity throughout Sydney (Chapa, 2007). Residences in Sydney have also focused on using water efficiently, another important goal in the city's plan. The Chippendale house collects all of its drinking water from the roof and processes waste water and rainwater on site (City of Sydney, 20120). These two buildings serve as models for future residential complexes.

The efforts seen in residential houses have been extended to commercial buildings as well. The greenest building in Sydney, The Bond (Chapa, 2007) provides a model for other buildings and has been accredited five out of five stars under the Australian Building Greenhouse Rating, which rates buildings based on their efficiency. The Bond serves as a commercial leasing building and incorporates fully natural finishes like bamboo and wool to reduce environmental damage. The Bond served as a pioneer of chilled beam cooling in Australian buildings (Chapa, 2007). Its use of natural ventilation, passive chilled beam cooling, and fully operable shading on the facades, helped.

Especially with Sydney pushing for extensive sustainability by 2030, we can expect to see more and more buildings undergo a greening process, but the changes take time, especially because of the large stock of existing buildings. Also, solar energy, which is a key aspect of Sydney's vision, is very expensive and the financial burden on families and businesses is a big weakness of Sydney's 2030 approach.

Sydney also has set a great example for the global community by making new commitments to making their businesses more environment-friendly. The city offers the businesses an opportunity to get involved with a sustainability program, and the city has also set up local electricity precincts, organized regions of an electricity grid. (City of Sydney, 2012). The City of Sydney is running several business programs that they hope will benefit sustainability for the future. These programs are helping organizations reduce emissions, saving businesses money on energy, and making the city sustainable. One such program is Smart Green Business, which has helped businesses save over 80 Olympic pools of water and over \$800,000 in annual bills. The program also offers advice to smaller businesses on how best to handle their energy, water, and waste. Another program is the Sydney Better Buildings Partnership, which is a group of the major landlords of Sydney that work together to cut carbon emissions and save energy, water, and waste in 60% of commercial office space in the city. A third program is the Green Apartment Buildings Program, which, as its name suggests, helps apartment owners become more environmentally friendly, additionally helping them find sustainable transport, take advantage of local biodiversity, and use communal gardens (City of Sydney, 2012).

The City of Sydney is also working to move from traditional energy creation to a more local, sustainable method of energy production. Currently, approximately 80% of the energy of the city is made from coal-fired power stations. However, the city has a plan to create local generators run on natural gas in four dense areas in Central Sydney. These can be built on vacant land or even in the basement of a building. These would produce as much energy as needed for the area, while any surplus would go back into the overall grid. They also have the advantage of using the waste heat they create to heat up buildings, or in the summer when it is hot, they can be converted to cooler air. Through local energy the city hopes to help end reliance on coal-fired power, cut greenhouse emissions, and reduce the cost of electricity for businesses (City of Sydney, 2012).

Currently, Australia is actually producing more food than is necessary to support its population (Hall 2011). However, as a nation, Australia is aware that with a growing population, the worldwide

demand for food is and will be on the rise. Despite the country's current surplus, Australia has chosen to focus on the domestic production and distribution of food before turning to export (SFFA 2008). This decision ensures that the distance food travels to market is shorter, thus decreases pollution as well as ensuring freshness.

One organization in particular is making a large effort to plan ahead for the future and secure a sustainable, plentiful food supply for Sydney. This organization, the Sydney Food Fairness Alliance (SFFA), is working toward the development of a food plan that promotes sustainability and localism as well as encourages a government-community partnership (SFFA 2009). The SFFA defines sustainable food systems as "systems which make use of agricultural, technological, distribution and economic techniques and ideas that enable food systems to continue in production and to fairly distribute food over a long period of time" (SFFA 2009). Sustainable agriculture provides far reaching benefits- it will create job opportunities, decrease the cost of transportation, have high economic return (lower production cost), and decrease the environmental impact (NSW Government). The current sustainability plan will be executed using "urban fringe farms," which are farmlands that surround Sydney and are able to support it from the outside as well as encouraging small community gardens (SFFA 2008). If the food plan ends up a success, Sydney will be entirely self-sufficient agriculturally and will reap the benefits that come along with having a sustainable food supply for the future. This development will address the concern that water shortages affecting the Murray-Darling Basin, which is currently responsible for a third of the entire Australian food supply, could affect Sydney's long-term food supply (SFFA 2008).

Viewing Sydney from above, it is apparent that it is part of Australia's "green oasis" (Fraser's 2012). Recently, Sydney has seen the formation of many parks, and many green roofs have been put up. One of the main features this city already has is its multitudes of parks, which in an effort to maintain the environment, also promotes others to come out and enjoy what there is to offer. Because the parks are a place to encourage outdoor activities, the parks are a place where there are no cars emitting carbon dioxide. One thing they have found is that the parks, from Hyde Park to Sydney Park to Belmore Park, are actually giving a place to help alleviate stress related disorders and give people a more positive outlook on life (Green Life Style Magazine, 2009). Since the creation of the parks, their plans of managements have changed over time to become more extensive and try to increase efforts in any shape or form. The city of Sydney now has a plan to be done by 2030: the "Green Square Project." The project takes up a space in the center of town of an urban area containing housing, open areas, offices buildings, shops and more. The key of the area is to keep it as green as possible and give quality facilities to current and future residents (Strategic Sites Sydney, 2012). There are currently 11,000 residents in this neighborhood, and the city hopes to have about 40,000 residents by 2030.

Sydney is also undergoing change through its dedication to new programs such as the Waste and Recycling Improvement Program. The goal is to make recycling easier for the residents of Sydney and for the city to become more efficient in using recyclable materials. Through a combined recycling system, where paper and cardboard can be recycled together, Sydney is attempting to wean off their old system. The city is installing new yellow bins rather than the original blue and green bins. Instead of requiring residents to separate the recyclables, all of them will go into the yellow bin and be transported by one truck to the materials recovery facility where they will be sorted. Once sorted, plastic materials may be used to make winter fleeces while cans may be used to build cars or airplanes. The city is visiting every apartment building to make sure that residents' recycling bins meet the City of Sydney standards. This process of visiting all the apartments will take time and until all residents have the yellow bin, the City asks the residents to continue recycling normally. This past year, Sydney collected 16,000 tons of recycling from city residents but plan to be even more productive this upcoming year. Another way in which Sydney is trying to become more environmentally friendly is by educating its residents on the importance of recycling and the proper ways to recycle. Sydney is aiming to become a world-standard

city, which can only happen if the city can become more efficient with its resources and better educated on environmental issues. (“Waste and Recycling Guide”).

