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USING GREEN BUILDING TO MITIGATE CLIMATE CHANGE IN THE TWENTY-FIRST
CENTURY

By

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ABSTRACT

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The need for green buildings are rapidly becoming more important as the nation faces impending energy crises and the world heats up from the overabundance of greenhouse gases. Buildings in America are one of the largest consumers of energy and one of the greatest contributors to CO₂ emissions; more than the total emissions from all the transportation vehicles used every day. By making the construction and use of buildings more resource efficient, this can help alleviate the environmental strain of climate change. Neutralizing or eliminating carbon emissions from building use will significantly reduce the amount of greenhouse gases in the atmosphere and is a single most effective way to begin the reversal of climate change.

Making this shift in the building industry will not be easy but is certainly possible at this moment in time. Cooperation from the government, the public, and the market is critical to help make sustainable building mainstream. Voluntary measures already in place can be revamped to appeal to more people and the introduction of green building codes and standards can work together to achieve this goal of the significant reduction of the emission of greenhouse gases.

Chapter 1: What Makes Green Building A Necessary Part of the Future?

One of the most important environmental issues facing the twenty-first century is mitigating climate change. Green buildings can play a significant role in reducing and minimizing the effects of climate change. In 2004, residential, commercial, and industrial buildings were responsible for 43% of total CO₂ emissions in the US.¹ The technologies we need are available but they are not yet as widespread or utilized. This chapter will explore the reasons why more efficient buildings are essential to the future of the twenty-first century and beyond.

It will take some time before these “radical” changes become the norm. By creating multi-use buildings that are higher-density and more compact, we can reduce the amount of travel by cars and reduce consumption of land and space, which could reduce greenhouse gas emissions by 45-50%. With that said, urban sprawl is directly correlated with higher greenhouse gas levels. A suburban density of four homes per square acre has about 25% higher greenhouse gas emissions per structure than an urban density of 20 homes per square acre. Planned neighborhoods reduces land use by 45%, roads cost 25% less, utilities cost 20% less, and schools cost 5% less.² Combating sprawl includes initiatives to plan communities based on a grid so that residential, commercial, recreational, and light industrial buildings can be plotted on the same development of land. We must also pay attention to the immediate outside, which calls for pathways for pedestrians

¹ Marilyn A. Brown and Frank Southworth, "Mitigating Climate Change Through Green Buildings and Smart Growth," (2006), 3.

² Brown and Southworth, 14.

and cyclists. The existence of parks and more trees within the neighborhoods will absorb some of the CO₂ in the atmosphere, while being dispersed enough to combat the heat island effect of developments.³

Green building rating systems is probably the best quantifiable way to judge whether a structure is reducing its impact on the environment or not. Although LEED is the most widely known in the US, there are a variety of other rating systems that work to achieve similar goals. One program is BREEAM (Building Research Establishment's Environmental Assessment Method) founded in the UK but is also utilized in the US; CASBEE (Comprehensive Assessment System for Building Environmental Efficiency), GBTool, and GreenGlobes US are other methods.

LEED (Leadership in Energy and Environmental Design) is probably the best well-known green building certification organization in the U.S. Formed in 1998, LEED is a program that assesses buildings based on five categories, which include sustainable site development, water savings, energy efficiency, materials and resources selection, and indoor environmental quality. It is a non-profit system within the United States Green Building Council (USGBC) whose goal is to help provide a guide for buildings to be energy and cost efficient. Currently, it is voluntary to be LEED certified.

According to the USGBC (where LEED is based) there are five steps for a standard building to become certified. Each step goes into great detail to help the consumer decide which rating system is a best fit for the building. First is choosing which rating system to use, which is based on the construction type. All of the rating

³ Brown and Southworth, 9.

systems have titles, which are: new construction and major renovations, existing buildings operations and maintenance, commercial interiors, core and shell development, retail, schools, homes, neighborhood development, and healthcare. Step two is registering the development, creating an application and paying for the process of certifying the building. Step three is submitting the application through a LEED project administrator. Step four is reviewing the decision and decisions can be appealed but they must occur within 25 business days. The final step is receiving certification and this has four different levels of achievement starting with certified, silver, gold, and platinum.⁴ This process can be completed either online or through personal interaction.

According to its website, BREEAM has 250,000 buildings with a certified rating and over one million are registered to receive a rating. It was first established in 1990. Instead of requiring regulation, buildings can volunteer to receive a BREEAM certification. The system is available to a variety of people including the everyday citizen, planner development agencies, funders, developers, property agents, design teams, and managers. It is commonly used in Europe such as in the Netherlands, Norway, Spain, and of course the UK. BREEAM evaluates building performance based on the use of energy and water, the health and wellbeing of the

⁴ "Choose Which LEED Rating System Best Suits Your Project," *LEED*. U.S. Green Building Council, n.d. Web. 17 Mar. 2014.
<<http://www.usgbc.org/leed/certification>>.

environment, pollution, transport of materials and waste, ecology and management processes.⁵

In order to get certified, the consumer must decide on which evaluation applies: communities, the construction of a general new building (commercial), a new domestic building, assessment of an existing building, or renovation. The next step is finding a BREEAM representative qualified to assess the building. Consulting with the assessor helps establish the building's potential. Then, the project is ready to be registered. The last step is certification, which is awarded once the construction is complete. Then the structure may be listed on GreenBookLive, which is affiliated with BREEAM and can be viewed on a Google map.

CASBEE is another system that rates and certifies buildings that is popular in Japan. It was developed in 2001 and the different evaluations are New Construction, Existing Building, Renovation, Heat Island, Urban Development, Urban Area + Buildings, Cities, Home, Property Appraisal, and one is in the works for Market Promotion.⁶ It has two assessment categories per building: the Q (which stands for quality) and means built environmental quality for the resident, and the L, which is the built environmental load. The negative impact the building has that affects the environment beyond the enclosed space.

Green Globes US is a green building rating system that is used in Canada and the US and began in 2000. The Green Building Initiative spearheads this system. It

⁵ "BREEAM: What Is BREEAM?" *BREEAM*. Building Research Establishment's Environmental Assessment Method, n.d. Web. 17 Mar. 2014. <<http://www.breeam.org/about.jsp?id=66>>.

⁶ "CASBEE," *Comprehensive Assessment System for Built Environment Efficiency*. Comprehensive Assessment System for Built Environment Efficiency, 27 Feb. 2013. Web. 17 Mar. 2014. <<http://www.ibec.or.jp/CASBEE/english/>>.

is similar to the other systems in the way that it can apply to many different types of buildings. For a new building, the assessment is based on eight categories: project management for a possible 50 points, site for a possible 115 points, energy for a maximum of 390 points, water for 110 points, materials and resources for a potential 125 points, emissions for a possible 50 points, and indoor environment for 160 points with a total of 1,000 points. Before even beginning the evaluation process, the building must be able to achieve 35% of the points confidently. The steps are as follows: project initiation, when the online evaluation will be processed. Step two is the design and the third party assessment (Green Globes employee) comes into play. Step three is the construction of the building and another third party assessment is made. Step four is commissioning and post assessment. Step five is when people may occupy it, and the building is then recognized as being certified. The whole process can take four to seven months excluding the time it takes to build the structure.⁷

The Green Building Challenge (abbreviated GBC) is another system in the UK that evaluates the environmental impact of buildings. It is related to BRE in that it is evaluative, but it goes a little further and examines buildings once people start to inhabit them. This is one of the big criticisms of LEED that there is a lack of evaluation for the eco-friendly buildings for their effectiveness post-occupancy. The GBC recognizes the challenge is making green building convenient and affordable

⁷ "Green Building Programs: Green Globes NC Overview," *The Green Building Initiative: Green Globes New Construction Module*. Green Building Initiative, n.d. Web. 17 Mar. 2014. <<http://www.thegbi.org/green-globes/new-construction.shtml>>.

enough so that everyday citizens will consider it to be a viable option when constructing.

The scholarly literature presents the economic, aesthetic, feasibility and energy saving components as the advantages of practicing green building. There is a debate concerning green buildings about whether they are affordable and efficient enough for consumers to invest in. One of the major critiques is that green building does not actually save a significant amount of energy and implementing these standards are too costly. The other side of the debate is that green buildings are necessary to help combat climate change. Since buildings are one of the main drainages for energy, it makes sense to start fighting this by making buildings more efficient.

The main argument for green buildings is that they are a viable option for energy savings. Therefore, it is hopeful that making low energy structures the norm will help mitigate climate change. Buildings account for 43% of total carbon emissions from the United States compared to the transportation sector, which accounts for approximately 30% of carbon emissions. Although this thesis focuses on commercial and other comparable buildings in size, single-family domestic dwellings use over 70% of all the energy used for residential purposes, which means that it makes sense to target single-family residences in addition to the large corporate use structures for energy performance improvements.⁸ This can be done through lighting, heating and cooling, and appliances. Simple measures such as properly insulating a home can make a huge difference in energy efficiency. This is

⁸ Brown and Southworth, 3.

an area where contractors will often cut corners in order to save a few dollars during the building process, but one that ends up creating a drain for energy. There are a variety of other easy modifications such as installing double-paned windows (instead of single paned), and pouring concrete instead of asphalt, which although more expensive, can greatly diminish the heat island effect in cities. These are simple measures that could make a huge difference if everyone realized what kind of an impact they could have.

Something that often gets overlooked and downplayed about green buildings is that there are many physical health benefits that lead to better wellbeing and better quality of life. Environmentally friendly aspects such as natural lighting, good indoor air quality, and the use of natural materials can improve the health and wellbeing of the workers. This means that if a company decides to go green, they will get a return on investment through higher worker productivity. More people need to understand green building in order to maximize the economic benefits while contributing to a more sustainable environment.

