Analysis of Green Job Training and Smart Roof Programs in Columbus, Ohio

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1.0 Executive Summary

The following report was completed as a 2015 capstone project for the Ohio State University program of study Environment, Economy, Development, and Sustainability (EEDS). Authors Jack Bowman, Elizabeth Greenslade, Ellen Grunewald, Nicholas Julian, and Laura Kington, are all seniors in the EEDS majors in the Sustainability and Business (Greenslade and Grunewald) or Community Development (Bowman, Julian, and Kington) specialization. The project was conducted from January to April 2015, utilizing key informant interviews, government and organizational reports, and other web resources.

This report seeks to address Green Memo III Goal B, Objective B.1, actions 3 and 5: green energy job training and smart roofs programs. To do so, we followed three research goals: a) to recommend a green energy job training program for the City of Columbus, building on existing assets and incorporating successful models from other Midwestern cities; b) to find an effective model of a city smart roof pilot program which could be replicated in Columbus, making a recommendation based on costs and benefits as to whether Columbus should prioritize this program; and c) to make a recommendation regarding the possible combination of the above two programs for the city of Columbus.

Our research findings, particularly based on Columbus' existing assets and successes of programs in other cities, led us to make the following recommendations for the City of Columbus and the Mayor's Green Team: a) that the City of Columbus create a job training program that is tailored to skills needed specifically for multiple Green Memo III objectives through a partnership with CSCC, and b) that the City of Columbus invest in either a cool roof, vegetative green roof, or solar roof pilot project.

2.0 Introduction

This research project is in response to the City of Columbus Analysis of Greenhouse Gas (GHG) Reductions Objectives in Columbus Green Memo III (EEDS002). We addressed Green Memo III Goal B, Objective B.1, actions 3 and 5: green energy job training and smart roofs programs. First, we addressed Columbus' call for recommendations regarding a green energy job training program. We provide detailed accounts of existing programs in Columbus offered by institutions with which the City could feasibly partner, report the efforts of cities similar to Columbus to address this need, and combine this information to offer a recommendation for the City to fulfill stronger job training in the green energy sector. Next, we addressed the City's call for recommendations regarding a Smart Roofs pilot program. We will forward relevant information regarding the costs and benefits of various types of Smart Roofs programs offered by comparable cities, ultimately concluding with a recommendation as to whether the City is advised to implement a pilot program and, if so, which type of program best fits the City's needs. Finally, we will provide a recommendation regarding the possibility to combine the above described programs through a program that would provide training relevant to the implementation of a Smart Roofs pilot project, ensuring that the job training and Smart Roofs projects are mutually reinforced.

3.0 Green Job Training

3.1 Growing Demand

There are many green jobs that exist throughout all facets of the economy, with a large number of these jobs growing in response to increasing investments in green energy policy. Other existing occupations are also becoming more environmentally oriented, as workers are modifying their skills to incorporate low-carbon and efficient technologies and practices. In a

2009 report prepared for the Department of Labor, 124 occupations were identified as areas where workers are adapting their skills to meet the growing demand for efficiency and clean energy. These occupations included fields such as heating and air conditioning installers, building and construction inspectors, mechanics, roofers, and plumbers (Dierdorff, 2009). Many of these are considered 'middle-skill occupations'. Middle-skill occupations are considered to be jobs that demand more than a high-school degree, but less than a four-year college degree (White, 2008). In a report on the future of middle-skill jobs published by the Brookings Institute, the Bureau of Labor Statistics is cited as predicting that approximately 45% of all job openings within the next ten years will be in middle-skilled occupations such as the ones mentioned previously. Simultaneously, the Bureau of Labor Statistics also anticipates that by the year 2020 the United States will see slowed growth in the "some college" level of education (Holzer, 2009).

Unfortunately, many workers are lacking the skills that are essential for entry into middle-skill occupations. According to a report by The Workforce Alliance, 57% of working age adults, or about 88 million people, have low literacy, limited English proficiency, or lack an educational credential past that of a high school diploma (The Workforce Alliance, 2009). An effective training program can provide the skills necessary for these individuals to access jobs in a continuously more efficient and sustainable economy.

3.2 Green Career Pathways

A 2010 report by Policy Matters Ohio analyzes the job training infrastructure and opportunities in Ohio and identifies essential elements of an effective green job training program. An important aspect of an effective green job training program identified in Policy Matters Ohio's report is the fact that the program should be demand driven. This means that individuals

should be trained for existing jobs, ensuring that they will not complete a stage of training only to be unable to find employment in the corresponding field. For Columbus, this could initially mean designing a training program to support other Green Memo goals by providing skilled workers to implement or maintain the objectives. Policy Matters Ohio also mentions the importance of involving employers in the industry in the process of designing programs and pathways. This input allows the programs to accurately train individuals in the skills that are necessary to be successful in the emerging green occupations.

