

**Green Technology High School Academies: Pioneers at the
Crossroads of Economic, Educational, and Environmental
Challenges**

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Executive Summary

Green technology academies in high schools are a rapidly growing venue for educational innovation. This study investigates the context and origins which have influenced the emergence of these academies as well as their initial successes and challenges. Through interviews with teachers, counselors, and administrators, this study finds that green technology academies have experienced initial success in developing curriculum, providing student support services and professional development programs, establishing community partners, and connecting students to post-graduation opportunities. However, to implement green technology academies on a larger scale, federal and state policy makers must allocate additional funds for the development and maintenance of these programs. On the individual academy level, community members and educators must leverage supportive policies and funding to establish green technology academies in urban areas where public projects which improve environmental quality require a specially-trained green-collar workforce.

Introduction

This study examines the rise of green technology academies in high schools in the United States. Green technology academies are high schools that expose and prepare students for entry into highly-valued careers that improve environmental quality. These academies occupy a unique position at the frontline of educational, environmental, and economic reforms. They utilize the model of career-technical education, which more fully engages students by thoroughly preparing them for entry into both post-secondary educational institutions and into quality careers. They are essential in confronting environmental challenges; an initiative which necessitates a highly-trained workforce in a variety of career fields. Finally, they are capable of confronting economic inequality by providing valuable opportunities for young adults across races, genders, geographic locations and socioeconomic status to take part in an economic sector with incredible potential for sustained growth.

This study provides a snapshot of the early stages of development of green technology academies and offers initial lessons for the expansion of these programs on a large-scale. The study finds that several recently-opened academies in California that have received special state funding to incorporate green technology as the educational focus for a small group of students have established themselves as leaders in a rapidly growing nationwide movement. The study also includes a discussion of other schools and academies across the country which have expressed interest or, to some extent, have implemented educational focuses similar to those of the California Partnership Academies.

One of these interested schools is the Architecture, Construction, and Engineering (ACE) Academy at the Locke Family of High Schools located in South Los Angeles. This study was completed to provide recommendations based on the experiences of other schools about how to

best integrate environmental sustainability and preparation for careers in environmentally relevant occupations in the context of a career-technical, or more specifically, a building-trades academy. While this study is relevant for a broad range of schools, educators, and communities across the country, it is especially written for institutions like Locke High School with interest in providing exceptional educational opportunities for historically underserved student populations.

The emergence of green technology academies can be understood as part of a larger political agenda which will be referred to in this study as the “green jobs movement.” This study includes an extensive discussion of this movement which has created a unique social and political context for the educational innovations of green technology academies. The green jobs movement is defined and introduced first through a discussion of the environmental and economic crises which have been its catalysts. Next the concepts of “green technology,” and “green jobs” are discussed. An historical overview of the movement for green jobs is followed by a summary of the contemporary characteristics in the movement such as mainstreaming and the focus on workforce development and providing opportunities for low-income communities.

Following the overview of environmental and employment connections, the educational issues and background behind green technology academies are introduced. This outline includes a summary of issues facing the public education systems, specifically pertaining to its failings in low-income communities. An introduction to career-technical education and specifically the California Partnership Academy system provides an understanding of the educational models which have given rise to green technology academies. The next section focuses directly on the specific model of the Green Technology Academy, including an analysis of legislation pertaining to the academies as well as the support the academies have received from other institutions.

The methodology of this study can be best characterized as a broad sampling of current high school programs in the United States that include an established focus on green technology and construction. The information on specific schools was gathered using a combination of online research of school websites and educational resources, a review of current newspaper articles highlighting new programs at schools, as well as informal conversations and several in-depth interviews with teachers, counselors, and administrators. The academies included in this study are presented in a condensed profile format which highlights key characteristics of each school including the community setting and student population demographics; the origins of the academy; school and classroom elements including curriculum, professional development, and student support services; post-secondary and community partners; and challenges that face each academy.

These school profiles are compared in a final section of the report, which provides an analysis of the findings of this study and their implications. The primary recommendations given in this study are to concentrate efforts to expand the presence of green technology academies in the United States. Further recommendations are based on the limited experience of existing academies. These recommendations indicate the inherent challenges and necessary initiatives in facilitating this expansion.