One study shows that there are potential health and productivity gains from more daylight in buildings. It was found that there were reductions in employee absenteeism, higher retail sales, and better health of students in proportion to the amount of natural light to which they were exposed. The results show that students in environments with the most natural light had 7%-18% higher standardized test scores than students with the least amount of natural light. Students in classrooms that had a controllable skylight diffuser improved 19%-20% faster than students

that did not have access to a diffuser.⁹ The regression equation controlled for 50 other variables and found that as a result of the statistical tests that there was a 1% probability that there would have been the same outcome as a result of chance. It was determined that there needed to be more studies to prove a causal mechanism between daylight and improved human performance. However the theory is that natural light leads to better visibility because of the higher illumination and light quality, provides mental stimulation, and improves the mood of the occupant.¹⁰

Bartlett and Howard are from the Building Research Establishment Ltd, Centre for Whole Life Performance in the UK. In 1921 it was established as the Building Research Station, and got its new name in 1972. It became independent in 1997. This organization has goals of mitigating climate change, while furthering economic productivity at the same time. They are a non-government based company that offers consulting for sustainable buildings, they conduct research for the most up to date information on these topics, and they test their buildings and smaller products. The group also offers training sessions that are led by their experts.¹¹

The quality of the indoor environment can directly affect health and consequently productivity. Things that can increase quality include adequate ventilation, presence of natural light, and low VOCs (volatile organic compounds) emitted from furniture materials (which include but are not limited to carpets, wood

⁹ Lisa Heschong, "Daylighting and Human Performance." *ASHRAE journal* 44.6 (2002), 65-67.

¹⁰ Heschong, 67.

¹¹ "About BRE: Expert Advice on Achieving Better Buildings, Communities and Businesses," www.bre.co.uk.

stains, and paint). In conventional building, indoor air quality is almost never taken into consideration because of all the things that can impact it. It is easy to make indoor air quality inferior from the off gassing of carpets, VOCs released from the paint on the walls, formaldehyde found in common building materials, the presence of radon gas in basements, and the lack of proper supply and return vents. A major source of loss of productivity happens when workers have allergies, low energy levels, fatigue and general discomfort. If these conditions cause employees to take sick days or leave work early, this has a negative effect on productivity. It is possible that these contributors have outside causes, but this study suggests that it is the indoor environment of the building that can cause these negative health effects.¹² Therefore, it is important to make sure that air quality is of a high caliber when building green. The elimination of annoying persistent health problems caused by environment can significantly reduce the strains on our health care system.

Green buildings in educational settings have also been shown to have a positive effect for students. Studies have shown that with the presence of natural light and in green building environments, students have consistently higher test scores than students in conventional building environments. Therefore students in green buildings have higher productivity in schools just like employees would at their jobs. M.J. Mendell conducted a study to determine whether the indoor environment affects students and their academic performance. The two main quantifiers that can assess productivity include student attendance and test scores.

¹² Robert Ries, et al, "The Economic Benefits of Green Buildings: A Comprehensive Case Study," *The Engineering Economist* 51.3 (2006): 262.

Targeted perpetrators are pollutants that cause asthma, dampness, and mold.

Children are most at risk for these pollutants in indoor environments.¹³

Research has shown that there is little to no regulation on indoor air quality, even in schools. The study concluded that we need indoor air quality to be taken seriously because many undesirable health effects can be avoided through adequate ventilation, elimination of harmful chemicals and mold, and moisture control. We need green buildings because people do not realize what poor indoor air quality they have. Conventional buildings contribute to numerous pollutants in the air. The study by Heschong showed that student performance on tests increased roughly 7-18% in the schools that had the most natural daylight sources compared to the students in schools that had low levels of natural light.¹⁴ They also improved their academic performance faster than children without a source of natural light (including skylights, largest window area, daylight diffusers, and the ability to control the amount of daylight presence in the classroom). When the study was conducted, fifty variables were taken into account and these results were consistent. There was a very low chance that the variation made the data insignificant.

Raising awareness about the need for these structures would be beneficial to prevent unnecessary costs to the health care system.¹⁵ In 2007, health care for asthma had cost \$56 billion, which took account for medical expenses, loss of

¹³ Mark J. Mendell and Garvin A. Heath, "Do Indoor Pollutants and Thermal Conditions In Schools Influence Student Performance? A Critical Review of the Literature," *Indoor air* 15.1 (2005), 27-52.

¹⁴ Heschong, 66.

¹⁵ Elizabeth Garland et al, "Impact of LEED-Certified Affordable Housing on Asthma in the South Bronx," *Progress in Community Health Partnerships: Research, Education, and Action* 7.1 (2013): 29-37.

productivity at work or school, and premature death due to asthma. The cost of hospitalizations due to asthma was \$535 million, also in 2007.¹⁶ Many are unaware of how preventable these respiratory diseases are and the building practices that may be an initial investment but offer a return in a multitude of areas including improved health and wellbeing. The participation of the occupants further showed that achievement of optimum health benefits could be reached through the combination of green habits such as the use of hypoallergenic mattress covers, cleaning products without toxic chemicals and the elimination of carpets in bedrooms and wherever they are not needed. Many “green” measures are simply taking initiatives for a healthier indoor environment, while simultaneously reducing impact on the outside environment.

Proper insulation can have significant energy savings, which is one of the biggest attractions to environmentally friendly alternatives. Many green initiatives are simple and cost effective, such as orienting a home in the Northern Hemisphere to utilize the angle of the sun throughout the seasons for cooling and warmth. This simple measure can save 30% off energy bills because south facing windows allow in warmth in the winter and an overhang will shade them in the summer.¹⁷

Investing in making a building green reduces costs in the long run.

Bartlett and Howard conclude that the advantages of building green outweigh the costs because they create economic benefits in the market.¹⁸ They

¹⁶ Garland et al, 36.

¹⁷ Charles Schmidt, "Bringing Green Homes Within Reach: Healthier Housing For More People," *Environews* 116.1 (2008): A27.

¹⁸ Ed Bartlett, Ed and Nigel Howard, "Informing the decision makers on the cost and value of green building," *Building Research & Information* 28.5-6 (2000): 315-324.

explored the assumption that cost consultants think that building green costs 5-15% more than conventional buildings and found it to be a misconception. They feel it is important to educate the stakeholders involved in order to make green building a viable option. From their view, a green building makes the workers more productive and therefore increases the revenue of the company. Making the move to environmentally sound buildings not only results in energy savings but also has myriad of other benefits that are not as tangible, such as the improved mental health of the employees. It is critical in the author's view to convince the stakeholders this is a serious issue because they have influence over whether these measures will be implemented or not.

The financial pros and cons are further explored in "The Economic Benefits of Green Buildings: a Comprehensive Case Study" by Robert Ries at the University of Pittsburgh where he is an assistant professor of civil and environmental engineering. Ries and his coworkers compared a new green building and an old office building. They showed that productivity was significantly higher in the new building, and had an unquestionably superior working environment. It concluded that the "correct economic choice was made."¹⁹ Things such as productivity of employees are difficult to quantify, but the data was collected through a detailed survey and the number of sick days that the employees took. The results were that they felt much more productive in the healthier environment and they needed fewer sick days.²⁰

¹⁹ Ries et al, 281.

²⁰ Ries et al, 281.

The article by Elissa Black²¹ argues that LEED should expand and not limit its certification solely to buildings, but entire neighborhoods. This can have a positive economic effect by shifting the supply of green buildings and shifting the demand to meet the supply. The article explains how there will be economic incentives from government subsidies and grants to make it more affordable for communities to construct. This is beneficial because it makes neighborhoods more marketable in the long run.

Producing green apartment buildings is another economic component and can have a positive effect on rent prices. Tenants will only continue to pay for a living space as long as it meets their minimum standards for living area quality, therefore a green, high quality apartment will be able to collect rent for a longer amount of time than the average apartment building. The study by Chegut, Eichholtz, and Kok explain that in the UK, the market for green buildings is rising because of new green policies implemented by the government.²² Building codes have been updated to include higher energy efficiency regulations, with the aim of the UK to reach its goal of zero carbon emissions for new construction by 2018.

According to the study by Miller, Spivey, and Florance, implementing sustainable measures in construction does pay off, however the willingness to pay for going green is not high.²³ Most landlords and owners are not willing to pay the

²¹ Elissa Black, "Green Neighborhood Standards from a Planning Perspective: The LEED for Neighborhood Development (LEED-ND)," *Focus: Journal of the City and Regional Planning Department* 5.1 (2008): 11.

²² Andrea Chegut, Piet Eichholtz, and Nils Kok, "Supply, demand and the value of green buildings," *Urban Studies* (2013).

²³ Norm Miller, Jay Spivey, and Andrew Florance, "Does green pay off?" *Journal of Real Estate Portfolio Management* 14.4 (2008), 385-400.

extra dollar up front for going green and will usually pick the less expensive conventional direction. It does not help that the cost of getting a building certified costs thousands of dollars. Although the return on investment is high, this initial cost can be difficult to pay. Some cities are making it mandatory for buildings of a certain size to be LEED certified, according to "Does Green Pay Off?" from the *Journal of Real Estate Portfolio Management*. However, a building does not need to be certified to be green. Single-family residences can make efforts to create a green home without spending so much money to get certified and still reap the benefits. At the moment there needs to be an incentive for these options to become attractive.

An important component of green building is making sure that the residents and the consumers are educated about how to use them. It does not matter how eco-friendly the building is if the residents are ignorant about using the features to their full potential. If residents do not know how to use a green building effectively, they can end up using just as much energy as a conventional one. BREEAM recognizes this by giving a post-occupancy evaluation report on energy consumption, however for other rating systems this is still a problem. The scholarly literature stresses that it is most important to educate students and young adults on how to use green buildings or even just to establish energy efficient habits, such as turning off electronics (computers are a huge drain on energy), layer clothing instead of turning up the heat, and using public transportation.²⁴ Creating green buildings is only meeting the challenge to reduce energy usage halfway. The other

²⁴ Stephen Browne, and Ian Frame, "Green buildings need green occupants." *Eco-Management and Auditing* 6.2 (1999), 80-85.

half is to educate people on how to be green occupants and use their resources successfully.

The study "Do LEED-certified buildings save energy? Yes, but..." illustrates the point that it is the occupants that need to take that extra leap to make eco-conscious habits.²⁵ In the study 18-39% of LEED buildings used less energy than the conventional buildings, but 28-35% of LEED buildings used more energy. This could be mostly attributable to different lifestyle habits of occupants. It concluded for the most part, building green does save energy, but the specific things that accumulate points for the score awarded by LEED do not necessarily live up to their expectations. The study also concluded that the certification level of LEED buildings do not seem to have significant effects on the energy efficiency between buildings. It was also found that Energy Star and LEED buildings correlated to a higher rent and sale price than conventional buildings.