Another aspect of an effective training program identified in this report is the accessibility of the programs to workers at an assortment of various skill levels. Along any given career pathway there should be multiple entry points to increase the accessibility to a multitude of individuals. As Columbus would like to particularly focus their training efforts on veterans, previously incarcerated individuals, and those in the low-income bracket, this point is of extreme importance. Policy Matters Ohio also identifies the importance of a smooth flow between different training levels. Making further training easily accessible to workers provides them with the opportunity to attain secure employment to support themselves and their families. The following graphic was featured in the report by Policy Matters Ohio as an illustration of the potential levels of green job training and the job opportunities that they provide. Following these guidelines will help to ensure the success of a green job training program that will benefit both the city and the individuals that take advantage of these training opportunities.

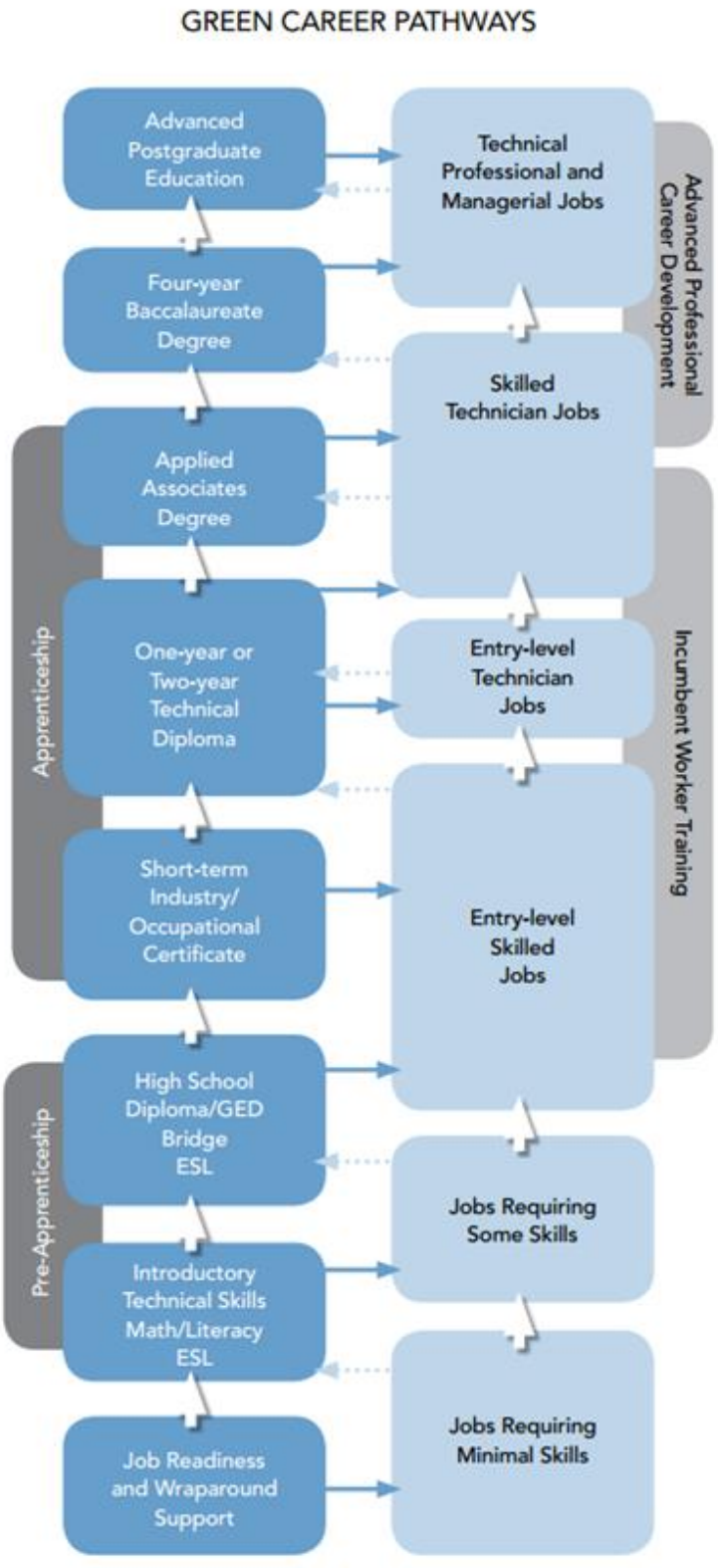


Figure 1.1: Green Career Pathways

3.3 Green Job Training in Columbus

While Green Memo III seeks to implement new projects, it is also essential to build on the many assets already possessed by Columbus. By exploring green job training programs underway in Columbus, Green Memo III can work to partner with, expand, or replicate successful projects while learning from the downfalls of less successful projects.