I. The Green Jobs Movement: Definition, History, and Contemporary Trends

The green jobs movement is an ongoing campaign for investment in and development of technologies and infrastructure which improve environmental quality and create employment opportunities. The catalysts for this movement are two of the most pressing crises facing the American public: environmental destruction including global climate change due to carbon emissions and widespread economic recession including unemployment and severe socioeconomic inequality.¹

Advocates and leaders from many different backgrounds including labor unions, environmental organizations, and community organizations have joined forces to campaign for political solutions which address both of these crises. They are pushing politicians to spur job creation by funding and incentivizing sustainable development and shifting towards more sustainable energy sources. To create a more thorough explanation of this movement it is necessary to first understand the environmental and economic crises at its roots. Rather than providing a detailed summary of current environmental and economic conditions, the following section seeks to introduce the issues in order to contextualize the current moment taking place in the campaign for green jobs.

Environmental Crises

The range of environmental issues facing the planet today is broad. These issues include a depletion of available natural resources, a decline in the quality of these resources due to

¹ Van Jones, *The Green Collar Economy*. New York: Harper Collins Publishers. 2008. 25.

pollution, a crisis in waste management in terms of both toxic and non-toxic materials, and a decline in biodiversity including extinction and endangerment of entire species. These issues involve ever-increasing threats to the environmental well-being of the planet; with the issues of global warming and climate change simultaneously emerging as the most pressing environmental issues of our time.

The greenhouse gas emissions resulting from the consumption of fossil fuels used to generate electricity, power industrial processes, and for transportation, have caused climate changes with both immediate and more serious future consequences. The human consumption of fossil fuels adds about seven billion tons of carbon or 26 billion tons of carbon dioxide (CO₂) to the earth's atmosphere every year.² Carbon emissions due to human activity have risen since the start of the industrial revolution in 1750, and increased by 80% from 1970-2004.³ This increase of carbon in the atmosphere is compounded by changes in land use due to human activity. Plant life, especially trees, pull CO₂ out of the atmosphere and replace it with oxygen. This process has been modified and its beneficial aspects undermined, due to the clearing of forests for timber consumption and agricultural uses, particularly livestock grazing.

An atmospheric increase in levels of carbon dioxide along with other gasses generated by human activities such as methane (CH₄) and nitrous oxide (N₂O) have a warming "greenhouse" effect on the planet by trapping the sun's warmth in the earth's atmosphere. Eleven of the twelve years from 1995-2006 ranked among the twelve warmest years since 1850.⁴ From 1900-2000 the average global temperature rose by 1.4 degrees Fahrenheit, however the Intergovernmental

² Jones, *Green Collar Economy*. 30.

³ *Climate Change 2007: Synthesis Report, Summary for Policymakers*. Geneva, Switzerland: IPCC. 2007. 5.

⁴ *Ibid.*, 2.

Panel on Climate Change estimates that if greenhouse gas emissions continue at the same rate for the next one hundred years, the earth's average temperature will increase by 10.6 degrees.⁵ The consequences of global warming include rising oceans, food and water shortages, ecological changes resulting in population decreases for some species and population increases for others such as insects and bacterial diseases, and an increased occurrence of natural disasters such as cyclones, floods, blizzards, droughts, and other extreme weather conditions.⁶

The consumption of fossil fuels results in 56.6% of the world's CO₂ emissions and therefore has a significant effect on climate change.⁷ Not only are emissions increasing due to fossil fuel consumption, but the world's demand for energy is increasing dramatically, and oil prices are steadily rising.⁸ These conditions have resulted in a greater demand for renewable energy and energy efficient products that reduce fossil fuel consumption and carbon emissions. The development and implementation of these products and new technologies create the bulk of emerging employment opportunities relating to environmental sustainability.

Economic Crisis and the Promise of Green Jobs and Green Technology

The current economic crisis facing the United States has resulted in a rising unemployment rate that reached 8.5% as of April 2009.⁹ Since the beginning of the recession in

⁵ Jones, *Green Collar Economy*. 30.

⁶ *Ibid.*

⁷ *Climate Change 2007*. 5.

⁸ *ACTE Issue Brief: CTE's Role in Energy and Environmental Sustainability*. (Alexandria, VA: ACTE. 2008.) 1.

⁹ "The Employment Situation: March 2009." *Bureau of Labor Statistics*. Washington, D.C.: United States Department of Labor. 4/3/2009.

December 2007, 5.1 million jobs have been lost, and almost two-thirds (3.3 million) of these jobs have been lost in the past five months.¹⁰

The concept of new green jobs seems like a godsend in the face of growing environmental and economic challenges. We need people working to develop and implement solutions to environmental problems, and a growing number of people need any kind of employment they can find to support themselves and their families. However, in order to quantify the actual potential for job creation it is important to clearly outline the green job sector. Pragmatic questions such as the number of jobs currently existing in this field; the number which are likely to be added if investment in green technology increases; and the definition of a green technology are all important. The following section will address some of these questions.