Green building organizations are a good starting point for people who want to build green. They provide checkpoints for different areas of the home to ensure that the quality of the building can be improved. There are tradeoffs to getting LEED-certified. It is a widely known system and although it is initially expensive it can lead to significant economic gain as well as the overall environmental benefits of sustainable construction. However, it is possible to accomplish all the same aspects of green building, but save thousands of dollars by not getting LEED-certified. This also creates more work to prove there are green characteristics in a building when trying to sell it on the market. In turn, people looking for economic gain have

²⁵ G.R. Newsham, S. Mancini, and B. Birt, "Do LEED-certified buildings save energy? Yes, but..." *Energy and Buildings* 41.8 (2009), 897-905.

abused the LEED-certification system. Contractors implement “easy” measures such as installing a bike rack or having an educational display to rack up points to advance their certification without actually taking as many truly significant measures that could set the building apart from the convention. Almost all of the research on sustainable building is recent, as a result of the impending energy crisis and climate change issues. This is why it is so important to implement sustainable building practices in order to become less reliant on fossil fuels that will be proportionately less available in the future.

Discussed in this chapter are aspects that make green building a viable solution to diminish the excessive amounts of carbon dioxide in the atmosphere, while providing general benefits to occupants such as improved health and mental wellbeing, potential lower costs, and improved efficiency of resources. A way to achieve this goal includes using the guidelines set by rating systems. However, is LEED the best policy strategy for achieving green building? LEED can be a useful tool, but it has many flaws and loopholes that make the system limited. Buildings can accumulate many credits that do not necessarily distinguish them from other inefficient structures. Consequently, other necessary measures include using tax incentives, subsidies, mandates, green zoning, and green building codes. Ultimately this thesis will analyze a combination of these factors in order to decide how to use low environmental impact buildings effectively to combat climate change.

Chapter 2: The Strengths and Limits of LEED: Is It Easy Being Green?

Leadership in Energy and Environmental Design is one of the pioneering rating systems for environmental standards of residential and commercial buildings. How did it get this way? Why were LEED and other rating systems created? There is not much information on the subject of why exactly LEED was created but we can speculate. The climate change movement was beginning in the early 1990s and some organizations started to recognize the need to reduce the amount of resources used. The United States Green Building Council was formed in 1993 by Rick Fedrizzi, David Gottfried and Mike Italiano as part of an effort to define what green building was, standardize it, and promote sustainability in the building and construction industry.¹ The USGBC also wanted to prevent people from making false claims that what work they had done was “green.” Consequently, they created LEED in 1998, which helped establish and standardize a market for green building practices.

The new market for sustainable buildings increased competition within the construction and real estate industries to build and sell green buildings, and raised awareness about the long-term and short-term gains in sustainable building. Premiums went up for real estate officially certified as “green” and therefore construction companies started adopting more green building practices. As a result of recognizing the need to reduce our carbon footprint, LEED has developed a rating system to evaluate buildings based on their impact on the environment. Although

¹ "USGBC History," *USGBC*. United States Green Building Council, n.d. Web. 17 Mar. 2014. <<http://www.usgbc.org/about/history>>.

LEED has only been around a short time, since 1998 it has already made a substantial impact on the market for green buildings. It has gained popularity for being the leader in helping businesses and the average citizen to build with environmental consciousness while receiving economic, aesthetic and health benefits in return. The demand and popularity for LEED services grew exponentially over the last decade. It received positive feedback and quickly became a well-respected organization. Within a few years there was already demand for a more diverse series of rating systems within LEED in 2002.²

As LEED grew, in 2005 they published a rating system for residential buildings. Soon after, they added systems to apply to a multitude of building styles. This made LEED gain more exposure and became more versatile. Quickly, it was established that LEED was a well-known standard for building sustainably.³ This has resulted in cuts in energy and general building costs, while maintaining a sustainable environment. While energy savings are an important element of LEED that is not all it is meant to do. LEED certified buildings should help reduce water waste, improve indoor air quality, promote the use of sustainable building materials, and maximize the use of brown field sites. These things do not necessarily have direct economic benefits, but they do contribute to conservation of resource and efficiency in the long run in the way energy savings do.

LEED evaluates buildings and has four levels: certified, silver, gold, and platinum. A certain number of points must be reached in order to gain a

² Jennie Richards, "Green Building: A Retrospective on the History of LEED Certification," *Sustainable Industries*. 2012.

³ "USGBC History," *USGBC*. United States Green Building Council, n.d. Web. 17 Mar. 2014. <<http://www.usgbc.org/about/history>>.

certification level, and each credit on the checklist is worth a point. LEED was initially focused on creating a simple rating system for commercial sized buildings to help them reduce their carbon footprints. Now in 2014, it has become a national system that encompasses several rating systems for different types of buildings.

As mentioned in the previous chapter, the United Kingdom has a system similar to LEED called the Building Research Establishment Environmental Assessment Method (BREEAM). Like LEED, it is a voluntary program of certification of energy performance on the structure, which shows that it adds financial value. BREEAM uses a tool called ENVEST to predict the whole life cost and environmental impacts of the building at the beginning stages of planning.⁴ This quality is different from LEED, which does not have this type of feature. These types of strategies allow people to plan what the most feasible design is for a particular project. Having this insight allows people to build green for any budget. It allows BREEAM to work with someone who has a budget of \$90,000, for example, and prioritize what efficiency techniques the owner will use in the construction process that will give him or her the most value for his or her money. However, another individual could have a \$300,000 budget and ENVEST would help this person select from a wider pool what types of efficient strategies would work best for them.

The LEED system has numerous strengths, the most important of which is that it creates a standard and provides a “measuring stick” for people building green. LEED in particular has five main categories. The first is constructing on a sustainable site, which means building on already developed land (brownfield) or

⁴ Bartlett and Howard, 320.

building that has low impact on ecosystems and water resources. Second, water efficiency credits can be achieved through reducing water consumption, creative ways of minimizing water waste and reusing water (such as rainwater and grey water collection). Third, implementing energy saving systems and appliances are part of attaining the energy and atmosphere credits. Fourth, the use of sustainable building materials and the reduction of waste contributes toward getting the materials and resources credit category. Finally, the efforts towards creating ambient indoor air quality are counted as credits in the indoor environmental quality category and can be achieved through using natural daylight and minimizing materials that cause the off-gassing of VOCs (volatile organic compounds). There are other credit categories that are tailored to the specific building type. Achieving these credits should contribute to the amount of energy savings overall, as well as the health of the occupants.

A study in the South Bronx was performed to see whether transitioning to a green home would reduce respiratory problems in inhabitants. Residents in the South Bronx moved to a LEED Platinum certified apartment complex. The results showed that there were significant improvements in the quality of health of the occupants. They were surveyed before and after the move to an environmentally healthy building. The outcomes focused on asthma, absenteeism from work or school, and number of trips to the emergency room. All of these negative health activities decreased while living in the green homes. The study concluded that more

green homes should be built especially for people who need affordable housing and are often affected the most by these chronic health problems.⁵

Raising awareness about the need for these structures would be beneficial to prevent unnecessary costs to the health care system.⁶ In 2007, health care for asthma had cost \$56 billion, which took account for medical expenses, loss of productivity at work or school, and premature death due to asthma. The cost of hospitalizations due to asthma was \$535 million, also in 2007.⁷ Many are unaware of how preventable these respiratory diseases are and the building practices that may represent a significant initial investment but offer a return in a multitude of areas, including improved health and wellbeing. The participation of the occupants further showed that the achievement of optimum health benefits could be reached through the combination of green habits such as the use of hypoallergenic mattress covers, cleaning products without toxic chemicals and the elimination of carpets in bedrooms and wherever they are not needed. Many “green” measures are simply taking initiatives for a healthier indoor environment, while simultaneously reducing impact on the outside environment.

In addition to the environmental benefits LEED provides, it has created a market for taking environmental initiatives. This offers economic incentives for building green. By displaying the environmental benefits in an attractive way and combining them with education about the impact buildings have on the

⁵ Elizabeth Garland et al, “Impact of LEED-Certified Affordable Housing on Asthma in the South Bronx.” *Progress In Community Health Partnerships: Research, Education, and Action* 7.1 (2013), 29-37.

⁶ Garland et al, 36.

⁷ Garland et al, 36.

environment, LEED has created a desirable product. LEED certified buildings have a higher value in the real estate market and therefore stimulates the economy.

Creating LEED also generated a market for green construction products. New products have been engineered to be more efficient and initiatives have been taken to recycle and repurpose materials in order to appeal to consumers. The more education about the benefits of building green, the more the market expands and the demands increase for these types of goods and services. The appeal of green buildings is evident from the growth of similar buildings in other countries.

There is debate about whether LEED certified buildings actually save a significant amount of energy and a number of studies have examined whether or not this was true. One study analyzed the use of each type of building, including schools, libraries, apartments, multi-use, offices, public orders, assemblies, higher education facilities, hotels or resorts, restaurants, retail stores, transportation, or other. Then they researched climate zones in the United States to compile matches between the LEED buildings and the zones. The table for certification level is shown in Figure 1 and is for medium energy use buildings (such as office buildings). The statistical tests determined that the amount of energy saved was not significant for the medium use buildings. This data concluded that certification level was irrelevant when it comes to energy savings within the LEED system itself. In other words, a LEED Platinum building does not statistically show that it saves any more energy than an entry-level LEED Certified building. This is an interesting finding since the purpose of certification levels are supposed to reflect relative energy efficiency. This suggests that the subtle distinctions between the LEED buildings are not

significant.⁸ The study mentions a range of possible answers for this. One is that there is a difference between the assumed hours in the initial design compared with the actual hours, the finished building has been altered from the original plan, the plug loads are more than initially supposed, and a distortion between the commissioning of the building and the actual occupants.⁹ A reason that the study does not mention could be that the occupants are not using the energy saving features as effectively as possible. Although not uncommon, green buildings are still not completely widespread. Therefore, occupants may not have the knowledge or education about the most proficient way to inhabit the building.

⁸ G.R. Newsham, S. Mancini, and B. Birt. "Do LEED-certified buildings save energy? Yes, but..." *Energy and Buildings* 41.8 (2009): 897-905.

⁹ Newsham et al, 903.

Table 5
Descriptive data by LEED certification level, for all medium energy use buildings.