Sydney has a large network of public transportation systems that travel from the inner city to the suburbs. The three main types of transportation throughout Sydney consist of the CityRail, public buses, and city taxis (City of Sydney 2012). The CityRail service is a system of trains that run through many suburbs and cities surrounding Sydney. Each weekday, the railway trains carries over one million passengers to and from 307 different train stations (Transport CityRail. 2012). Maintenance and management are crucial to keep the trains running properly and on time each day. CityRail is considered to be the most cost effective and green public transportation system in Australia (The Sydney Guide. 2012). It takes one train to carry one thousand people, which adds up to around fifty thousand people an hour. According to the CityRail website, on a per kilometer basis their trains has five times lower greenhouse gas emissions (Transport CityRail 2012). By far, CityRail is the most popular unit of public transportation.

In Sydney, public buses transport citizens to work, shopping centers, and home. They are very popular, convenient, and accessible for people living inside of the city. Each day the bus system carries over six hundred thousand people on a total of 300 different routes (The Sydney Guide. 2012). Although they have this advanced system already in place, the government needs to change the fuel source of the buses to natural gas in order to present a greener bus transport system. These buses are a huge part of everyday life for citizens of Sydney, and thus the environment could really benefit from a switch from petroleum to natural gas.

In addition to buses, taxis play an important role in the public transportation system of Sydney. Taxis are able to carry people from specific locations and take them to a wider variety of places in contrast to the buses and CityRail, since they only stop at certain stations. Each year, taxis transport around 175 million people, which increases the money flowing through the economy (The Sydney Guide. 2012) and decreases personal car use. The only downside to the taxis in Sydney is their fuel, petroleum, which can lead to a larger emission of greenhouse gases.

By the year 2030, Sydney plans to have an even more developed light rail system in order to move the community throughout the city. Also, the government of Sydney is encouraging carpooling, and it is beginning to provide special parking spaces for motorized scooters in order to convince people to use less petroleum (Sydney2030 2012). Transportation makes a huge difference in the community of Sydney because it is able to transport a large portion of the population to a multitude of locations in the city.

Sydney has ambitious plans for the future. Although the majority of plans are well thought out, such as the food plans and the recycling initiative, their implementation takes time. Additionally, although the public transit system is well established, it is not necessarily extremely green in terms of the transition from fossil fuels. Many changes are necessary in order to make it a greener component of the city. However, it is not unrealistic that their sustainability goals will be met by 2030, especially given the success of the green buildings, businesses, and spaces.

#### Best Practice: Green Spaces

Sydney is making a name for itself with its multitude of green spaces. These green spaces mostly consist of green parks the city has, but they offer benefits that go beyond simply recreational spaces. Although many of these parks were being renewed, about 20 new projects have been completed. For example, with the Balfour Street Park, the focus was to create an open space that would “integrate local traffic management” (Dodd and Mongale, 2012). In addition, the space implemented a water feature that captures storm water and then treats it. The CBD Streetscape Upgrade was an effort to renovate streets and enhance the view of city life for residents (Saxby 2012). The Chippendale Pedestrian Cycling Traffic Calming improved pedestrian walking conditions and implemented a system that harvests storm

water and creates garden beds. Many other green spaces such as Hugo Street Yellowmunde, Pemulwuy, Harris Street, the Frog Hollow Reserve, Macleay Street, Lillian Fowler Reserve and Newtown Public School Playground, were upgraded in order to provide a better recreational space for public enjoyment (Parry and La'Rance, 2012; Criniti 2012; Dodd 2011; Britten 2011; Teh and Dodd, 2012). The renewed spaces have improved accessibility, new gardens, equipment, furniture, and enhanced lighting and footpaths. Improvements were not made solely in the central business district, but also in the inner city such as with Harmony Park (Morgan and Merchant 2012). In addition to the green parks, there is also the Green Square Project described above. Although this project is still in development, the use of urban space as green space has been a great effort towards sustainability. All of these improvements and innovations have helped establish green spaces as Sydney's best practice.

The green spaces in Sydney benefit the city on an environmental, social, and economic level. One of the main environmental effects of green spaces is the temperature modification of the area. According to some studies, the urban vegetation can "result in air temperature reduction of between 2-8 degrees Celsius" (Fam, Mosley, Lopes, Mathieson, Morison, and Connellan, 2008). This cooling helps businesses save money on energy through reduced costs in air conditioning. Another major way green spaces affect the environment is through improved air quality. This is particularly useful in large cities, such as Sydney where pollution has been a continual struggle. (Fam, Mosley, Lopes, Mathieson, Morison, and Connellan, 2008).

On a social level, these green spaces provide room for recreational activities including sports teams. As people come together in these recreational areas, they get exercise; studies have shown that areas with green spaces have lower rates of childhood obesity, which is a growing problem in Australia. (Fam, Mosley, Lopes, Mathieson, Morison, and Connellan, 2008).

Additionally, green spaces have benefited the Sydney economy. Through the creation of green spaces, the government is creating many jobs. In 1998, Australia had 52,164 individual recreational parks and gardens, which created 16,646 jobs (Fam, Mosley, Lopes, Mathieson, Morison, and Connellan, 2008). In addition to creating many jobs in the production and upkeep of the green spaces, as well as the aesthetically pleasing benefit of their appearance, having these beautiful green spaces greatly increases property value in the area (Fam, Mosley, Lopes, Mathieson, Morison, and Connellan, 2008).

Each year, Sydney upgrades the green spaces in their city. There are about 330 total parks in the town, and the government makes an effort to replace old playground equipment, benches, seats, and different gardens (Sydney 2030). Eventually, the city wants to transform the areas of Central, Town Hall, and Circular Quay into green spaces that will connect with the new light rail system that is being built. In April 2011, the city began construction on a new pool in the Prince Alfred Park. The main idea behind renovating different areas into recreational parks is to create a stronger community atmosphere and encourage people to be active by exercising outdoors. These improvements allow the use of green spaces to be maximized and continually expanded.

Sydney's approach to green spaces is a model for other cities. The green spaces are continually renovated and improved, ensuring that they are not outdated and that the city continues to reap the benefits of them. With the government fully committed to the upkeep of old and the development of new spaces, it is clear that the green spaces of Sydney are a leading example of the sustainability efforts of the city.

## Conclusion

Sydney's sustainability goals set for 2030 have unified the city through multiple programs and initiatives to become greener. Advancements have been made in the fields of green spaces, food, green business, green buildings, recycling, and transportation all according to the City of Sydney 2030 plan. Regarding green spaces, Sydney's most developed initiative, the Green Square project focuses on creating and increasing the size of an extremely green community in the center of Sydney. Sydney, as

well as the rest of the nation, also has chosen to address the topics of domestic food production and food distribution. Encouraging localism will decrease the distance the food must travel, resulting in decreased pollution and fresher food. Businesses in Sydney are offered the opportunity through economic initiatives to get involved in making their own businesses more environmentally friendly. Sydney's goal by 2030, concerning green buildings, includes the wastewater-recycling plants combined with rainwater capture, green rooftops, and solar powered lighting in public and residential spaces (City of Sydney, 2012). Recycling has become easier for city residents through the new combined recycling program where paper and cardboard can be recycled together. Lastly, transportation in Sydney is already quite developed, consisting of three main types of transportation: CityRail, public buses, and city taxis. By 2030, Sydney plans on expanding the light rail system to make it easier for city residents to navigate around the city.