For the purposes of this study, green technology can be defined as the “application of knowledge for practical purposes as it relates to the environment.”¹¹ Green technology includes renewable energy technologies such as solar photovoltaic power, solar thermal power, wind power, geothermal power, hydroelectric power, as well as biomass power and biofuels like ethanol and biodiesel. These technologies provide alternatives to generating electricity from fossil fuels which create the carbon emissions which cause global warming and are non-renewable, (they exist in a limited supply.)

Other green technologies relate to the conservation of energy. Examples of energy efficient technologies include hybrid vehicles which run off of both electricity and fossil fuels; household appliances which are engineered to consume less energy; and construction techniques

¹⁰ Ibid.

¹¹ *The Strategic Opportunity to Build a Green Workforce in Los Angeles*. (Los Angeles: Los Angeles Trade Technical College: Regional Economic Development Initiative, 2008). 9.

which allow residential, commercial, and industrial buildings to operate without using as much energy. These technologies as well as others are included in the following list of industries with energy efficient sectors: energy service companies, recycling, vehicle manufacturing, household appliances and lighting, windows and doors, computers, copies, and fax machines, TV, video, and audio equipment, HVAC systems, industrial and related machinery, durable and non-durable manufacturing, utilities, and construction.¹²

For the purposes of this study, a green job can be defined as any job which is involved in the production of goods and services that directly improve environmental quality. Unlike other job sectors, the green job sector is defined by the objectives of the products and services that it develops. Because of this non-traditional definition, green jobs do not form a separate economic sector, but instead are embedded within existing industries that are influenced by similar economic factors.¹³

Green jobs are inclusive of different industries and technologies, types of professions, and levels of contribution to environmental quality. In the report “Job Opportunities for the Green Economy,” authors Robert Polkin and Jeanette Wicks-Limm establish six “strategies for green economy investments” that can address global warming trends.¹⁴ These categories are “building retrofitting, mass-transit, energy-efficient automobiles, wind power, solar power, and cellulosic biofuels.”¹⁵ Listed with each category are the occupations related. For example wind

¹² Roger Bezdek, *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. (Boulder, CO: American Solar Energy Society, 2007). 30.

¹³ *Strategic Opportunity to Build A Green Workforce*. 9.

¹⁴ Robert Polkin and Jeanette Wicks-Limm. *Job Opportunities for the Green Economy: A State-by-State Picture of Occupations That Gain From Green Investments*. (Amherst, MA: Political Economy Research Institute, 2008). 6.

¹⁵ *Ibid.*

power development requires “environmental engineers, iron and steel workers, mill wrights, sheet metal workers, machinists, and electrical equipment assemblers,” just to name several of the occupations listed.¹⁶ The relevance of this table is its demonstration of the breadth of employment fields necessary for environmental improvement (See Fig. 1). In fact, this table provides a limited listing of jobs, and does not include other renewable energy fields such as geothermal energy.

Strategies for Green Economy Investments	Representative Jobs
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Production Helpers, Bus Drivers, First-Line Transportation Supervisors, Dispatchers
Energy-Efficient Automobiles	Computer Software Engineers, Electrical Engineers, Engineering Technicians, Welders, Transportation Equipment Painters, Metal Fabricators, Computer-Controlled Machine Operators, Engine Assemblers, Production Helpers, Operations Managers
Wind Power	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Cellulosic Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Fig. 1 “Jobs that will build the green U.S. economy and fight global warming,” *Job Opportunities for the Green Economy*, (Amherst, MA: Political Economy Research Institute, 2008.) 6.

Other publications such as the Green Jobs Guidebook and Raquel Pinderhughes analysis of “green-collar jobs” provide similar listings of the diverse career fields that make up the green job sector. The Green Jobs Guidebook establishes twelve green job industry segments while Pinderhughes describes 22 existing green job fields.¹⁷ The relevance of Pinderhughes’ study will

¹⁶ Ibid.

¹⁷ *Green Jobs Guidebook: Employment Opportunities in the New Green Economy*. www.cdf.org/cagreenjobs. 3. and Raquel Pinderhughes, *Green Collar Jobs: An Analysis of Green Businesses to Provide High Quality Jobs for Men*

be discussed in more detail in terms of the opportunities that it outlines for job-seekers with barriers to employment.