	Certification level		
	Certified	Silver	Gold/Platinum
<i>N</i>	38	35	27
Energy performance credits, mean (s.d.)	2.8 (2.1)	4.9 (2.7)	6.9 (2.6)
Proposed % energy savings (<i>N</i> = 75), mean (s.d.)	21.0 (7.5)	26.1 (9.5)	33.8 (11.8)
Measured EUI, kBtu/sf/yr, mean (s.d.)	72.4 (27.9)	69.2 (28.1)	58.7 (30.5)
Measured % energy savings (<i>N</i> = 75), mean (s.d.)	21.7 (27.5)	25.1 (42.1)	20.2 (39.9)
Floor area, s.f., mean (s.d.)	134,600 (177,800)	112,100 (164,100)	76,100 (79,900)
Climate zones (<i>N</i>)			
Hot (1-3)	5	8	5
Mixed (4)	10	12	14
Cold (5-7)	23	15	8
Year occupied (<i>N</i>)			
≤2004	18	22	16
≥2005	14	7	7
Activity type (<i>N</i>)			
Interp center	1	5	3
K-12 ED	4	3	0
Library	2	1	1
Multi use	5	7	6
Multi-unit res	1	3	2
Office	16	7	12
Public order	2	3	0
Remaining Types	7	6	3

Figure 1 “Do LEED certified buildings save energy? Yes, but...”

Why create different levels within buildings if they do not actually save any more energy or are not significantly more efficient? A problem identified by this and other studies is that it is simply not enough for the building to be built green. It is people who control how much energy they use. If occupants do not have eco-conscious habits, then some of the green features of the building will be lost.¹⁰ The study demonstrates the need to educate people about these energy saving

¹⁰ Stephen Browne and Ian Frame, "Green Buildings Need Green Occupants," *Eco-Management and Auditing* 6.2 (1999): 80-85.

technologies for both new and existing buildings. While there is a slow shift from conventional buildings to more energy conscious efforts, there is also a clear need for people to comply with the new techniques to make them truly efficient.

While LEED certified buildings can help mitigate environmental issues, it is obvious that on a larger scale (such as in a neighborhood) they are much more effective and will have more of an impact than on an individual level.¹¹ This is an interesting concept because this will also gain public attention and attraction to a LEED neighborhood. It gains attention on a broader scale. If LEED certified buildings can become more popular this could start to form a revolution and completely change the real estate market.

The fact that LEED does not take regional climate into account is also an issue. This is a major flaw of LEED because the system is too rigid and does not provide enough flexibility on a regional basis. The certification levels are the same for a building anywhere in the US, which is a fault because climate certainly affects a building's performance. LEED could address these flaws and find solutions in order to keep its system more relevant as the nation needs more solutions to environmental protection.

Although LEED has many beneficial qualities that promote green building, it can be expensive. Registering to be certified costs thousands of dollars on top of building practices that are already expensive. This leads to a dilemma: pay for the LEED "name" or channel the funds into implementing more green technologies? It is

¹¹ Elissa Black, "Green Neighborhood Standards from a Planning Perspective: The LEED for Neighborhood Development (LEED-ND)," *Focus: Journal of the City and Regional Planning Department* 5.1 (2008): 11.

more common for commercial buildings to obtain LEED certification than residences because they normally have access to a larger pool of funds. It is unusual for many single-family units to have the reserve to pay for LEED.

In addition, commercial buildings have more incentive to pay for the label because it is good for PR and the image of the company or organization. For example, the Wold science center on Union College's campus has LEED gold certification. This is advertised in the display in Wold, on Union's website, on brochures, and every guided tour for prospective students that passes through this structure. In return for making these green initiatives, Union College receives a positive image from being LEED certified. It attracts publicity and looks good to prospective students applying to colleges and their families. Although Union is a college, it is also a business. LEED provides a way to make green building something marketable and tangible in exchange for positive appearance. This is good in the sense that it encourages more commercial structures to build using resources efficiently, but negative in the sense that there are ways to achieve more credits instead of taking strong measures to truly improve the building. Some LEED credits earned do not necessarily reflect on the efficiency of the building. For example, four credits under the Sustainable Sites section were earned for "Alternative Transportation by being close to public transportation, a bicycle rack, parking for low-emitting and fuel-efficient vehicles, and the lack of a new parking lot to go with the building."¹² Wold did not earn these credits because they made the building more efficient it was simply the lack of constructing new parking and the location of

¹² "LEED-NC Version 2.2 Registered Project Checklist: The Peter Irving Wold Center," *LEED-NC*. Schenectady, NY 12308. 2011.

the site. Things such as environmental displays and bike racks can help accumulate points, but do not actually improve the “greenness” of the structure.

The Wold certification hints at a larger issue with LEED and the green product industry in general. This glaring problem is green washing and LEED is no exception. Green washing is used to describe products or services that appear to benefit the environment, but in reality are only partially beneficial. The words “green”, “natural”, “eco-friendly”, “organic” are all powerful marketing words. These terms are not regulated and so therefore can be used freely regardless of the ethics involved. As a result of these lack of regulations, living green is incredibly difficult because determining what actually has a low impact on the environment and what does not is challenging, which is an enormous barrier for the average citizen. Numerous products are sold, which are advertised as “eco-friendly” but in reality are hardly any different from the conventional product. There are companies that use the green movement to their advantage and create products that appear to meet those terms but in reality it does not even come close to truly having those qualities. In order to be more marketable, LEED can help corporations access funding to give their new building LEED certification and make it easy for them to achieve accreditation. For example, LEED has helped a casino in Nevada receive a multi-million dollar grant to achieve the title of a “green” building, although it contradicts many rules set by LEED. It allows indoor smoking and allows a bunch of small things to accumulate points such as bike racks, special parking for fuel efficient cars, cards that announce when housekeeping washes the towels, which do not actually

make a significant difference on the environmental impact of the building.¹³ The consumer must constantly be on the lookout and question the motives of corporations, because the unfortunate reality is that most of them are out to make as much profit as possible and often do not care about cutting corners.

LEED is truly one of the pioneers in the green building industry. This system has only been around for little more than a decade and it has already become well known and well respected. The idea is that building sustainably will help us achieve harmony with our society and our environment, but it still has a long way to go until we get there. LEED was created for people to build green for the right reasons with an added tag of standardized certification to attract people looking to live sustainably. However, this mark of greenness has lead corporations to build green for the wrong reasons, to increase PR, image, and profits rather than making the efforts necessary to reduce carbon footprint. The loopholes in the list allow the accumulation of credits for a higher certification level without the environmental consciousness required. When used by people that only want it for the “name,” these buildings are often no more efficient than standard buildings because the use of buildings, not simply certification plays a major role in environmental impact. The practices of LEED can be used as a guideline for green building in general, without the LEED label, especially since the process of certification itself is a major financial cost.¹⁴ It is unlikely that market power alone will reduce our carbon footprint through green buildings. There is too much greed and willing to cut

¹³ “In U.S. Building Industry, Is It Too Easy to Be Green?” *USA Today*, October 24, 2012.

¹⁴ U.S. Green Building Council, *U.S. Green Building Council*. U.S. Green Building Council, 1998.

corners. What can we do instead? If the market is not effectively transitioning to more sustainable levels of energy use and greenhouse gas emissions, then perhaps government mandates can make a difference. A combination of both could potentially lead to a greener future, but it is without doubt that we need something to increase regulation and give America a firm push towards sustainable living.

Chapter 3 – Solution to the Limits of LEED and Make Sustainable Building Mainstream: Regulation

In the past, when voluntary measures have not been enough to create a desired outcome, the government has stepped in to implement policies that require them necessary. In the housing industry, this can happen in the form of mandates, building codes, zoning and building permits. The government will only implement these regulations if the industry is not able to self-regulate and these actions are often avoided because Americans do not like regulation.¹ Currently, it does not seem like the industry is strong enough to quickly make building sustainably mainstream. However, local governments where most of this regulation occurs will not be enough to revolutionize green buildings.² Government involvement at higher levels will be a critical step in making the public finally aware and force people to abide by certain rules and ultimately avoid environmental crisis in the future. Government regulation will bridge the gap between those who have no idea about how to live green and those who make it their life's work. This fundamental change will become the basis of the future of society and critical in order to achieve a zero-carbon emissions planet.

Mandates could be one way to make sure that all future structures are built sustainably without exception. There is a lack of awareness of green building

¹ "Section 2: Views of Government Regulation," *Pew Research Center for the People and the Press RSS*. People Press, 23 Feb. 2012. Web. 04 Mar. 2014. <http://www.people-press.org/2012/02/23/section-2-views-of-government-regulation/>.

² Carl J. Circo, "Using Mandates and Incentives to Promote Sustainable Construction and Green Building Projects in the Private Sector: A Call For More State Land Use Policy Initiatives," *Penn State Law Review* 112 (2008): 731.

techniques and bias against them because of the traditional procedures ingrained by the industry. This is why a mandate makes sense because so many contractors have habitually been building the same way for decades. Implementing requirements would cause everyone to adopt new, more environmentally aware techniques. Mandates are difficult to pass because people are resistant to regulation in the private sector. Additionally, there is resistance to federal land use regulation, despite the inadequacy of local governments to manage this type of legislation.³ Currently, most building regulation is controlled at the state and local level so mandates would radically change the system. Creating mandates would hold the construction industry to a higher standard and all but eliminate the need for LEED and other green building rating systems, but potential green building mandates can only cover a small number of structures. Even with government regulation on building, there will still be private-sector obstacles to applying these by-laws. According to Circo, the federal government can be expected to support research, education, and monetary incentives for efficiency building and to be less inclined to mandate because buildings are regulated at lower levels.⁴ However, the government at the federal level has the power to bring about some of these changes through policies because they are less susceptible to pressures from developers.

Buildings codes are one of the most powerful regulation tools to achieve green building. What are the barriers to changing codes in order to promote more sustainable building? The Development Center for Appropriate Technology (also

³ Adam Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism*. (Cambridge University Press, 2001), 237.

⁴ Circo 2007, 9.

known as DCAT, a non-profit organization) developed a system called *Building Sustainability into the Codes* with its headquarters in Tucson, Arizona.⁵ Currently the non-green regulations in place tend to have a more detrimental impact on the environment than a positive one. This means the codes themselves are actually inhibiting green and sustainable development. Additionally, it is difficult to propose and establish alternative codes to the people that have the power to adopt them. There is a lack of communication about how to go about changing the codes and the systems involved that can modify them.⁶ DCAT's solutions include education about the detriments that current building practices have and that it is necessary to ensure that the benefits will be maximized. They also believe that multiple stakeholders should have more access to the revision of the codes and that organizations should take accountability for environmental impacts and protect the citizens.