Out of all of Sydney's sustainable practices, its initiatives concerning green spaces have been considered the city's most outstanding sustainability initiative, Sydney's best practice. Promoting green spaces in Sydney has some key strengths and weaknesses. From an environmental standpoint, Sydney's green spaces helped reduce the average temperature 2-8 degrees Celsius and have helped reduce pollution through improving air quality via natural processes. But the greatest strength of green spaces is their ability to improve society in many other aspects, other than just the environment. Green spaces provide parks for recreation and helps people get exercise, which in turn helps lower obesity and overall consumption. Green spaces also help improve Sydney's economy by creating jobs in order to create and maintain green spaces, as well as increase property values. One key weakness is the cost it takes to produce new green spaces and sustain the 46 it has already. The Sydney government funds these green spaces and the ability to maintain them is highly dependent on how well the economy does. If the economy is in a recession and the Sydney government accumulates massive debt, the green spaces will suffer due to decreased funding. Overall, the ability for green spaces to benefit multiple facets of society significantly outweighs the potential weakness tied to government debt.

The green spaces that Sydney has developed provide a model for other cities. As far as uniqueness is concerned, green spaces are not unique to Sydney, although the city has unique individual green spaces like the Chinese Garden of Friendship, which is designed like a Chinese paradise, or the fig lined avenue in Hyde Park. Rather, the city's program of creating new green spaces within an already densely populated area is a good template for cities across the globe, as it can be easily applied and does not depend on unique attributes of Sydney or Australia. The main obstacle for its portability is the monetary cost cities must overcome, but other than that, Sydney's model is quite portable.

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## Vancouver's Built Environment Initiatives

By Jordan Clark

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The city of Vancouver has consistently been ranked as one of the most livable cities in the world (Gulliver, 2011). A coastal metropolis nestled in a natural setting, the unique environment of the community is telling of its prime livability. In addition to its atmosphere, Vancouver is also known for a dynamic culture of health and sustainability. Indeed, by the year 2020, the community plans on being not only the most livable but also the greenest city on the planet.

The city of Vancouver has historically been progressive in the field of local sustainability. In fact, the ambition of the community is so renowned that it has spawned the nickname "Vancouverism" (Wikipedia, 2011). This ideology of livability, sustainability, and efficiency has shaped Vancouver into one of the most advanced communities of the twenty-first century. Through the innovative efforts of city leaders, business, and citizens, Vancouver has become a world leader in local sustainability with notable advances in urban design and green space.

In this study, an overview of the Greenest City 2020 plan will first be discussed, then we will look specifically at Vancouver's efforts to integrate green space within the city. Finally, a critique of the plan as well as an analysis of its future and portability will be provided in the conclusion.

### Greenest City 2020

In a 1975 document called "The Downtown Official Development Plan," Vancouver policymakers outlined specific goals addressing urban sustainability such as efficient land use, eco-density, public space, and pollution control (City of Vancouver, 1975). These measures made strategic city-planning a priority for the city and laid the groundwork for future green initiatives. In 2010 the people of Vancouver ratified the "Greenest City 2020" proposal, a new, comprehensive sustainability plan that mapped out the next decade of development (GCAP, 2011).

The "Greenest City 2020 Plan" has the stated objective of making Vancouver the greenest city in the world by the end of the decade, with ten specific strategies to make that goal a reality. Each strategy, divided into subgoals and benchmarks, targets an issue within the city (Vancouver, 2011). In general, these strategies can be divided into addressing one of three areas in the city: energy, economics, and the environment.

*Energy.* Economists and analysts often refer to energy as the "master resource." In the agrarian economies of the past, a community was only as good as its soil; the dirt from which crops grew was the foundation of the entire society. During the industrial revolution of the twentieth century, however, electrical and transportation innovations led to an explosion in demand for affordable sources of energy. A new gold rush was born in the form of cheap fossil fuels, and the world economy quickly shifted its dependence from physical land to its underground products.

Vancouver is located in the southwest corner of the Dominion of Canada, bordering the warm water currents of the Pacific Ocean. Because of its unique location, Vancouver has historically possessed an advantage in energy production, primarily through access to hydroelectricity. The benefits of this advantage are twofold: the energy economy is less dependent on unsustainable fuels, and both the

citizens and city leaders are open to more progressive policy. These two factors, particularly the latter, help make Vancouver a leader in the green cities movement of this century.

In terms of creating a more sustainable energy infrastructure, the city of Vancouver separates its initiatives into two sectors: energy production and energy savings (Talk Green, 2011). The former is accomplished through direct investment and development of renewable sources of energy, whereas the latter deals with the efficient use and distribution of that energy. Seeing both sides of the coin in this sense empowers city officials to focus on innovation from both ends of the energy spectrum.

The hydroelectric systems surrounding Vancouver already provide close to eighty percent of the city's energy; however, there is a movement within the municipality to replace environmentally destructive dams (Green City Times, 2009) with more localized forms of creating energy. An example of this effort is the increasing investment in solar power. Unlike other cities that rely largely on external solar fields, Vancouver aims to transform buildings from energy users to energy producers through a combination of energy savings and independent solar production. A provincial program called Live Smart BC incentivizes solar production by providing professional audits, subsidies and installations of household systems (Livesmartbc, 2010). Overall, Vancouver has remarkable flexibility and private-sector cooperation in its energy initiatives.

Perhaps greater than energy production, energy savings is also a priority among Vancouverites. The most prominent project Vancouver has promoted is a renewable heating system called Neighborhood Energy Utility, or NEU for short. In the neighborhood where NEU was tested, a sewage treatment plant was converted into a source of heat and warm water for local homes. The program has been called a tremendous success, as one analysis claims that there has been an over seventy percent energy savings in the neighborhood (Challenge Series, 2010). Likewise, public-private partnerships have also produced retrofit campaigns, green project funds, electric fleet conversions and energy efficiency software in newer buildings (Vancouver, 2011).

*Green Economics.* As F.W. Geels notes in his study, "The Dynamics of Transitions in Socio-technical Systems," no sustainable sociotechnical transition can occur without essential economic conditions such as affordability, practicality, and a wide variety of options. In effort to stimulate green economic development, the city of Vancouver engages in a number of activities and partnerships with private institutions. The two major economic emphases of the Greenest City 2020 plan are a) building a green enterprise economy and b) investing in local food (Talk Green, 2011).