The most notable project for green job training in Columbus is Blueprint Columbus, a project by the Department of Public Utilities. Blueprint Columbus began as a way to comply with wet weather consent mandates, as the City wanted to simultaneously improve neighborhoods, create local jobs, and clean rivers by utilizing a community-based approach (Water Environment Federation 2015). To do so, the City partnered with local nonprofits, the Columbus Urban League and Alvis House, and Columbus State Community College to implement a new job training program which could work with small business owners as well as provide employment strategies for disenfranchised and disadvantaged populations (Water Environment Federation 2015).

The training program for Blueprint Columbus trains individuals in the skills they will need to fill the jobs created by the efforts of Blueprint Columbus. In this way, both a demand for jobs and a supply of skilled workers are created by the same entity. This closed loop design ensures the most beneficial training program for the city. Blueprint Columbus' pilot of the training program is currently underway, and because Blueprint Columbus is not yet ready for construction, the City is securing private partners to employ participants after they complete the training (Smith interview). Keena Smith, assistant director for workforce and economic development for the Department of Public Utilities, believes that the strengths of Blueprint Columbus could be expanded upon or replicated by the implementation of Green Memo III, such

that a training program could be implemented which provides workers with the skills needed to fill the jobs which will be created by Green Memo III.

3.4 Green Job Training Around Ohio

To analyze Columbus' current and potential green job training programs, it is essential to research green job training programs that exist around Ohio. Two specific programs relevant to Columbus' green job training are Hocking College's Energy Institute and Cuyahoga Community College's Pathways Out of Poverty Through Green, Sustainable Jobs.

The Energy Institute is an extension of Hocking College that was opened in 2009 (Energy Institute). The addition is an innovative learning facility located on Hocking's Logan campus. The Energy Institute features green building design aspects and hands-on learning labs for students studying in the college's advanced energy, fuel cells, and vehicular hybrids training programs (Energy Institute). Darin Hadinger, an instructor in advanced energy, works at the Energy Institute and was able to provide information about their training program.

The college offers classes in a range of topics including solar photovoltaics, sustainable building, fuel cells, and microgrids. The institute focuses on a hands-on approach to include involved projects based on real world scenarios. These projects give the students training in real world positions, such as project managers. Some projects have included solar panel installation and management and wind generation on Leadership in Energy & Environmental Design (LEED) buildings on the Energy Institute campus (Hadinger). Hocking College provides associate's degrees in applied science and advanced energy that incorporate this green job training. The program is trying to make students flexible in many areas of training to develop their skills extensively. One major goal that Darin Hadinger stressed was the program's incorporation of students from "all walks of life", including previously incarcerated and veterans,

and train them for success in the workforce when they leave the program (Hadinger). One challenge that the institute has encountered is with the changing local climate which limits their renewable energy portfolio. Job training for solar and wind generation are important areas, but are difficult to utilize in the Ohio climate.

Another program in Ohio was Cuyahoga Community College Pathways Out of Poverty Through Green, Sustainable Jobs program. This program focused on job training in alternative energy. Upon contacting the school about this program, they stated that they have not run any classes in this program lately because of a lack of job demand and open positions. However, the school may revisit providing classes and training in this area if they see a demand for workers. This information is important for Columbus to take into consideration because job demand is essential for the incorporation of a green jobs training program.

3.5 Green Job Training Conclusion

From the above research on green job training programs in the state of Ohio, the initial conclusion is that the best green job training program for the City to undertake will likely be attained through a partnership with Columbus State Community College, and will be focused on training participants in the skills they'll need to fill positions created by other objectives of Green Memo III.

4.0 Smart Roofs

In order to discover how Columbus could effectively pilot a smart roof assessment and installation program, the first step was to conduct a case study of successful smart roof programs in the United States, and then to compare the different types of roofs that contribute towards the goals in the GMIII.

4.1 City Case Studies

Smart roof case studies were conducted in three cities that share similar attributes to Columbus, including: Indianapolis, Washington D.C., and New York City. By highlighting the features that make up the internal structures of each cities successful smart roof/green infrastructure programs, a transfer of information could be made available to the Columbus' Green Team in their efforts to create such a smart roof initiative outlined in the Green Memo III.