Several sources support the fact that state and local governments can begin a movement to alleviate climate change. Green building codes would dictate exactly how the structure needs to be created and this would cause any new structures to adhere to these standards. This green building code for the state of California is the first of its kind. The state mandate California requires that they apply to all buildings owned by the state and must meet the energy efficiency standards of the state of California. California has always taken initiative when it comes to environmental issues such as air quality, and it is not surprising to see it taking the lead in this situation. They are similar to LEED standards in which they demand

⁵ David Eisenberg, Robert Done, and Loretta Ishida, *Breaking down the barriers: challenges and solutions to code approval of green building* (Tucson, AZ: Development Center for Appropriate Technology, 2002), 1.

⁶ Eisenberg et al, 2.

smart planning, high efficiency standards, the ability to more efficiently use water, the use of sustainable materials and techniques that allow them to be used more efficiently, and overall low impact on the environment.⁷ It includes a list of several terms and their definitions for clarification within the codes. The state explains that residential buildings consist of:

Hotels, motels, lodging houses, apartment houses, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities regulated by the Department of Housing and Community Development (California Code of Regulations).

The list goes on to include public schools and community colleges, historical structures, hospitals, and the implementation of gray water systems. The regulations apply to all buildings owned or subject to regulation by the state. There are two voluntary tiers within the system that go above and beyond what is required: Tier 1 is the standard that must be consistent with “Savings By Design, Healthcare Modeling Procedures”, which is available online. Tier 2 means that the structures must go beyond the descriptions in the manual by at least 15%.⁸

The California codes are broken down and give minute detail about what exactly fulfills the code. Introduced in 2008, these codes were mandatory as of 2010. There was a voluntary period in order to give local communities time to adjust. The Founding Chair and CEO of USGBC Rick Fedrizzi disclosed that LEED set the standard for green building and that it gives the state governments in general

⁷ California Code of Regulations. Washington, D.C: International Code Council, 2013.

⁸ California Code of Regulations, 18.

something to refer to as they write the new codes.⁹ LEED takes pride in paving the way for green building standards. The Californian codes are the rough equivalent of a LEED silver rating. They help require buildings to meet this standard without having to go through the hassle and expensive of being officially LEED certified. However, the fact that all buildings have to meet these standards leaves no room for doubt that the structures are as green as they claim to be.

Green zoning and building codes have already been a solution for other areas in the U.S. Boston has also initiative to participate in the green building movement by becoming the first city in the United States to implement municipal green zoning requirements through Article 37 of the municipal building code. This was put into effect on January 10, 2007. It creates a standard for large-scale projects and says that they must meet the LEED certification level of the Green Building Council.¹⁰ The Model Municipal Ordinance in New York is a guideline for sustainable practices such as building green and using wind and solar energy, while covering the legal loopholes that these ordinances inevitably create. Columbia has created a framework that is specific to New York but is broad enough so that other governments could adapt to them with some minor tweaking.¹¹ However, not all areas have been receptive to new sustainable building codes. For example, in Albuquerque, in 2007 a code stated that all developers have to include appliances that are 30% more energy efficient than the standard in new commercial

⁹ "California Adopts Green Building Code All New Construction," *GreenBiz.com*, N.p., 17 July 2008. Web. 03 Feb 2014.

¹⁰ "Green Buildings," *Official Web Site of the City of Boston*, City of Boston, n.d. Web. 17 Mar. 2014. <<http://www.cityofboston.gov/eeos/buildings/>>.

¹¹ "Center for Climate Change Law," *Columbia Law School*. Columbia Law School, n.d. Web. 06 Mar. 2014.

buildings.¹² The court overruled the green code saying that it obstructed the federal standards (although they are out of date and out of touch with regional climate differences). However, amendment to this type of federal law will be slow and relying on market incentives to change the codes will work better at present.

The people that create the codes come from a couple of organizations, which include ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers). They create codes that are called the Energy Standard for Buildings Except Low-Rise Residential Buildings. Another group is the International Code Council (ICC), which produces the International Energy Conservation Code (IECC). These non-governmental organizations are comprised of a group of experts on this topic. Their goal is to raise the minimum standards on building efficiency and do not label themselves as being sustainable codes.¹³ They research and reach a consensus about the codes, then update them every few years. The most important concern is the “building envelope” and how the outside environment affects the inside and vice versa. This is especially important regarding energy efficiency and making sure that the temperature inside the building stays constant using as little energy as possible.

Raising the codes higher than the standard is something that only California has done to create a policy regarding mandatory building codes. According to *The New York Times*, these requirements will reduce carbon emissions in the air by three

¹² Elliot Harvey Schatmeier, "Avoiding Albuquerque: How Incentive-Based Green Building Codes May Regulate Appliance Efficiency Standards and Avoid Federal Preemption," *Columbia Environmental Law*. Columbia Journal of Environmental Law, 19 Dec 2012. Web. 06 Mar 2014.

¹³ Thomas Hutton, "Toward Better And More Uniform Building Efficiency Codes," *Virginia Environmental Law Journal* 28.1 (2010): 121-172.

million metric tons by 2020.¹⁴ California's environmental regulation and emission standards are notoriously tougher than what is required by the federal government. If all 50 states adopted similar green building codes to California, the result could be astounding. This could cause the US to become a world leader in the reduction of carbon emissions and make a dent in mitigating climate change. However, not every state is as liberal as California and it will take other states such as New York to become a leader before it becomes widespread throughout the US. This will help convince much more conservative states, such as the Midwest, to adopt these policies.

Why not focus on change at the local level? If a modified code is proposed, it will often be shut down if there is "conflict with the intent of the code" and if there is not enough explanation about the safety of the new environmentally friendly method. This happens so often that it is likely there are other reasons why these requests are not approved. Local engineering and zoning boards are concerned with the lack of evidence supporting these new green techniques because the old ones have been around for so long and know that they work. Even when the methods are certified and proven safe by authorized engineers and architects, it is still problematic to get them approved because of preconceived notions and judgments about them. The boards do not want to take the time to verify the research and proof they have been presented with or do not have the skills necessary to determine whether these techniques are actually a viable alternative.¹⁵

¹⁴ "California Adopts Green Building Codes," *Green Blogs New York Times Comments*. N.p., 15 January 2010. Web. 03 Feb. 2014.

¹⁵ Eisenberg et al, 21.

In addition, there are code provisions that actually make it harder for some green practices to get approved. In many cases, the proposed alteration is too much like the original and the proposition gets thrown out. When requests are submitted, regulators often evade them because they do not want to seek out the other information necessary to support the proposed codes.¹⁶ Improving the process to propose new codes will open up significant opportunities for more efficient options.

Although changing the codes is challenging, there are ways to get around the obstacles that the system presents. To make them more likely to accept the new proposals, adequate research must accompany the new recommendation because otherwise regulators will just assume that there is no information or literature available to support it. Having good communication with the code officials is important because it makes them more likely to accept the proposals when there is frequent contact as opposed to being difficult to work with. Networking with other people that have the power to make changes raises the chances of the support of future proposals that concern efficient products and projects.¹⁷

Green zoning laws would change the way people permit land to be developed. This would ensure that developments on untouched land would be minimal. Making sure that land use is smart is essential. In order to zone effectively, sprawl needs to be reduced and density needs to increase.¹⁸ Many zoning codes actually inhibit environmental initiatives. Some current zoning actually does not allow the installation of solar photovoltaic panels on rooftops of

¹⁶ Eisenberg et al, 22.

¹⁷ Eisenberg et al, 22-23.

¹⁸ Chris Duerksen, "Saving the world through zoning," *Planning* 74.1 (2008): 28-33.

residential homes or the construction of wind turbines. This is mainly because people do not like the aesthetics of seeing pieces of metal on someone's roof or wind turbines on the horizon. For example, although Nantucket and Cape Cod would be ideal places for wind turbines, there has been a debate about erecting them because the residents do not want their view of the ocean obstructed. However, 86% of the residents of Massachusetts and 74% of the residents of Cape Cod were in support of the project and the creation of renewable energies in the area. The people that own the expensive waterfront property are afraid that the wind turbines will disrupt the aesthetic appeal of Cape Cod and Nantucket and therefore have a negative effect on real estate prices of that region. These people are not against renewable energies but have adopted the "not in my backyard" mentality. In other words, wind energy and turbines are essential for our future in sustainable power sources, but they do not want them where it might obstruct their view.¹⁹

It is necessary for zoning to be up to date with climate change looming on the horizon. Zoning regulations have created some new mixed-use developments. This can help reduce the commute times between frequently visited places such as grocery stores, shopping centers, schools, and even jobs. It cuts down on the carbon emissions from these trips. Good zoning can promote more walking and better health in a nation that is plagued with obesity, diabetes, and other diseases.²⁰ Proper zoning will encourage energy conservation and lower carbon emissions.

¹⁹ Peter W. Fulham, "Cape Cod Wind Farm Controversy Still Roiling Nantucket Sound," *Politics Daily*. Politics Daily, June 2010. Web. 04 Feb. 2014.

²⁰ Duerksen, 31.

Zoning can work with mandatory building codes to back up the effort to build sustainably.