The long term goal stated in the Vancouver plan is to "gain international recognition as a mecca of green enterprise," (GCAP, 2011) with the benchmark of doubling the number of green jobs in the city by 2020. With special focus on technological development, the city government makes direct investments in upgrading infrastructure and partnering with businesses to advance energy efficiency research. One such example is Pulse Energy, a firm that was contracted to develop energy auditing software for community buildings. After significant investment by the city, today Pulse provides sophisticated computer programs that monitor building efficiency and increase energy awareness (Pulse Energy, 2010).

In addition to creating new opportunities on a business level, Vancouver is also making significant investments in the local food economy of the city. Community gardens, rooftop agriculture and farmers' markets are the primary areas of focus in the 2020 local food plan. City officials aim to carefully develop these regions of the plan through a combination of job creation, policy change, education, and access initiatives. For instance, one of the proposed objectives is to "ensure that a majority of residents live within a five minute walk of ... fresh produce." (Talk Green, 2011)

Non-profit organizations are also heavily involved in the development of Vancouver's local food economy. One such organization, called City Farmer, sponsors a program called Sharing Backyards in Greater Vancouver, which attempts to foster urban agriculture by connecting resident gardeners with local resources. The Sharing Backyards site features an interactive map of the city that can be used to

both locate and publicize shared garden space. Additionally, residents can freely post notes expressing interest in sharing land and contributing to existing projects (City Farmer, 2011). It is this type of innovative approach that facilitates the grassroots base of a local food economy.

*Environmental Policy.* As Vancouver continues to develop, it is clear that its environment must be strategically preserved. Normally, as a city urbanizes, waste and pollution expand and the natural environment deteriorates; however, the Greenest City 2020 plan aims to reverse this trend. Indeed, as Vancouver continues to grow, it is actively working to expand its natural environment while eliminating waste and fossil fuel emissions altogether. (Vancouver, 2011) To augment the total living atmosphere of the community, the 2020 plan addresses both the natural and the built environment of the city.

Issues of both space and pollution can be addressed with strategic waste management. For this reason, an increasing number of communities are choosing to recycle and reuse salvageable materials. Vancouver, in what is referred to as a 'closed-loop' strategy, aims to become a zero-waste community by reducing landfill use by fifty percent before the year 2020. Organic waste is a major target in the 2020 plan as the city plans to "make organics collection mandatory for apartments, condos, businesses and institutions by 2015" (Talk Green, 2011). So far, the city is making strides. In 2009, the government of Vancouver signed a contract with a local soil company to collect kitchen waste from the metropolitan area. The business, Fraser Richmond Soil, converts the organic waste into compost, which is distributed back to the city accordingly (CBC, 2009). Recycle and reuse are also priorities for Vancouver, as fifty-five percent of its non-organic waste is already reclaimed or recovered. (Talk Green, 2011)

Another environmental strategy of Vancouver is its active mitigation of traffic on city roads. Preventing a massive influx of commuter cars reduces pollution and promotes a livable urban environment. Vancouver actively reduces the need for individual vehicles through public transport systems, namely light rail and rapid-transit buses. The former, operated by Translink Skyrail, transported over 400 thousand commuters daily in the middle part of 2011 (APTA, 2011). Equivalent measures in bus transit are currently still in development, but a Vancouver Vision group has already acknowledged that "a free and frequent service around the downtown core could really reduce traffic congestion if planned correctly" (Vision, 2005).

Along with investments in public transport, Vancouver also encourages alternative forms of personal transport such as biking and walking. In many parts of the city, designated bike lanes are facilitated with physical barriers. A tangible divide between bikers and drivers creates an autonomous, safe route for both mediums of transportation (Vancouver, 2011). Similar measures are being taken with pedestrian traffic, as wider sidewalks and open streets create a more walkable city. Long strips of curb-side grass often separate walkers from the road (Urban Toronto, 2011). City sidewalks are also constantly renovated and redesigned. In one noteworthy experiment, recycled tires were used to construct new sidewalks after concrete ones had cracked due to shifting soil. (CTV, 2011).

Along with efforts to reduce waste and pollution, Vancouver city planners also aspire to increase significantly the green space within the city. By planting 150 thousand trees in the next decade—90 thousand of which on city-owned land—and investing in local parks, greenways and gardens, the 2020 plan aims to place every citizen within a five-minute walk from nature (Talk Green, 2011). This 'urban forest' strategy is unique to Vancouver, and is possibly the most innovative policy in its plan.

*Evaluation.* The most common criticism of the Vancouver plan is that it is almost lyrical in rhetoric but lacking in practicality, especially in terms of the economic impact of such immense investments. Some analysts who oppose the plan even claim that the government of Vancouver may be using the popularity of the green trend as a vehicle to commandeer the local economy (Enchin, 2011). Additionally, one of the largest criticisms of the plan is that, as of 2011, there has been no known budget projection for the Greenest City initiatives (Wood, 2011). With ambiguous costs to Vancouver residents, there will clearly be significant hurdles in executing the ambitious 2020 plan.

Because of the high costs of sustainable policy, there are concerns that in becoming the world's greenest city, Vancouver may inadvertently become its most expensive city as well. Vancouver is among the most costly places to live on the planet, and it already tops the list for North America cities. (Vomm Hove, 2008). Gentrification is a real obstacle in rapid community development. Even before the 2020 plan, there existed widespread concern over class segregation in Canadian cities (Stoffman, 2006). One recent report that analyzed development in a targeted Vancouver neighborhood noted, "No housing is proposed for people living in poverty below the low-income cut off line, which consists of about 70% of those living in the Downtown Eastside" (Stanislavski, 2010).

On balance, Vancouver's sustainability plan is notably extensive, addressing issues of energy, the economy, and environment while outlining specific strategies and procedures to achieve its goals. However, there is much work to be done, especially with the financial projections of the plan and its impact on the cost of living. It is possible that there is an 'E' missing from the plan in the form of equality, a significant problem that has yet to be confronted. If issues of finance, classism, and land value are properly addressed—and the plan redressed—Vancouver could very well lead the world as its greenest city and remain a livable city for all residents.

### Livable Urban Design

Vancouver employs a number of strategies to become a more sustainable community; nevertheless, its most innovative practice is the integration of green space and urban design to create a dense yet livable modern environment. As previously mentioned, eco-density and the preservation of nature have been goals of the city circa three decades. Moreover, the unique culture of both the people and policymakers of Vancouver has cultivated a collective desire to maintain a deep connection with nature as the metropolis continues to develop. As a result, the communal vision of the future city looks less like a concrete jungle than it does the urban forest described in its 2020 plan.

In this section, I will conduct a brief case study over the strategy and execution of Vancouver's vision for a green metropolis. First, the city's built environment will be discussed, then an overview of its integration of green space will be given. Finally, we will look at some potential challenges to these respective goals and what an urban forest might look like in the future.