Methods included research on city websites, specifically those listed in the case study. Also, by taking the perspective of an entity trying to participate in the programs listed, one is given the tools necessary to contribute towards improving sustainability by either undertaking a smart roof project, or a similar green infrastructure project. Several key informant interviews also were a valuable means of data collection in order to gather specific program costs, features, and evidence of benefit.

4.2 Research Findings

4.2.1 Indianapolis:

In Indianapolis, the City government is engaging in a few distinct programs with the goal of improving green infrastructure. The city offers capital in the form of the "Green Infrastructure Grant Program", with the primary goal being to capture and treat stormwater. With a maximum of $20,000 per grant, the city is primarily offering the grant specifically to nonprofit organizations that are committed to sustainable development efforts in the area (Green Infrastructure Grant Program, 2011). The grant is supported by many different types of organizations, including: the city's' Office of Sustainability, United Water, SustainIndy, and Local Initiatives Support Corporation (LISC) Indianapolis. LISC specifically, is a part of the

nation's largest community development corporation that has invested over $1 million in program grants (About LISC, 2015).

SustainIndy, another organization involved with the green infrastructure grants specifically created as an initiative by the city government, offers their own "Community Grants", with a max of $10,000. In collaboration with the McKinney Family Foundation,a local sponsoring nonprofit, any project qualifying for the grant needs to address sustainability principles as well as the STAR Community Rating System (SustainIndy, 2015). Goals within the STAR ratings include greenhouse gas mitigation and "greening" the energy supply, among others (STAR Community Index, n.d.). SustainIndy has had recent success improving the sustainability of the City-County building in downtown Indianapolis. Some highlights of the project included solar thermal panels mounted on the roof and a 3.7 kW solar photovoltaic system, that are expected to decrease energy consumption by 35% and save $750,000 annually for 15 years (Greening the City County Building, n.d.).

One relevant example of a green infrastructure initiative in Indianapolis is the Union Station Green Roof. The Citizens Energy Group, which is a, "public trust providing natural gas, thermal energy, water, and wastewater services to about 800,000 customers in Indianapolis" (About Citizens, n.d.), provided the necessary grant to fund the project. With a total cost of $250,000, the roof will serve to reduce stormwater runoff and set the standard for future green initiatives within the city (Brooks, 2011).

Indianapolis does a great job diversifying their green initiatives, as well as diversifying the sources for the proper funding. Including a wide variety of government offices, local foundations, and nonprofit organizations is a key trait leading to the success of green infrastructure projects in the City.

4.2.2 Washington D.C.:

In our nation's capital, there are green infrastructure, and specifically smart roof initiatives worth noting. First, within Washington D.C.'s District Department of the Environment, the primary goal is also to reduce local stormwater runoff. The department has created various programs under the jurisdiction of the DDOE's RiverSmart program. Financial incentives are provided by RiverSmart to assist local property owners to, "install green infrastructure such as rain barrels, green roofs, rain gardens, permeable pavement, shade trees, and more" (Get Riversmart!, n.d.). They also offer a green roof rebate program that provides, "base funding of $10 per square foot, and up to $15 per square foot in targeted subwatersheds" (Green Roofs in the District of Columbia, n.d.). Such rebates can apply to residential, commercial and institutional properties.

The City works closely with the Chesapeake Bay Foundation, which has the task of protecting and conserving the Chesapeake Bay and its tributary rivers. (Our Mission, 2014).Treating stormwater with green roofs is one initiative of the foundation to protect the local waterbodies. Starting in 2003, the foundation began a "green roof demonstration project" with the goal to, "demonstrate the technical, policy and economic feasibility of installing green roofs on commercial buildings in Washington DC." (Green Roof Demonstration Project, 2008) The Chesapeake Bay Foundation achieved this goal by providing grants for eight green roofs with the grant covering up to 20% of the project costs, which was also noted in the project report.

Washington D.C. has also emerged as a leader in smart roof implementation as they have created a comprehensive "Smart Roof Program" focusing on 435 area buildings, focusing heavily on local school buildings. The program ran out of the District Department of General Services, working in close ties to BLUEFIN LLC, the project indeed showed results that alluded

to, “better roofs for a lot less money” (Rast, 2013). The conclusions included definitive cost savings of taking such a proactive with restoration approach rather than a reactive approach to dealing with roofs. Some anticipated goals include, 10,000+ MWh of energy generated annually and 7,000 ton of carbon dioxide annually displaced from the solar photovoltaic installations alone (Rast, 2013). This project also explored the prospects of cool (white) roof installations and vegetative roofs, as well as demonstrated the value gain of leadership for local communities through education and job creation and training as a result of the roof initiatives.