According to the USGBC website, it works with areas that have mandatory green building codes, which become the new minimum for the system and combined with voluntary rating systems people can improve structures more effectively.²¹ The mandatory codes necessitate the things that everyone must adhere to, and the voluntary measures are things that people can do to make the buildings even better. This leaves room for improvement because it is difficult for people to employ changes that are too radically different or too hard to adjust to. Mandatory codes support the creation of sustainable building codes using LEED's guidelines. By raising the minimum requirements for codes, this in turn will raise the standards for LEED, as it is intended to give credit to buildings that go above and beyond the minimum. LEED is updated every few years to keep up with the changing and adjusting to new standards and research. The LEED rating system sets an example for public and government owned buildings to follow, including schools, hospitals and public housing. The next step is in the private sector where commercial buildings voluntarily take steps to promote sustainability and reduce their carbon footprint. As a result, the International Green Construction Code decides on a mandatory baseline for commercial buildings (which excludes most residential

²¹ Jeremy Sigmon, "As Green Building Codes and Standards Emerge – Where Do We Go from Here?" *U.S. Green Building Council*. USGBC, 15 June 2011. Web. 04 Feb. 2014.

homes) based on techniques and efficiency methods that have been proven to make a difference in the effectiveness of the structure.²²

Although California has advanced codes and regulations on the types of construction in the state, numerous states have little regulation or have a lack of it entirely. Some states have no mandatory codes concerning energy efficiency including Alabama, Arizona, Colorado, Hawaii, Illinois, Kansas, Oklahoma, Mississippi, Missouri, North and South Dakota. In fact, some are “home rule” states that specifically do not allow state governments to impose regulations on construction and must be left to local governments.²³

The reason why nationwide codes are an appealing way to mitigate climate change is because making energy efficiency mandatory can have a huge effect when put on a large scale. This puts a blanket requirement on all new buildings without exception. It is difficult to make energy saving habits make a difference as an individual, but if everyone had these habits there would be a massive decrease in carbon emissions. It eliminates confusion pertaining as to whether some practices are actually working, or if there is other information out there that would be more of an improvement. Making building codes demand more efficiency is the “low-hanging fruit” that will make a substantial difference in terms of carbon emissions for little investment, especially if these measures are implemented at the beginning of a construction project.

²² Jeremy Sigmon, “As Green Building Codes and Standards Emerge – Where Do We Go from Here?” *U.S. Green Building Council*. USGBC, 15 June 2011. Web. 04 Feb. 2014.

²³ Hutton, 129.

Climate smart communities are another piece of the puzzle that can contribute to improved land use. Communities can turn to codes as part of climate change adaptation. Current actions are on a small, local scale and occur because a community wants to take part in mitigating climate change. These communities recognize that climate change is not a debate but is happening. Communities plan, organize, and build in such a way that functions well in the short term, and will be able to adapt to the changing climate of the long term. Green building codes would help strengthen these types of plans even further and should be considered in the near future. In the Capital Region (which includes Albany, Columbia, Greene, Rensselaer, Saratoga, Schenectady, Warren, and Washington), the New York State's Cleaner, Greener Communities Program was revealed in 2011. The goals of this program are to incorporate sustainable land use policies, invest in smarter infrastructure, and allow growth with minimal impact on the environment. In order to meet these goals the program needs the cooperation of many types of organizations and decided to form committees called Climate Adaptation, Economic Development, Energy, Food Systems, Land Use and Livable Communities, Transportation, Solid Waste, and Water.²⁴ The community enacted this plan so that the results would be seen in terms of energy efficiency, a lower carbon footprint, more availability for green job opportunities, and the increased use of renewable energy.

According to Wilson, the plan is going to have five main concerns for the Capital Region. First is to create agendas that will help the community prepare for

²⁴ Steven Wilson, "Capital Region Sustainability Plan," Union College Climate Change Conference. 24 January 2014: 15.

and adjust to the impending climate change. Second is a plan to create more public friendly transportation modes, which will incorporate safer walkways for pedestrians and bike paths, while discouraging the use of cars for commuters. Third, there will be more opportunities for residents to purchase food and other merchandise produced by local farms and businesses. Fourth is to enact ways to combat poverty and provide job opportunities. Fifth is to make city areas more attractive and up to date in order to resist urban sprawl.²⁵ As part of the Cleaner, Greener Communities Program, the Capital Region also has a plan to attack greenhouse gas emissions from its two greatest contributors. Fuel and gasoline use for transportation is the biggest factor because of the Capital Region's low density and numerous roads and thruways. Emissions from residential and commercial buildings are another, which we can hopefully mitigate through better urban planning.²⁶

State organizations are providing funding to work towards making the aims of the climate smart communities a reality. New York State Energy Research and Development Authority (NYSERDA) is helping the Capital Region meet their goals through a land-use toolkit. The toolkit helps communities figure out what are the most practical and necessary steps, and identify what is the "low-hanging fruit" in their area. It tailors climate change adaptation techniques for the specific community.²⁷

²⁵ Wilson, 16.

²⁶ Wilson, 16.

²⁷ Veda Truesdale, The Climate Smart Communities Land-Use Toolkit, Union College Climate Change Conference, 24 January 2014: 17.

The mandatory route for green buildings adds another dimension to the success of this plan to mitigate climate change. It is unlikely that LEED will be able to make the transition to sustainable building on its own and that it will take government and local organization action to make this a reality. A combination of mandates, green building codes, zoning, and voluntary and mandatory certification could provide the strength that we need to push towards being a carbon neutral society. Climate change is approaching and we know that we need to somehow offset these problems to improve our future. Now we need a policy that is realistic but aggressive enough to accomplish what we need to. It cannot be so difficult and foreign that it is too unlikely of a possibility.

Chapter 4: What should the current policy be on sustainable building?

Making the shift to building green has drawbacks because first there must be initial fundamental structural changes to the system, which can be costly. It is challenging to get general infrastructure updated and replaced by the time it needs it, let alone trying to implement a new design of infrastructure. Most of the infrastructure in the United States has been around for decades and is in dire need of updating, but it is usually one of the things that are last to be renovated. The reason is that no one wants to pay for the cost to fix or replace infrastructure because if it is still functioning, there are other things that many can be channeled into. Infrastructure is one of those crucial things that is often overlooked and neglected and no one thinks about until something drastic happens and people are forced to update infrastructure. Many businesses are reluctant to change their practices that have been ingrained and that they know are reliable and predictable. Learning new practices also contributes to delays in construction. However, governments that desire to make the changes towards a greener future need to impose these requirements in addition to taxing and fees because the voluntary mechanisms simply are not effective on a large enough scale.

Creating more efficient buildings is without a doubt critical for our future. We cannot expect that the majority of homeowners will take the required actions without some type of incentive or guidance due to upfront costs and the long horizon for return on investment. Some of the policy strategies tried in the past include regulation, financial incentives, tax breaks and returns, subsidies. Some of these things are already in place in some states. We can look at the effectiveness of

them and how they are working presently. Some of them work well and others are under-utilized, which diminishes their success rates. By doing this, we can in turn look at the flaws and limitations of these policies to explain why they are not as effective at shifting the way buildings are designed and built. The next step is to look at the big picture and figure out how to combat the obstacles to making building efficiency mainstream.

As discussed in the last chapter, more regulation is necessary if we are to move forward with making sustainable building a realistic goal for the future. People such as scientists, planners, and architects are often the most informed about what regulations on building should consist of, but often do not have the power to put these into effect. The people that do have this power include builders, public officials, and homebuyers, however they usually take environmental considerations into account only in monetary terms. People looking to buy homes like having the ability to choose from a wide array of options and the reason why they do not support regulation is because those constraints will limit the available options.¹

A common problem with passing more laws is that most Americans are anti-regulation. The Republican Party in particular makes it difficult to pass a lot of legislation.² The legal system makes it so that it takes a long time to get approval for a bill and it can take years to go in and out of Congress. Even if a law does get passed, loopholes are created to allow people to continue to practice what they have always been doing. However, we must look into regulation as an option to work

¹ Rome, 268-269.

² "Section 2: Views of Government Regulation," *Pew Research Center for the People and the Press RSS*. People Press, 23 Feb. 2012. Web. 04 Mar. 2014.

with for a sustainable future, because without regulation there will be chaos. We will be unable to meet many of our goals, one of the most important, reaching a zero carbon emission future. One of the biggest challenges to the regulation of building is that if the change is too big or too drastic, it will be strongly opposed by the people because they will see it as too daunting and impossible to comply with the new rules, and it will be easier for the people to simply advocate to get rid of them.

As described by Rome, rural landowners are strong opponents of land-use regulation. They have long believed that owning land gives them economic power and they are reluctant to give up that power. However, they are supporters of subsidies and tax relief to reduce costs for farming while the surrounding area becomes urbanized. Many rural farmers that resist regulation believe, “If a man’s home is his castle,’ a rural Pennsylvanian explained, ‘then his land is his fertility. To take away his rights in the land is nothing less than castration.”³

Americans generally respond well when they know there are financial and economic benefits involved. Most contractors think of the upfront cost as the most important compared to the long-term cost benefits.⁴ The main objective of a subsidy is to encourage people to adopt practices conducive to meeting the end goal of creating a more efficient building. Hopefully, if enough people begin to follow the requirements needed to bring the prices of these goods and services down, they will become more widely adopted and eventually the subsidies will be unnecessary. That is the ideal goal of the subsidy, but in reality it hardly ever follows that path.

³ Frank Popper, *Politics of Land-Use Reform*. Madison: University of Wisconsin Press, (1981): 211. As quoted in Rome, 268.

⁴ Benjamin S Kingsley, "Making it easy to be green: using impact fees to encourage green building," *NYUL Rev.* 83 (2008): 544.

There is usually not enough funding for the people who would actually put the funds to suitable use, because people that do use the subsidies would have taken the sustainable route anyway. There are subsidies available to people that build with eco-consciousness, but there is a lack of standard to dictate how much funding a project can receive and what sustainable initiatives must be taken. There are programs in Seattle and Portland (two progressive areas in environmental protection) that provide subsidies in the name of building green. However, they only cover the cost of getting certified through a system like LEED and ignore the costs of designing the building and actually constructing the green building.⁵

There is a lack of funding to fuel the subsidies in order to have a significant effect as a result.⁶ The budget deficits that many states have hold them back from providing more funding towards these types of expenditures. The funding that can be used towards a green subsidy is usually not enough to meet the bulk of the original cost of the project. Another setback is that the people making use of the subsidies would have taken the same measures towards building green even if they did not have funding sponsorship. This is called the “free rider” effect and undermines the intentions of a subsidy and basically makes them ineffective.⁷ A penalty combined with a subsidy would work better by penalizing companies that do not build green, and then use the money from that to aid companies that do build green until there is enough demand to make the cost come down and make the subsidies unnecessary. The money would become revenue and would not take

⁵ Kingsley, 546.

⁶ Kingsley, 545.

⁷ Kingsley, 546.

away from the budgets that could be designated for other important projects.