Vancouver's "view corridors" are exemplary of its advanced urban planning. The primary strategy for improving the urban environment of the city involves creating certain "cones" of panoramic scenery that dictate the height of downtown buildings to preserve landmark views. These paths of visibility are built into the city zoning plan adopted in 1978 (City of Vancouver, 1978). The goal of this policy is to maintain a pleasant urban atmosphere in the presence of dense development. Over the years, Vancouver's view corridors have caught the attention of other cities and even inspired some to suggest similar policy in their own communities (Chappell, 2003).

Another notable policy outlined by the Downtown Development Plan is the promotion of mixed-use buildings. In fact, the 1978 plan specifically directs the city to increase the amount of residents in the downtown region (City of Vancouver, 1978). Such a goal is quite unconventional compared to traditional zoning mentality which separates homes from businesses. Nonetheless, residential areas in the metro area promote the idea that Vancouver is designed for its citizens first, even as the business sector continues to expand.

To further augment the livable environment of the metropolitan area, Vancouver officials plan to expand significantly the green space within the city. As previously mentioned, the 2020 plan defines two benchmarks addressing green space: one being a five-minute walk for every resident to a natural area, the other being a minimum of 150 thousand more trees planted over the next decade. Naturally, with such substantial envisaged expansion, limited space inevitably raises challenges. Vancouver meets the issue of land use with emphases not just on parks and greenways, but also creating green space within the city through community and rooftop gardens (Talk Green, 2011).

Community gardens are common among sustainable-minded communities. Not only do they create green space and stimulate the local food economy, they have also been shown to promote a sense of community and even decrease crime in some cases (ACGA, 2010). In Vancouver, the Board of Parks and Recreation oversees garden development on city land. Through education, policy and startup investments, the board hopes to utilize the 3200 acres of park land to create hubs of green space and produce for their surrounding neighborhoods (Board of P&R).

Because Vancouver encourages downtown residency, green space must be created within highly developed regions. Obviously, new parks cannot be built in such areas. A proposed solution to the space predicament is an increased investment in rooftop gardens, i.e. patches of vegetation and produce that grow atop city buildings (Vancouver, 2011).

Aside from the traditional benefits of a community garden, rooftop gardens offer additional advantages to building efficiency like water absorption and building insulation (Peck, 2008). For this reason, many private organizations have partnered with the government of Vancouver to sponsor independent rooftop gardens. One of the earliest examples of a successful garden project was implemented by the YWCA of Vancouver on the roof of St. Paul's Hospital. According to a blogger from the cultural magazine *Granville*, the 2000-square-meter area of public green space atop the hospital has fashioned strong intercultural bonds among local employees, patients and constituents (Laidlaw, 2010). If the St. Paul partnership serves as an example of a successful rooftop garden, then it is likely that other similar projects can also make positive impacts on the livability of Vancouver.

*Criticisms.* Community gardens undoubtedly promote a more livable community, but one study published by New York University showed that urban infill often inflates the land value for surrounding properties (Been & Voicu, 2006). At first glance, higher property value may seem desirable to the city; however, the issue of gentrification arises once again when local demographics change because of steeper prices. Because community gardens create more valuable neighborhoods, it is possible that they might isolate certain demographic groups instead of uniting them. The biggest fear among critics is that ubiquitous gardens could drive out lower-income residents as more affluent citizens buy up neighboring property (Anonymous, 2010).

Although there is significant support for inner-city agriculture in Canada, some citizens question whether rooftop gardens are practical enough to implement on a large-scale. In an assessment of the feasibility of urban rooftop gardening, analyst Joseph St. Lawrence calls it an "impractical idea," writing: "There are too many technical barriers to make gardening a convenient and inexpensive undertaking on most roofs" (St. Lawrence, 1996).

Overall, Vancouver is unquestionably a world leader in terms of livable urban design. Challenges exist, however, in the forms of social impact, practicality, and cost. Ambitious investments require extensive funding, and there is increasing debate over where those funds should come from. Though the city claims to have consulted with citizens in its planning phase, it has not been transparent in its budget nor the potential consequences for tax-paying Vancouverites (Marshall, 2011). There are undeniable issues with financing these measures, and these must be addressed before any major changes are carried out.

## Conclusion

Vancouver has proven to be a world leader in sustainability and effective community planning. With a unique populace and progressive policy-making, Vancouver has met goals that would take some cities years to achieve. There is no shortage of support among Vancouverites for greening programs; nevertheless, it is possible that the ambitions of the 2020 plan outrun the means by which they can be accomplished. Budgeting is arguably the most prominent issue, for the city has yet to accurately project the costs of its sustainable investments (Marshall, 2011). There are also many questions about the true

economic impact of such a rapid transition on lower-income Vancouverites. All of these matters must be addressed if the 2020 plan is to be successful over the next decade.

In terms of portability, the culture of Vancouver gives it an advantage over less progressive regions of the world, such as the more conservative political climates of many American cities. The overall ambition of the community, however, is indeed replicable. Other city governments could certainly emulate similar goals as Vancouver, such as a zero-waste society and significant growth in green space. Transportation reform, in general, is also a reputable strategy for any major city. There is no doubt that the world can learn from Vancouver's efforts, even if it cannot reflect immediately the level of enthusiasm for such policy.

Whether or not Vancouver will become the greenest city on Earth by 2020 remains to be seen. There is much work to be done within the city, and other progressive communities could clearly surpass Vancouver given the right socioeconomic factors. One thing is certain, though: as of 2011, the city of Vancouver has one of the most ambitious sustainability plans in the world, and so far it shows signs of progress in obtaining its objectives. If city officials respond to the challenges facing the plan—finances, practicality and equality—it is likely that Vancouver will indeed achieve its goal as a metropolitan mecca for sustainable cities. Even if it does not finish first, however, Vancouver will always claim that it started the race to the greenest city title. And regardless of the outcome, the Greenest City 2020 plan will likely serve as a model for other communities for years to come.

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## Washington, D.C.: Streetcar Initiatives amid Small Steps Toward Sustainability

By Bradley Roche

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Across America, many cities are taking action to become more environmentally sustainable. Among them is Washington, D.C. As the nation's capital, the city is unique in the fact that its local government does not have to worry about state laws, and essentially it has autonomy to run its own affairs as a city. However, the city has not taken full advantage of its status. Failed policies and poverty have made many parts of the run down and led the city to focus on issues such as the crime rate and poverty reduction.

Regarding sustainability, D.C. could best be described as slightly above average in most areas. Although the city has no concrete plan that focuses on sustainability, all is not lost for the District. The main city plan has several sections that contain initiatives that will make the city more sustainable. Through initiatives like solar panel rebates, free energy audits, and many plans for transportation, D.C. is finding ways to improve its environmental footprint. Although D.C. remains behind many more progressive cities on sustainability issues, its strong transportation plans and systems make it a leader in that one area.