The strength of D.C.’s smart roof and green infrastructure goals lies within the strong initiative of the local government, and undertaking a bold, comprehensive plan. By doing so, the city can have effective oversight of the projects, and can ensure an extensive priority of local, non-residential buildings. The program also allows any data related to the initial and lifetime costs/benefits to be relayed back to one body which facilitates program effects.

4.2.3 New York City:

New York City was the final location within the smart roof case study. New York City has shown great effort to utilize cool roof technology through the NYC °CoolRoofs program. Working alongside many corporate sponsors, community and nonprofit sponsors, and government partners to name a few, the goal is to encourage, “building owners to cool their rooftops by applying a reflective white coating that reduces energy use, cooling costs and carbon emissions” (About NYC Cool Roofs, 2015). Similar to the Green Memo III, the program is set to contribute towards supporting, “New York City's goal to reduce greenhouse gas emissions by 30 percent by 2030, as outlined in PlaNYC - the City's comprehensive sustainability plan”(About this Initiative, 2015).

Also within New York City, specifically in the Bronx, exists an organization known as Sustainable South Bronx (SSB). SSB specializes in green job training for low-income community members in response to the heavy environmental burden placed on the community. SSB includes five programs, focusing on green jobs training (BEST Academy), smart roofs, energy efficiency, policy and planning, and education (Our Mission, 2013). For smart roofs specifically, the program employs BEST Academy graduates, who gain valuable hard labor skills. Finally, the program was also certified to work directly with the NYC °CoolRoofs initiative, allowing BEST graduates to construct the cool roofs (Smart Roofs, 2013).

The strengths of New York City's efforts are within the cool roof sector. Cool roofs have specific advantages compared to other smart roofs that will be discussed below. Also SSB remains one of the most ideal models of a smart roof and green job training programs discovered. A program that focuses on training and then placing low-income residents would benefit a city like Columbus.

4.5 Discussion

Across the span of research, all cities involved in the case study, and most cities within the United States, have undertaken some sort of push towards improving sustainability. One common theme is involved with the capture and treatment of stormwater through green infrastructure which does not immediately call for smart roof projects. It does seem, however, that more cities are realizing the potential in smart roof technology and the benefits associated. Cities have also available capital for projects, either from governmental collaborations, or private foundation/nonprofit.

Columbus is not alone in attempting to improve community sustainability with their Green Memo III actions. There are, however, features from the previously explained programs

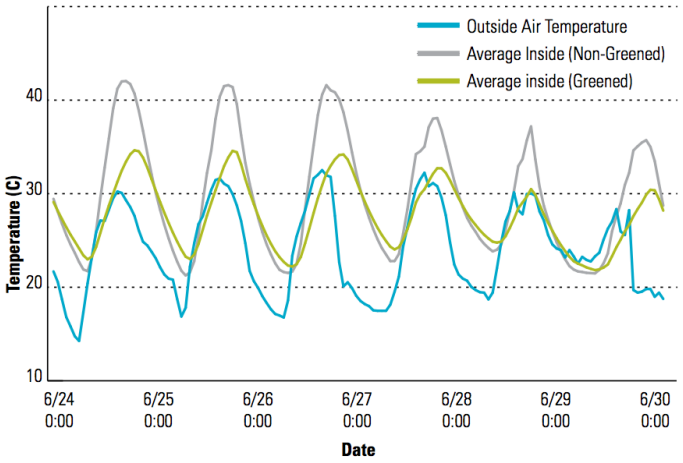
that Columbus would be strategic to consider and/or implement. The most proactive, and beneficial would be to follow along the lines of the comprehensive plan set out in D.C., as well as the Sustainable South Bronx program. Each would allow Columbus to work towards the Green Memo III goals, while simultaneously promoting community development.

4.6 Smart Roof Analysis

The second smart roof analysis conducted for Green Memo III included a focus on the varying types of smart roofs and how they could apply to Columbus. In the following text, the roof types focused on were: green vegetative roofs, cool (white) roofs and solar photovoltaic (PV) roofs. As far as the predictive prospects, or implications, associated with the city of Columbus with smart roof types, annual sun and annual rain are important to note. Finally, the costs and benefits, especially those related to meeting the GMIII goals, were discovered and presented.

4.6.1 Green Vegetative Roofs

In a study of 22 green vegetative roof projects across the United States, median data amounts are presented as representative for the average vegetative roof (Sproul, 2013). In U.S. dollars, the average vegetative roof has an installation cost of $172 per square meter, as well as $1.64 per square meter maintenance costs per year (Green Roof Maintenance, n.d.). Maintenance costs, however, vary greatly based on local rates. These roofs have a positive and sustainable effect on building temperatures, leading to an aggregate average avoided heating fuel and cooling electricity costs by $0.60 per square meter per year. The temperature difference for greened versus non-greened roofs can be seen in the following graph.