Voluntary programs that provide subsidies have not significantly increased demand enough to be competitive with conventional building.⁸

A way to help provide funding for sustainable building cost involves tax increment financing. Tax increment financing (called TIF) is when the developer collects the taxes from the increased value of the property as a result of the new development that their company created. This money counts towards the costs of the developer to implement new infrastructure for a certain period of time.⁹ Some states use this to make developers create efficient and suitable infrastructure quickly. The private development of infrastructure using TIFs would help raise neighborhood property values. A more widespread use of TIFs could result in more sustainable design of infrastructure. Since TIFs are most often used to fund the advancement of infrastructure because they generate their own source of revenue, the funds could be used to make the infrastructure greener. TIF investment could be applied to the development of sustainable infrastructure. This would make TIFs successful in promoting green building.¹⁰

Since 1960, the local governments in Florida have wanted to make the development community to take responsibility for financing infrastructure instead of the local governments taking responsibility for it.¹¹ They have used this strategy to achieve that. This way, when builders construct new development, they have to

⁸ Kingsley, 543.

⁹ Julian Conrad Juergensmeyer, "Infrastructure and the Law: Florida's Past, Present and Future," *Journal of Land Use and Environmental Law* 23 (2008): 441.

¹⁰ B. Baker, Richard Mahé, Kaeley Wiseman, and D. van Vliet, "Green infrastructure networks as urban connective tissue," *Plan Canada* 49, no. 1 (2009).

¹¹ Juergensmeyer, 449.

make sure the necessary infrastructure is in place to make the development functional. It avoids future problems by making the infrastructure and the development a package deal. That way there is not a beautiful new development that is rendered useless because of the lack of infrastructure available and implemented or the town is not stuck building it. This is now a prerequisite for getting permits for development. In the absence of TIFs, developers have been required to pay fees so that the government can use the money and land to build infrastructure. These necessities are important because infrastructure is so essentially imperative and it is always difficult to figure out who will fund it.

Another example that closely relates to impact fees is putting a tax on the negative environmental effects of non-green building construction creates a tangible responsibility for impacting the environment. This reduces the adverse externalities and gives them a cost. Therefore, by comparison, more efficient practices will cost the same, if not less than the conventional practices. This is called a Pigouvian tax. The tax raises the total price of the good and if therefore lowers demand, creating a loss of production. However, this is beneficial because the new policy will take the externalities into account. Pigouvian taxes help balance out the costs versus the benefits of building. It makes the conventional building more expensive because it then places a cost on outliers. This means that the conventional methods are too costly and not worth it to society to keep using. These are more beneficial than requirements because requirements can unintentionally impede some sustainable building. However, with this approach there will be a shift towards the more sustainable practices for economic reasons.

This is especially important for the people that have no interest in sustainable building for the sake of sustainability. Most people will always choose the most cost-effective option. By creating sustainability as the cost-effective option, these clients will be more inclined to side with the sustainable method.¹²

One method of mitigating the problem of development on new land is to impose an impact fee for private developers and then channel that money into subsidies for builders that develop efficiently. This approach places an extra cost on developing new land and the creation of sprawl, therefore making the green option cheaper. Avoiding sprawl and promoting density is one of the most important aspects of green building. A number of factors would be considered, such as the energy efficiency, water, sewage, and transportation that would also be necessary in developing a new site. The costs would balance themselves out because then it would make more sense economically to automatically use resources efficiently.

The problem with impact fees is that it is difficult to convince local governments to implement them because of laws that are currently in place. The fees would have to be tested for substantive due process, which means that it would be decided if the fees were helping to meet the goals of the state. Then it would have to be determined what the correlation is between the money made from the fees and what the money is used for. Lastly, the fees would have to equal and match the cost of the effects of the development on the land.¹³ This is one of the most important aspects because the costs of environmental externalities are never factored into the original cost of a product or service. If the government could

¹² Kingsley, 549-550.

¹³ Kingsley, 533.

impose fees that do place a dollar amount on these negative environmental effects, it would seriously discourage people from continuing those types of practice. In fact, it would create a push towards greener practices and sustainability because these options would be economically more appealing by having lower costs. Imposing a resource consumption tax would make developers and clients to internalize the externalities created by development. As a result, demand would increase for more sustainable buildings and therefore resource consumption would be reduced.

Requirements (such as building codes) have positive but can also have backlash effects. They are usually fairly rigid without much room for change. It causes developers to only reach the minimum for what the code requires instead of what makes the project the most cost-efficient. It also makes it difficult to allocate resources to different areas of the project if regulations require that a building must have a certain baseline of energy efficiency, which, for instance, could mean fewer resources for water efficiency.¹⁴ It is arduous to even get state and local governments to adopt new requirements and regulations because the process is not conducive to amending the currently existing rules. Even if new requirements are successfully passed, there will inevitably be uproar from several groups of people including developers, consumers, and manufacturers. Harsh approaches that radically change the process of the way things are done are generally received with less enthusiasm than tactics that have obvious benefits such as monetary returns.

Providing incentives to give sustainable building appeal is another challenge. Seattle has a system in place for financial incentives concerning sustainable

¹⁴ Kingsley, 548.

building. One example of this includes grants for the setup of water efficient systems in commercial buildings as a result of the collaboration of the local government and the public utility companies.¹⁵ Another method is getting financial assistance for LEED certification as part of the LEED Incentive Program. The LEED incentive program is something that is adopted by different cities and towns to give monetary amounts to people who want to build green. For example, the City of Burbank Water and Power (in California) accepts applications for this funding. For a certified level the maximum amount that can be obtained is \$15,000. For the silver level the amount of \$20,000, for a gold level it is \$25,000, and for a platinum level it is \$30,000.¹⁶ Another example of an incentive in Seattle is the provision of money that goes toward the protection and improvement of watersheds, streams, and rivers, which can be financed up to \$50,000 as part of the WaterWorks Grants program. Additionally, revamping irrigation systems that currently exist and are no longer efficient is covered as part of the Water Efficient Irrigation Grants Program.

Another aspect of these incentives includes raising the energy efficiency of existing structures by using energy conservation incentive programs for commercial clients. Canada has a system called Model National Energy Code for buildings, which offers a method that would help make sustainable building in Canada more feasible. This is aided by subsidies in addition to taxes that are put on practices that contribute negatively to the environment. The European Union has monetary aid

¹⁵ Nancy J. King, and Brian J. King, "Creating Incentives For Sustainable Buildings: A Comparative Law Approach Featuring The United States and the European Union," *Va. Env'tl. LJ* 23 (2005): 397-479.

¹⁶ "LEED Incentive Program," *LEED Incentive Program*. City of Burbank Water and Power, 2013. Web. 25 Feb. 2014.

for building green and uses it in the form of building assessment tools (like BREEAM), regulation in building codes, financial incentives such as subsidies and environmental taxes.¹⁷ As we have discussed in this chapter, although tax breaks provide incentive for people looking to build sustainably at an affordable price, tax breaks and subsidies in particular are not a strong enough tactic to make changes significant. This is because subsidies have not been adequately funded to be effective or provide rapid results. Judging by the fact that the European Union does not rely on tax breaks to make their shift to green building, they have recognized their limits. By contrast, in the United States, tax breaks are more common and available than anywhere in the European Union. Other types of financial incentives are lacking in the United States and these fiscal motivations are not as widely accessible to commercial and individual clients as they are to people who live in the European Union.¹⁸ The European Union has a system in which it gives incentives to encourage green building by engaging stakeholders, and to get certified through green building assessment systems such as BREEAM. They also have codes and regulations that are consistent with sustainable building practices. They offer subsidies for people that build sustainably and taxes for people that do not build with eco-consciousness.

Other financial incentives in the United States that promote sustainability include encouraging businesses to invest in better development of environmental technologies. However, there is no obligation for corporations themselves to undertake any sustainable practices, technologies, or designs in order to receive the

¹⁷ King and King, 10.

¹⁸ King and King, 1.

monetary grant by the government. Their support is strictly based on investment in research and development. The federal government also encourages corporations to invest in renewable energies, most importantly solar and geothermal energy systems. They provide subsidies to people that install solar panels and use geothermal technology in corporate buildings. Other general benefits include complying with energy efficiency tactics and receiving income tax credits, income tax deductions, or property tax reductions. The states that partake in doling out these benefits are Hawaii, Maryland, Massachusetts, Montana, North Dakota, Oregon, Texas, and Utah.¹⁹

Oregon has a unique policy concerning tax credits and sustainable buildings. It has what is called the Oregon Sustainable Buildings Credit and what makes it so different is that it is transferable to another taxable entity. This means that non-profit organizations can use them as an incentive when they otherwise would not be able to use them. In addition, if a company does not use the tax credit within the allotted time frame they will not lose it. Currently, there are no other states that agree to the movement of green tax incentives to other taxable units besides Oregon. Businesses can benefit because they will have more time to use them if they are unable to use the tax credit before the year is up.²⁰

Encouragement of environmentally friendly construction is another aspect of sustainable building, for which the government (on federal, state, and local levels) gives financial incentives. These are usually shown as tax incentives or grants for the building industry. The government may show the industry an indirect benefit,

¹⁹ King and King, 5.

²⁰ King and King, 8-9.

such as less “red tape” surrounding other government rules and regulations that the businesses would otherwise need to follow. If they do not have as much red tape, this could save them substantial amounts of money that ideally would have been channeled into the green building initiative and used to make the buildings more efficient.²¹ Currently, a “green building tax credit” is not in place anywhere however innovative it is. Current tax incentives for efficient construction are more narrowly targeted and mean that the energy systems are designed to be more effective. There is more incentive to invest in renewable energies as opposed to other aspects of “green.” Tax credits take the next step in building sustainably. Energy efficiency and renewable energy sources are important, but improves the air quality, the health of the occupants, and pays attention to the community outside the individual building and works in as close to harmony with it as possible. New York, Maryland, and Oregon are the three states that have tax incentives available for sustainable buildings.²²

Municipal Energy Financing is another useful tool that will help people learn how to live more sustainably. Berkley FIRST offers the up-front funds for people to buy systems that convert solar energy to electricity for their homes and other buildings, as well as other energy-efficiency advancements. This is unique to Berkley FIRST because most other programs will not provide the up-front cost for these systems, but will offer a rebate. A proper owner can fill out an application for the program and pick a project such as a PV solar system, solar thermal system, add

²¹ King and King, 7.

²² King and King, 18.

insulation, new ducts, seal building shell leaks, replace furnace or AC unit.²³ This is one system to encourage people to make efficient home improvements.