This paper will analyze the strengths and weaknesses of both the plan and the initiatives contained therein. Each of the initiatives that the District is considering will be described and analyzed. After the discussion of the plan, we will focus on the best practice of D.C., the initiative that makes it stand out among other cities. For D.C., the best practice is their plan to install streetcars, which are environmentally friendly and encourage mass transit.

### Sustainability Plans in D.C.

Washington, D.C., is an interesting city with regards to sustainability because the city does not have a defined, specific, sustainability plan. Rather, the city has a comprehensive plan that incorporates elements of sustainability. The plan includes sections on land use, transportation, housing, urban design, and infrastructure. The plan is vastly detailed and covers nearly every aspect of policy in the city, but within this plan there are several initiatives having to do with sustainability that will be examined.

The "Comprehensive Plan for the National Capital Region" grew out of the Home Rule Act of 1973. This act, passed by the federal government, gave D.C. much more autonomy in local affairs. D.C. was allowed to elect a mayor and a city council for the first time, and gained the ability to pass local laws and program. One of the provisions of the law required the District to form a Comprehensive Plan.<sup>1</sup> Thus, every couple of years the District revises its plan for the city. The most recent overhaul was in

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<sup>1</sup> Flowers, Brian. "District of Columbia Home Rule Act." Sept 1999. 9 Nov 2011.  
<<http://www.abfa.com/ogc/hrtall.htm>>

2006; however, the city periodically updates the plan to incorporate new ideas. The remainder of this section will discuss the plans of Washington, D.C., in four areas: pedestrians, mass transit, alternative energy, and green jobs.

*Pedestrians.* Many of the initiatives of the plan have to do with transportation. One of the first foci is on pedestrians. This is beneficial because encouraging walking within a city takes cars off the streets and makes a city more livable and easier to get around, because one does not have to worry about parking or bus fares when one walks. The Comprehensive Plan extensively discusses the idea of improving pedestrian access throughout the city, but there are very few specific initiatives planned. However, the plan does mention an “example” of redesigning the bridges over the Anacostia River to be more pedestrian and bicycle friendly.<sup>2</sup>

Despite this lack of information on pedestrians in the main plan, D.C. has a separate plan devoted to making the city more pedestrian friendly. The Pedestrian Master Plan has many technical details and goals; however, there are two main goals. According to the plan, the first is to “To reduce the number of pedestrians killed and injured in crashes with motor vehicles,” and the second is to “increase pedestrian activity by making walking a comfortable and accessible mode of travel throughout all parts of the District.”<sup>3</sup> Because emissions from motor vehicles are the greatest source of emissions in D.C.,<sup>4</sup> pedestrian friendly streets allow the reduced use of cars, which reduces the pollution in the District.

The District’s first priority in the Pedestrian Master Plan was to look for the areas that had the most fatalities for pedestrians and were the hardest to navigate by foot. The District used Portland, Oregon, as a model for how to approach the analysis.<sup>5</sup> However, the main way that the District approached creating the master plan was through community input. The District Department of Transportation (DDOT) created an online survey that garnered over 4800 responses, interviewed 600 people as they walked along the main “arterial” roads that were identified as problem areas, and held meetings that sought community input.<sup>6</sup> This community-based way of creating the plan and identifying problems was an excellent way to make sure that the program met the needs of the community. The methodology, although not giving a totally representative view of the District, nonetheless allowed views of many residents to be sought. The main survey that made the community input truly valuable was the interviews with the random pedestrians. This was an excellent way to make sure that input was received from people who actually walk.

The Pedestrian Master Plan also analyzed the pre-existing walking conditions in the city. It noted that 12% of residents of the District walk to work, which is twice the national average.<sup>7</sup> The problem was that many of the streets in the city had “sidewalk gaps” that did not allow pedestrians to walk all the way down a block. Also, there were issues with intersections. The walk signal often did not last long enough for all pedestrians to cross, and skewed intersections made it difficult for pedestrians because motorists could take the turns at higher speeds.<sup>8</sup>

Thus, the Pedestrian Master Plan laid out initiatives to fix these problems. New countdown lights were installed at 95% of the intersections in the city, and the times for crossing were adjusted. Finally, new flashing lights were added at several intersections warning motorists about the

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<sup>2</sup> Black, Gale et. al. *The Comprehensive Plan for the National Capital: District Elements*. Washington, D.C.: DC Office of Documents and Administrative Issues, 2007

<sup>3</sup> District of Columbia Department of Transportation. *District of Columbia Master Plan*. Washington, D.C.: Toole Design Group, 2009. Page 3-4

<sup>4</sup> Ibid. Page 5

<sup>5</sup> Ibid. Page 9

<sup>6</sup> Ibid. Page 10

<sup>7</sup> Ibid. Page 12.

<sup>8</sup> Ibid. Page 14.

pedestrians.<sup>9</sup> In addition to these measures, the plan also makes many recommendations about how to improve pedestrian safety, including educational campaigns, redesign of crosswalks, and stricter fines and penalties for motorists who endanger pedestrians. Importantly, the plan also has the concrete goal of reducing pedestrian fatalities by 5% every year and increasing the number of residents who walk or bike to work every year. There are also plans to assess the progress of these goals.<sup>10</sup>

However, the best plan in the world is no good if it does not work. Therefore, the question is whether the plan actually met its goals. According to *The Washington Post*, a pedestrian or cyclist is hit four times a day in the District, and the number of pedestrian or cyclist accidents has risen by 25% since last year.<sup>11</sup> However, the number of cyclists and pedestrians has increased by 68% over the past three years, so this may explain the rise.<sup>12</sup> Nonetheless, it is clear that the District needs to do more work on protecting its pedestrians, because it has achieved its goal of having more people bike and walk. To achieve this goal, the *Post* article notes that D.C. has begun a new pedestrian safety program, although it is too early to know if the program will achieve results. However, the effort is necessary because promoting walking and cycling is one of the best ways to make a city more sustainable and reduce its emissions.

Overall, the Pedestrian Master Plan is well designed. It sets specific goals, contains actions to help achieve those goals, and includes ways to measure the progress made toward these goals. It seems to have failed to decrease injuries from cars striking pedestrians; however, the city has learned from this and is trying a new measure, which is the hallmark of a good, flexible plan.

*Mass Transit.* Washington, D.C., is a leader in mass transit. According to the Comprehensive Plan, the District has the “second largest rail transit system and the fifth largest bus system in the United States.”<sup>13</sup> However, the main mode of transportation in the city, the Metro, is not effective in connecting neighborhoods within the city. It is also extremely expensive to construct new subway lines. The District plans to solve the problem by installing streetcar lines and rapid transit buses. More detail on the streetcars will come in Section II, but for now it will suffice to say that they are powered by electricity and are environmentally sustainable. Bus Rapid Transit essentially makes buses run like subways. The buses run in dedicated lanes so that they are not late and don’t get caught in traffic. They also have special signals to synchronize with the lights in the city so that they can quickly pass through the lights. This makes riding a bus a more attractive alternative than driving because it is faster. Buses hold many people, and thus the carbon emissions are less than if all the commuters were to take separate cars.