Source: Penn State Center for Green Roof Research, 2009.[76]

Figure 2.1: Comparison of Building Temperature for Green Roof vs. no Green Roof (Garrison, 2012).

An average green roof can also mitigate carbon dioxide emissions by 5.7 kilograms per square meter per year (Garrison, 2012).

4.6.2 Cool White Roofs

For cool roofs, in this case approximated for a thermoplastic polyolefin single-ply roof, the installation costs are much lower than green vegetative roofs and solar PV roofs, only $20 per square meter (Sproul, 2013). Maintenance costs are also relatively lower than the green roof at $0.20 per square meter per year. Cool roofs contribute towards reducing electricity costs by a rate of $0.20 per square meter per year, and contribute towards the GMIII goal of reducing carbon dioxide emissions by 4.3 kg per meter per year. (Levinson, 2009).

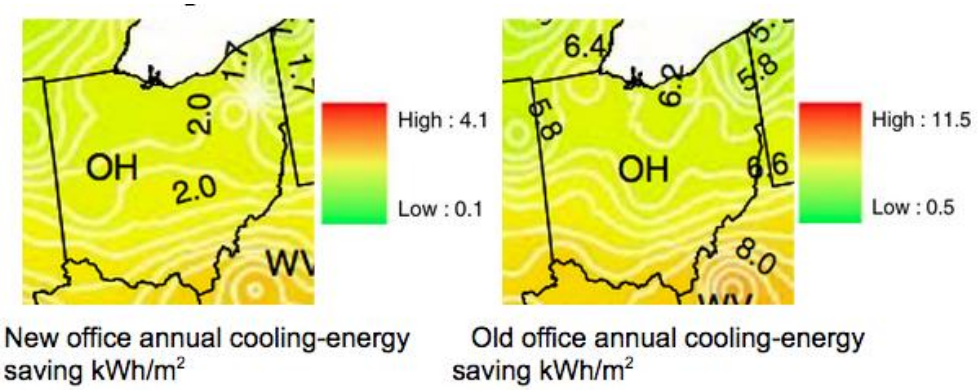


Figure 3.1: Comparison of Cooling-Energy Savings for New Offices vs. Old Offices

Such installations can save around 2.0 kWh per square meter of cooling energy for new office buildings, yet can save up to 6.6 kWh per square meter of cooling energy for old office type buildings (Levinson, 2009).

4.6.3 Solar PV Roofs

Solar panel, photovoltaic roofs, vary greatly depending on individual situations, yet the new Block-O solar array constructed on the rooftop of the RPAC at Ohio State provides reliable information for conclusions. The project, which is 10,000 square feet, or 929.03 square meters, costs approximately $131 per square meter (AEP Energy Installing Solar Array at Ohio State, 2014). Unique compared to the other roofing types, these are capable of generating their own energy in the form of electricity. The OSU array will have the ability to produce 38 kWh per square meter annually. It also will mitigate 20.4 kg per square meter of carbon dioxide annually. The following graph displays the energy payback times of varying solar roof types, which is the amount of time is takes for the money saved as a result to cover the upfront costs.

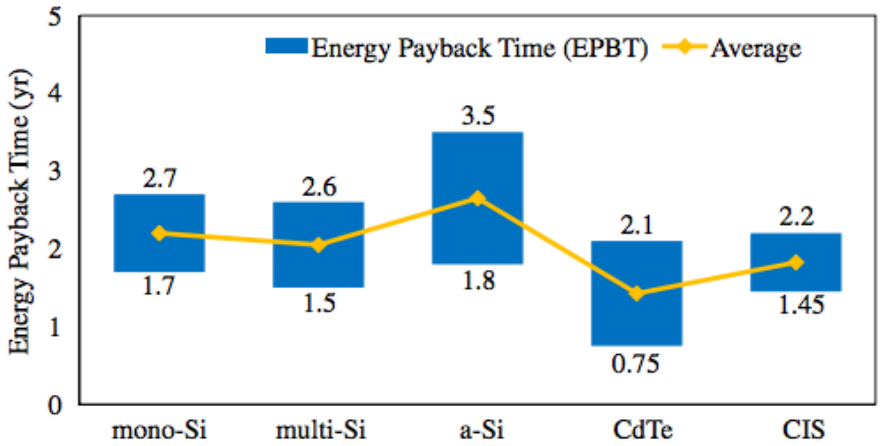


Figure 4.1: Energy Payback Time for Varying PV Roof Types (Peng, 2012)

4.7 Discussion

In such an analysis it is crucial to keep in mind some certain limitations or weaknesses of the data gathered. In this instance, the data has to be averaged, or gathered from many different

systems. Also, many different factors can affect the data reports, including local rates of business contractors. The individual materials used in each system can vary greatly from roof to roof, thus impacting costs and environmental benefit as well. The simple geographical location for a roof can make it more or less effective at achieving sustainability goals, yet should be considered before breaking ground on a new smart roof project. Finally, the available technology for smart roofs is ever changing and evolving, leading to materials that are both less expensive and more innovative. Improved technology and information will also lead to smart roofs becoming more effective at achieving goals such as treating stormwater, increasing energy savings, and cutting greenhouse gas emissions.