The U.S. federal government has begun to utilize LEED as a standard to provide economic incentives for general green building including tax credits, rebates, low-interest loans, mortgage for energy-efficiency, and financing the initial cost of some green projects through LEED. The low-income weatherization assistance program helps people implement energy saving techniques in their homes in order to reduce the amount of their income that is spent on energy bills.²⁴ Tax credits for smart growth are also awarded as locationally efficient mortgages (LEMs). LEMs take into account that the resident lives in a neighborhood that is compact with less sprawl, and allows people to take out larger mortgages.²⁵

Many methods of making green building more popular are already in place. There are already some subsidies available for people who install solar panels and obtain LEED certification. However, there is frankly not enough funding for them and not enough people make use of them. Many people who apply for a subsidy are people that would have purchased the solar panels anyway, without the subsidy, which is not supposed to be the goal of subsidies. Comparing how the European Union uses financial incentives to promote sustainable building instead of using tax credits is intriguing because tax credits in the United States offer little stimulus to the green building movement. Part of this is attributed to how the United States

²³ Merrian C. Fuller, Stephen Compagni Portis, and Daniel M. Kammen, "Toward a low-carbon economy: municipal financing for energy efficiency and solar power," *Environment: Science and Policy for Sustainable Development* 51, no. 1 (2009): 22-33.

²⁴ Marilyn A. Brown, and Frank Southworth, "Mitigating climate change through green buildings and smart growth," (2006).

²⁵ Brown and Southworth, 22.

government works – it has always been a country that firmly believes in the free market and economic supply and demand. Until the supply of sustainable building is high enough for the demand to match it, we will still struggle to make the transition from conventional building to low-environmental impact structures.

Chapter 5 – What to do from here?

Revolutionizing the building industry will make huge strides in mitigating climate change and other environmental issues. Since buildings are one of the largest segments that contribute to carbon emissions, tackling this sector will significantly lessen this environmental burden. The LEED rating system has opened doors to begin the sustainable building movement and has proven itself a leader in setting the standard for green buildings. Some state governments like California have mandatory criterion equivalent to different certification levels of LEED for newly constructed buildings to meet. However, more steps need to be taken to make this truly groundbreaking.

Like any system, naturally LEED has some considerable flaws that hinder the progression of green buildings. One of the largest obstacles is that the LEED system does not take climate into account. The credit system for each type of building is the exact same in Arizona as it is in Maine. Clearly, it is not difficult to understand that a building in Arizona should not be constructed the same way as it would in Maine. The climates are drastically different, as Arizona is part of the Southwest and has a hot, dry, and sunny climate, while Maine is in the Northeast and receives much more rainfall, has a long cold season, and more cloud cover. LEED should improve its system to have enough flexibility to design a building specific to its climate, as a sizable amount of resources go towards heating and cooling indoors.

Additionally, not all credits are created equal. Each point earned towards sustainability counts as one credit. This creates inequality because a water efficient system equals one credit, a bike rack equals one credit, and the absence of needing

additional parking is worth another credit. The water system probably costs the most, a bike rack considerably less, and not paving another parking lot has zero cost. Yet, to LEED, all of these credits are equivalent to each other. If California mandates that all new buildings must have comparable qualities to LEED Silver rating, this does not necessarily mean the building is significantly more efficient. LEED has been a good benchmark, but now it is the time to reexamine the integrity of some of the credits. Using LEED as a guide puts the building industry at an advantage, but it is important to be able to identify and remedy the flaws in the system. A better policy for California would be to scrutinize the LEED system checklist, add ramifications for buildings that are solely constructed in California, and re-prioritize the credit list so that the most important things are worth more (energy efficient lighting systems) than the aspects that do not demand as much effort (bike racks).

Buildings are not already more sustainable because many Americans know little about efficiency and lack the interest or incentives to improve efficiency in their daily lives. A combination of factors will be necessary to shift the construction industry. They include raising awareness, educating children and adults, making information more widely available, building political support for these programs, and implementing new codes and regulations to make the shift mandatory. Soon, it will no longer be an option to choose between sustainability and conventional inefficient use of resources.

Many Americans lack knowledge about sustainability and how important it is. Education about building environmental impacts is a necessary step to changing how people view resource conservation. A way to introduce this is to start making

environmental education more standard in schools. It is critical to convince children as well as adults that environmental issues are significant and that everyone can make a difference. There are a myriad of things people do every day that have a negative impact on the environment without even realizing it. Making new public school buildings greener and more resource efficient is a start. Environmental classes would help young students learn how to use them and reduce impact in other aspects of their lives, however a large barrier is that it often does not fit with the testing regimen for a school.

Convincing schools that this is an important part of education for children is another important step. Therefore, this would hopefully be more likely to translate to more environmentally friendly habits at home as well as visits to libraries, offices, and other frequented buildings. It has been proven that when children learn values at a young age they are more likely to retain it throughout their adult lives. Therefore, it makes sense to teach environmental consciousness at a young age. According to Stephen Sterling, “we are educated by and large to ‘compete and consume’ rather than to ‘care and conserve.’”¹ The majority of people do not know how to how to live sustainably since they have become used to living unsustainably. It is up to the education system to help change that. Although this is a more long-term approach, it is not meant to be a solution on its own, but to work in conjunction with the other types of policy methods. It will allow the next generation to understand the necessity of the policies and permit them to remain in place.

¹ Stephen Sterling, "Sustainable education," *UK: Green Books Ltd* (2001).

There are a number of small approaches that we can use to work towards making a difference. They are lax enough that they do not cause too much opposition. Many of these things work towards raising awareness, encouraging the use of LEED for commercial and municipal buildings, or that permit applications must show that the plans for the building take sustainability into account. Providing information and educational displays and websites are another tactic that can contribute to promoting green building.² It counts as a credit on the LEED checklist, while does not directly make the building any more sustainable, it helps educate its occupants about green habits and efforts they can make while using the building. Although these methods do not involve a substantial amount of funding they still do require some money and resources.

Advocating for environmental causes is daunting and exhausting work because most people do not understand the issues. Once citizens are educated about the heavy risks and impacts it is a little easier to take consequent action. Making information more widely available should increase awareness and decrease apathy regarding efficiency and the reduction of environmental impact. Achieving this can come through the cooperation of local businesses and policy makers that promote sustainability and actively support it. If children grow up being taught that environmental issues are important, more of the population will be more likely to adopt legislature that puts more requirements into effect. Part of the reason why there are not more environmental mandates is because most people do not fully

² Carl J. Circo, "Should Owners and Developers of Low-Performance Buildings Pay Impact or Mitigation Fees to Finance Green Building Incentive Programs and Other Sustainable Development Initiatives?" *William & Mary Environmental Law and Policy Review* 34 (2009): 55.

understand the ramifications of harming the environment. More education is needed for more people to be on board with necessary changes in legislation. The history of environmental education shows that when environmental problems change, perceptions on sustainable education change and support has grown over the years.³

A large component will be government cooperation. If legislation changes the way buildings must be constructed, there will be a great deal more turnover from conventional buildings to efficient green buildings. The industry needs an authoritative push to get this movement going. One way to do that is to require that all publicly owned newly constructed buildings must reach a certain level of efficiency. Doing so will gradually make green buildings mainstream and more feasible for homeowners to get accustomed to. It is clear that voluntary measures are not strong enough on their own. It makes sense to pair the voluntary methods with some mandatory conditions.

The public and private sectors will need to work together to further policy better than either one on their own by combining the two sectors. Voluntary changes work better for the private sector because people like having power over shifting the market. This means that they like to choose from an array of options. If the sustainable options happen to be more appealing than the inefficient ones, this is how the market will ideally change. This is why tax breaks and returns and subsidies are appealing because they offer private financial return from the

³ Daniella Tilbury, "Environmental education for sustainability: Defining the new focus of environmental education in the 1990s," *Environmental Education Research* 1, no. 2 (1995): 195-212.

government for making sustainable choices in building. People argue that building green is “too expensive”, but people who build homes have above average incomes. People who construct new houses have a civic duty to help protect the environment if they choose to develop otherwise untouched land. However, they do not always see it that way, which means that mandates are necessary. Some mandatory changes are favorable because it forces people who would not normally choose environmental options for their homes. This creates a larger group of people participating and using resources efficiently therefore creating a greater impact than the voluntary measures on their own.

Taxes put on non-green construction that contributes to waste and inefficiency make sense because these practices appear to have a lower cost but when the cost of harm to the environment is factored in it takes into account the whole cost. The Pigouvian tax example described by Kingsley says that if an industry costs ten dollars of negative impact to society for every ton of air pollution, then the industry would need to pay ten dollars for every ton of air pollution it creates.⁴ In the green building industry, taxes could be used on anything that causes environmental harm. Common things that could have a tax include constructing on undeveloped land, inefficient uses of water and energy, and the use of materials that off-gas. Taxes are controversial but they can be beneficial especially if they are used to fund public projects that would otherwise have no sponsorship. Policy should ensure that this revenue helps lower the cost of using these newer and more resource efficient strategies at the commercial level instead of the individual level.

⁴ Benjamin S. Kingsley, “Making it easy to be green: using impact fees to encourage green building,” *NYUL Rev.* 83 (2008): 549.

A good portion of the revenue should also benefit research in order to further develop technologies to help society reduce environmental impact such as solar and wind energy. Ideally in the future, these energies would be good enough for building use in commercial and residential areas. The research field for green technologies desperately needs public funding.⁵ Greater development on technologies to make everything within buildings more efficient is invaluable especially in light of the energy crisis and impending climate change. With more research and more planning it will be easier to make buildings use resources as efficiently as possible.

The green building movement has begun. As the population grows, demand will grow for more types of buildings commercial, residential, etc. Therefore these buildings will need to have the ability to conserve and use resources most efficiently. The resources and innovation are already available to make this a reality. Updates to the programs to make them more current will help individual people use the voluntary programs more effectively, and state-wide, if not federal requirements for building codes and zoning will help meet the goals of creating new sustainable buildings. LEED has been established as one way to help buildings meet these goals but restructuring and updating requirements to tailor to specific areas of the country will prove this an even more powerful tool. Although the movement has only just been born, it can be said with confidence that in the not too distant future, America will be looking at a nation that is nearly uniform in its ability to use resources efficiently and innovate new green construction for years to come.

⁵ "The Funding Gap," *Sustainable Development Technology Canada*, N.p., n.d. Web. 17 Mar. 2014. <http://www.sdtc.ca/index.php?page=the-funding-gap>.

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