One of the elements of the plan that aims to make buses a more attractive option is renovating the bus stops. The District plans to use GPS in bus stops to notify those waiting for the bus when the next one will arrive and adding a real-time scheduling system, as well as making the bus stops more comfortable and ensuring that they are well-lit and safe.<sup>14</sup>

The District also plans to improve mass transit further by installing water taxis. These will run across the Anacostia River and will provide a way for people to get to work when traffic is heavy on the bridges or bus or Metro service is disrupted. Although water taxis are not as environmentally

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<sup>9</sup> Ibid. Page 17.

<sup>10</sup> Ibid. Page 29.

<sup>11</sup> Klein, Allison. “Campaign to protect pedestrians, cyclists as number of crashes in the District rises.” *The Washington Post*. 30 Mar 2011.

<sup>12</sup> Ibid

<sup>13</sup> Black, Gale et. al. *The Comprehensive Plan for the National Capital: District Elements*. Washington, D.C.: DC Office of Documents and Administrative Issues, 2007. Section 4, Page 12.

<sup>14</sup> Ibid. Section 4, Page 19.

sustainable as buses or subways, they still encourage residents to forgo the use of cars because they provide yet another alternative to automobiles.

Overall, there is little in the plan about the Metro. This is because the Metro already does a stellar job of connecting the outskirts of the city with the central areas. The Metro is run with electricity, so it is more sustainable than a bus, and will be even more sustainable once D.C. gets more of its energy from renewable power in the future.

*Alternative Energy.* One of the major flaws with the Comprehensive Plan in regards to sustainability is that it does not address renewable energy at all. This may be because the Comprehensive Plan is not focused on environmental issues, and thus merely looks at electrical generation from a pragmatic standpoint. The plan simply states that the District will continue to electricity from the Potomac Electric Power Company (PEPCO). PEPCO uses two oil-burning power plants to generate electricity. However, with updates to the grid, most of D.C.'s power now comes from coal-burning plants in Maryland, which also create environmental burdens.<sup>15</sup> However, despite the lack of alternative energy plans in the Comprehensive Plan, D.C. is sponsoring some initiatives to encourage the use of renewable energy in the District.

One of the simplest ways to encourage the use of renewable energy is rebates on solar panels. This is exactly what the D.C. local government is offering. If a person in D.C. elects to purchase solar panels, they get a \$1.50 rebate per watt of capacity<sup>16</sup>. This is in excess of the rebates and credits that the federal government already offers, so it greatly reduces the cost of solar for citizens in Washington, D.C. The program began in late 2011, so there is no data on how well it is working yet, but with the greater initiatives for solar, it is hoped that it will be a success and encourage more people and especially businesses to install solar electricity.

Another interesting initiative that D.C. is exploring is giving consumers the option to pay extra on their utilities in order to receive their power solely from wind farms. Wind power, of course, is much more sustainable than fossil fuels. However, the main problem with wind power, and indeed with all forms of renewable energy, is that the initial costs are much higher than they are for an existing coal or oil plant, for example. This program helps to provide the wind companies a way to pass some of this high initial cost onto the consumer. Basically, the program targets upper-middle class consumers of electricity who want to "go green." These consumers can pay an extra fee on their utility bill (usually it is higher, but on occasion the wind is cheaper and the consumer pays less) in order to get the building's power either 50% or 100% powered by wind energy from West Virginia, Pennsylvania, or even Indiana. The extra money is reinvested into the wind farms in order to promote the growth of this green energy source.

*Green Jobs.* Noticeably absent from the Comprehensive Plan is any mention of green jobs or businesses. This is perhaps unsurprising, because the plan focuses on the general city, not specifically on sustainability. However, green jobs are an important part of any plan to make a city more sustainable, this once again demonstrates the District's need for a sustainability plan. Despite the lack of government support, there are still several business organizations in D.C. that promote environmentally friendly businesses.

One organization that attempts to establish connections among businesses nationally is Green Business Network (GBN), an organization that is extremely active in Washington D.C. The GBN states that its goal is to "link businesses to a growing market of value driven consumers."<sup>17</sup> One of the primary

<sup>15</sup> Ibid. Section 13, Page 18.

<sup>16</sup> Green Energy D.C. "Renewable Energy Incentive Program." 10 Nov 2011. <<http://rrc.dc.gov/green/cwp/view,a,1244,q,461562.asp>>

<sup>17</sup> Green Business Network. "Green America Business Network" 9 Oct 2011. <<http://www.greenamerica.org/about/businessnetwork.cfm>>

ways that they attempt to achieve this goal is through their green seal of approval program. Businesses have to meet several requirements in order to get the seal of approval. They have to “focus on using business as a tool for positive social change,” first and foremost.<sup>18</sup> Just as importantly, however, businesses with the seal of approval have to be socially and environmentally responsible in the way that they make their products.

Of course, the Green Business Network does more than simply certify businesses as green. In the D.C. area, many businesses are members, mostly restaurants and retailers. The GBN organizes events for the local businesses, such as a happy hour between three organic restaurants.<sup>19</sup> Also, they organize programs to raise awareness for sustainability, such as a bike ride between New York and D.C.

However, as a national organization, GBM cannot have as much impact as a local organization can. This is where the Sustainable Business Network of Washington (SBNW) comes in. The SBNW is an organization that aims to foster connections between local businesses that are, once again, value-driven.<sup>20</sup> The main benefit of the Network is the connections that it fosters between members. The members are encouraged to connect through seminars and networking events that SBNW sponsors. These links are valuable to community businesses because often they can refer each other. For example, a local restaurateur who serves Italian food could refer a customer who asks to a local sustainable steak restaurant, who would do the same for him. Or an electrician who works on solar panels could refer a plumber who installs heat-saving pipes when he is done with his work. This is one of the major benefits of small business networks in general, not just the SBNW, in fact, but SBNW is unique in that it only contains businesses that are committed to sustainability, and thus allows consumers to shop at sustainable businesses, as well as letting business owners draw inspiration and ideas from other like-minded owners.

The final organization in D.C. that I would like to discuss is the local Business Alliance for Local Living Economies (BALLE) chapter, Think Locals First. The chapter contains 401 local D.C. businesses.<sup>21</sup> Although BALLE is not strictly oriented towards businesses that are committed to sustainable practices, the mere fact that they support local businesses does help with environmental issues. This is because local businesses are more involved in the community, and therefore have more of an interest in community response to environmental problems that the company may cause. BALLE has many programs for its members. On the website of Think Locals First, there are announcements of farmer’s markets, happy hours, and seminars.<sup>22</sup> BALLE has many of these activities, as well as networking events among local businesses, to help grow the localist business movement in D.C.