For Columbus, the most effective roof type at meeting the Green Memo III goals would be solar energy roofs. They work best towards reducing GHG emissions, and also towards cutting energy consumption by contributing to the electrical grid. However, with capital spending taken into consideration, cool roofs are the most cost-effective option. Cool roofs are the least expensive, yet still contribute towards Columbus' sustainability goals. Based on the goals that Columbus puts the highest priority on, and on the amount of capital dollars available, the most efficient smart roof type changes. It is up to Columbus to decide where their priorities lie.

5.0 Recommendations

5.1 Current Demand and Training Provided in Columbus

Through researching the future trends in green job employment in Columbus, OH, we have found that as of 2006, 3,938 green jobs exist in Columbus, OH and that number is expected to rise to 31,163 in 2038 (Global Insight). To meet the demand for this future growth in green jobs, it will be necessary for the city of Columbus to develop their workforce to equip persons with the green skills needed to meet the demand of this job growth.

Our research shows that the City of Columbus is already creating programs to meet this demand in some capacity. For example, Blueprint Columbus aims to address stormwater runoff in the city of Columbus by training low-income and previously incarcerated individuals in green construction. These training programs are run by Columbus State Community College. Figure 5 below summarizes what individuals are trained in if they complete the Blueprint Columbus training program.

Training Provided by Blueprint Columbus

- Overview of the City's Blueprint Program
- Hydrologic Cycle
- Existing stormwater infrastructure and proposed alternatives
- Soil basics including preparation techniques, plant ecology, identification and garden types
- Greenspace maintenance including tools-of-the-trade, Hardscape fundamentals and maintenance
- OHSA 10-hour Construction Safety Awareness (OHSA card issued upon completion of training)

Figure 5.1: Training Provided by Blueprint Columbus

Although Columbus has started to identify their need to train individuals in skills related to green job employment, our group believes that Columbus should explain their efforts in providing job training opportunities for low-income and previously incarcerated individuals. We recommended that Columbus use methods from the Sustainable South Bronx program and incorporate them into Blueprint Columbus. Figure 6.1 highlights The Sustainable South Bronx training program.

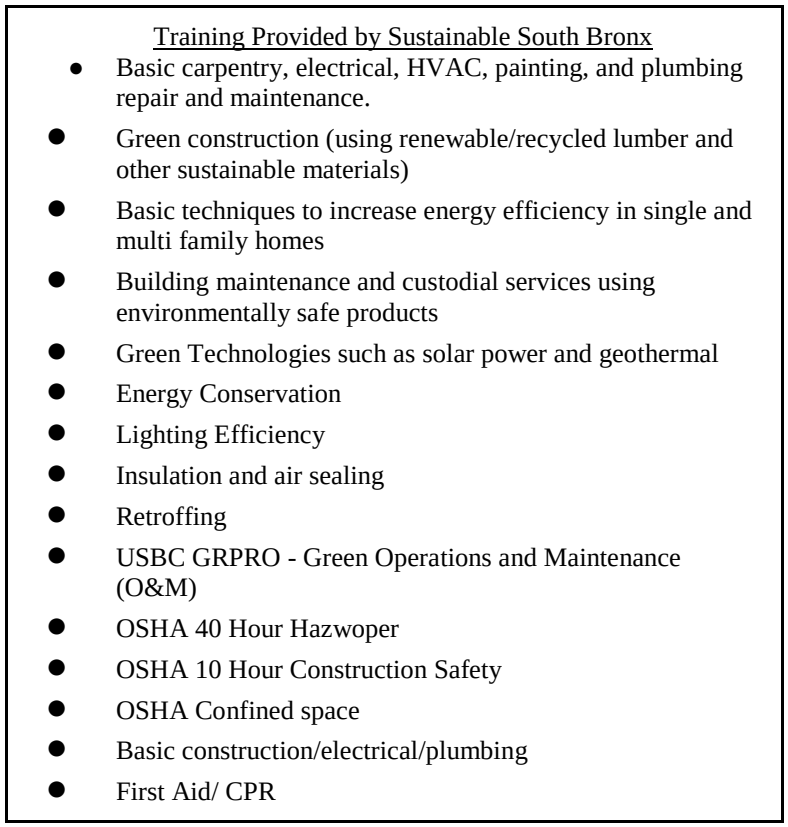


Figure 6.1: Training Provided by SSB

5.2 Sustainable South Bronx

Sustainable South Bronx represents a best practice green job training program that not only incorporates elements of Blueprint Columbus, but also expands into other important entities of green job training programs such as energy conservation, lighting efficiency and energy retrofitting for buildings. By training Columbus residents' in these skills, Columbus would be working towards actions 6,7 and 11 under Green Memo III Objective B.1, which aims to reduce energy consumption community-wide by 20% over the next five years. Furthermore, by expanding the training offered from Blueprint Columbus, Columbus could build smart roofs on city buildings and businesses. Our group recommends that the city begin creating cool roofs by painting the top of roofs white. This would be the cheapest solution to reducing energy costs of a building over time. Vegetative roofs would have a larger reduction of energy costs, and would

create jobs due to the maintenance required of the roofs, but the upfront investment is more expensive than the cool roof option.

6.0 Conclusions

After researching green job pathways in various community colleges and smart roof programs, we recommend that the City of Columbus expands their Blueprint program so that it is tailored to skills needed specifically for multiple Green Memo III objectives through a partnership with CSCC. For example, a training program could focus on the skills needed for the Energy Star, energy efficiency and benchmarking actions. Furthermore, if Columbus began building cool, solar, or vegetative roofs on city buildings, they would be directly reducing their energy costs over time and reducing the effects of urban heat islands. By expanding Blueprint Columbus, individuals will be trained in skills needed for the future demand of green jobs in Columbus, and contribute directly to the workforce development needed to perform the actions within Objective B.1 of the Green Memo III.

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Appendix B – Other Sources Consulted

http://wwww.MappingGreenCareerPathways.pdf
This infographic was used in the report to show the pathways to green job training opportunities in community colleges.

http://www.policymattersohio.org/wp-content/uploads/2010/01/MappingGreenCareerPathways2010.pdf
The 2010 report from Policy Matters Ohio looking at the development of green career pathways in Ohio. This report helped to inform the important aspects of an effective training program and provided the green career pathways graphic used in the report.

SSBX. "BEST Academy | Sustainable South Bronx | Addressing Economic and Environmental Issues in the South Bronx – and throughout New York City." *Sustainable South Bronx*. Sustainable South Bronx, n.d. Web. 15 Apr. 2015. <http://www.ssbx.org/best-academy/>
The Sustainable South Bronx website highlights information about their training program, BEST Academy. The information provided under the BEST Academy webpage that gives information provided about the training opportunities within their organization

Global Insight. *U.S Metro Economies Current and Potential Green Jobs in the US Economy*. Rep. Global Insight Inc, 2008. Web. 2015. <http://www.usmayors.org/pressreleases/uploads/greenjobsreport.pdf>.
The report prepared by Global Insight gives a detailed account of the current green market in various metropolitan areas including Columbus and gives insight of the potential green job growth in metropolitan areas. This report was a logical report to use to highlight and understand the potential for green job growth in Columbus, OH.

Sproul, Julian, Man Pun Wan, Benjamin H. Mandel, and Arthur H. Rosenfeld. "Economic Comparison of White, Green, and Black Flat Roofs in the United States." *Energy and Buildings* (2013). ScienceDirect.
the one study provided insight as to the costs and benefits of two different roof types in our analysis. The data was gathered from many different projects across the United States.

Appendix C - Personal Interviews

Megan Meier. Higher Ground LLC. Megan Meier was one source of information regarding the smart roofs portion of our research. We interviewed Megan to ask her about the assets of each type of smart roof we were reaching and asked her input about our recommendation of expanding Blueprint Columbus to include more training opportunities. Megan was a logical choice to interview for this project because her company was responsible for building the vegetative roof on Howlett Hall on Ohio State's Agricultural campus.

Paul Lanning, BLUEFIN LLC. Paul Lanning is the vice president of the BLUEFIN company which was a major part of Washington D.C.'s comprehensive smart roof program. Details surrounding the features of the program, how it is structured, and some of the costs/benefits were provided by Paul.

Keena Smith, Blueprint Columbus. Keena Smith was the key source of information regarding green job training in Columbus, as she works with the city through Blueprint Columbus. We interviewed Ms. Smith to ask about the successes and challenges of Blueprint, and whether she thought that a training program modelled after Blueprint could be successful in helping to implement Green Memo III.