Thus, we see that even though the Comprehensive Plan does little to support green jobs from a governmental side, there are still many private organizations in D.C. that support businesses that follow an environmentally sustainable pathway.

### Streetcars

Although D.C. often looks bad compared to other cities when it comes to environmental issues, one of the ways that it stands out is through its plan to install streetcars throughout the city. However, some people oppose the installation of the streetcars on aesthetic grounds. Even though the installation

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<sup>18</sup> Green Business Network. “Screening green Businesses” 9 Oct 2011. <  
<http://www.greenamerica.org/greenbusiness/screening.cfm>>

<sup>19</sup> Ibid

<sup>20</sup> Ibid

<sup>21</sup> Number obtained from counting all the businesses listed on the sidebar of the website here:  
<http://www.thinklocalfirstdc.com/businesses>

<sup>22</sup> Think Locals First. “Think Locals First: DC Locals Mean Business.” 9 Oct 2011. <  
<http://www.thinklocalfirstdc.com/businesses>>

of the streetcars is still being debated, their potential for sustainability and their potential to connect the city make them Washington, D.C.'s best practice.

There are numerous reasons why streetcars are good for cities. First and foremost is the environmental benefit. Streetcars are powered by electricity, which is much more efficient and clean than diesel or petroleum. Even when the streetcar is powered by coal electricity, it still emits less carbon per person than a comparable bus, and much less than a gas-powered car. Even if one considers the emissions from coal, one has to remember that buses and cars emit their pollution at street level, in the middle of a dense urban area. The pollution from streetcars is much farther away from population centers. Of course, the real benefit of the use of electricity is the potential to use renewable energy. Although Washington, D.C., does not get much of its electricity from renewable energy, in the future it likely will. This will make streetcars a virtually zero-emission form of transportation.

There are also more practical reasons for D.C. to install streetcars. As the NGO Streetcars4dc points out, the Metro provides access to downtown from the suburbs, but "does not always meet the needs of those traveling [within] the District, and does not serve all areas."<sup>23</sup> Also, many of the bus routes are overcrowded.<sup>24</sup> Finally, buses are not as environmentally sustainable as streetcars, and the buses emit their exhaust directly into the city's air.

There is also the economic side of streetcars to consider. The DDOT official website states that "fixed rail lines have demonstrated that they can be catalysts" for economic investment.<sup>25</sup> There are noticeably more businesses around Metro stations, and the same effect should hold for streetcars. The web site also notes that many of the public transportation options in D.C. are operating at full capacity. This means that they will not be able to adapt to the projected 32% increase in public transportation use.<sup>26</sup> Thus streetcars have both environmental and logistical benefits for the District.

However, there are negative sides to streetcars. To the casual observer, the aesthetics of a city may seem to be secondary to its practicality, but in Washington, D.C. this is not the case. The federal government, which has always exerted special control over the District, is against the streetcar plan because of the overhead wires that go along with streetcars. The federal government believes that these wires will ruin the city's iconic views of the Capitol and the monuments that define D.C.<sup>27</sup> Although D.C. is a historic city, the benefits of streetcars far outweigh the aesthetic issues. At worst, the streetcars could simply not run in areas where they would obstruct the view of monuments. However, the overhead wires of the streetcars would not unduly obstruct the views of the Capitol and other historic buildings, since they would be seen as simply part of the street.

A case study of how streetcars can revitalize an area can be seen on H Street in D.C., where tracks have already been installed and streetcars will be running by 2013.<sup>28</sup> *The Washington Post* notes that new shops and restaurants are already beginning to open on the street, and these businesses combined with new sidewalks and redone landscaping have totally changed the once rundown area.<sup>29</sup> Although improvements this drastic cannot be expected in all cases, it still demonstrates the potential streetcar lines have to attract investment.

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<sup>23</sup> Streetcars For DC. "Why D.C. Needs Streetcars." 10 Nov 2011. < [http://streetcars4dc.org/?page\\_id=2](http://streetcars4dc.org/?page_id=2) >

<sup>24</sup> Ibid

<sup>25</sup> District Department of Transportation. "D.C. Streetcar Overview." 10 Nov 2011. < <http://www.dc.gov/DC/DDOT/On+Your+Street/Mass+Transit+in+DC/DC+Streetcar/DC+Streetcar+Overview> >

<sup>26</sup> Ibid

<sup>27</sup> "Washington D.C. Seeks to Build Streetcar Network." *All Things Considered*. NPR. WAMU, Washington, D.C. 22 Dec 2010. Radio.

<sup>28</sup> Halsey, Ashley. "DC Wants Streetcars to Roll by Mid-2013." *The Washington Post*. 10 November 2011.

<sup>29</sup> Ibid

As a technical matter, streetcars are very easy to fit into existing streets. D.C. plans on using, according to DDOT, “a unique shallow 12-inch deep track slab design” that will allow the track to be installed without disturbing the utility lines to an undue extent.<sup>30</sup> Also, the vehicles that the District will be using are narrower than conventional streetcars. This allows the track to be fitted to existing slopes and reduces sharply the amount of construction required on the streets.

In conclusion, the streetcars are an environmentally friendly form of transportation that allows local areas to be revitalized and encourage the use of mass transit within the city, replacing cars as it does so. Thus D.C.’s streetcars are its best environmental practice, and one that could be emulated across the country.

#### Conclusion

D.C. has a limited range of sustainability initiatives, but the District’s excellent plans to install streetcars may enable the city to develop a best practice that other cities can emulate. The most likely reason why the District is not an urban sustainability leader is that it is far from prosperous. There are high crime rates and poverty, and these are the priorities, not environmental issues. Furthermore, as a national capital, the city is focused on national issues, and the local issues sometimes take a backseat.

The bottom line is that D.C. needs better planning and initiatives to become an environmentally sustainable city. The city lacks governmental plans for green jobs and local food, although private groups are working to fill this gap. There is no plan that focuses on environmental sustainability at all. The first step in any plan to fix the city should be to create a sustainability plan that states goals for air and water quality, as well as for waste produced and carbon emitted/electricity consumed. The plan should include elements of renewable energy, mass transportation, and urban design, as well as sustainable food and green jobs. Then, the city should find ways to ensure that it reaches the benchmarks in its plan, and evaluate its progress as the plan goes on. Of course, D.C. has a problem finding political will to achieve these goals, because the citizenry is much less supportive of environmental programs than in other cities. However, by organizing initiatives similar to the ones the District is currently pursuing and coordinating them, as well as by adding some of the best ideas from other cities, Washington, D.C., could, over time, become a much more environmentally sustainable.

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