In 2007, the American Solar Energy Society published a landmark study on the number of jobs and revenue created by the renewable energy (RE) and energy efficiency (EE) industries. The report estimated that in 2006 8.5 million jobs were created by these industries and that together they had generated \$970 billion in revenues.¹⁸ The study was significant because no other previous study had generated such comprehensive data on the implications of investment in renewable energy and energy efficiency. The report has been cited in numerous articles and other reports, and has become a central research finding supporting the fact that technology which improves environmental quality is already a substantial economic stimulus. In 2009, ASES released a follow-up study that includes data for 2007. The 2009 report shows continued growth, with 9.1 million jobs generated in 2007, up 600,000 from the previous year.¹⁹

Although these numbers are remarkable and have gotten the most attention from the information published in the study, the 2007 ASES study was also significant in discussing the challenges of defining the RE and EE industries. In fact, the study dedicates an entire chapter in narrative form to describing the process by which the definition they used in the study was developed. Just to give an idea of the types of issues encountered in coming up with a definition, the report described the hypothetical situation of a worker involved in the manufacture of solar panels at a factory which gets its power from a highly-polluting coal power

and Women with Barriers to Employment. (Berkeley, CA: The City of Berkeley Office of Energy and Sustainable Development, 2007). 3.

¹⁸ Bezdek. *Renewable Energy and Energy Efficiency.* 31.

¹⁹ Roger Bezdek, *Green Collar Jobs in the U.S. and Colorado: Economic Drivers for the 21st Century.* (Boulder, CO: American Solar Energy Society, 2009). 32.

plant.²⁰ As such, this worker occupies a position in the renewable energy industry that is actually damaging the environment. This type of ambiguity proved problematic for the ASES study and demonstrates that there is much room for improvement in these emerging industries.

The Historical Precedent of Investment in Environmental Technology as a Strategy for Job Creation

The intensification of environmental and economic pressures have energized the current movement towards the implementation of technologies that support environmental quality. However, many technologies such as photovoltaic solar panels and “green building” techniques have been in existence for several decades. Previous movements have pushed for the implementation of these technologies on a large-scale and have experienced varied levels of success.

Throughout the history of advocacy for renewable energy and energy efficiency, the relationship between environmental concerns and employment concerns has been a contentious issue. In the book *Fear at Work*, authors Richard Kazis and Richard Grossman explain the history of this tenuous relationship. They explain the false dichotomy which negates the possibility of simultaneously improving the environment and employment opportunities. They attribute the preponderance of this dichotomy to corporate greed and misinformation.²¹ This history of controversy is one reason why the current movement and general acceptance of green jobs is especially significant.

²⁰ Bezdek. *Renewable Energy and Energy Efficiency*. 20.

²¹ Richard Kazis and Richard L. Grossman, *Fear at Work*. New York: Pilgrim Press, 1979.

The historical period of the 1970's offers several parallels in regards to energy production and the economy. In their 1979 book, *Energy, Jobs, and the Economy*, authors Richard Grossman and Gail Daneker describe a situation that sounds remarkably similar to recent economic condemnations. "The latest recession is the sixth since World War II. It is the most severe. Total real unemployment is between 8% and 10%. Women, minorities, and young people are out of work in even higher percentages. In 1976, incomes of three million additional Americans fell below the 'poverty line.'"²²

The economic troubles of the 1970's were largely due to a sharp rise in oil prices. In October 1973, the Organization of Petroleum Exporting Countries (OPEC) issued an oil embargo on the United States in response to the U.S.'s support of Israel in the Yom Kippur war against Syria and Egypt. The effects of this embargo on oil prices and the economy as a whole in the United States were immediate and quickly resulted in an economic recession. Many have attributed this recession to stagflation: the simultaneous occurrence of stagnant economic growth with runaway inflation which in turn is "almost always fueled by a sharp rise in energy prices."²³ The economic effects of stagflation were felt throughout the 1970's in the form of high unemployment rates, high interest rates, and high rates of inflation. The Iranian revolution in 1979 reinforced these trends and drove the price of oil higher.

It was in this context of economic and energy crisis that groups such as the Environmentalists for Full Employment (EFFE) first began discussing the links between creating employment opportunities and shifting towards renewable and energy efficient technologies.

²² Richard Grossman and Gail Daneker, *Energy, Jobs, and the Economy*. Boston, MA: Alyson Publications, Inc., 1979. 22.

²³ Jones. *Green Collar Economy*. 1.

This group was founded in 1975 to “publicize the fact that it is possible simultaneously to create jobs, conserve energy and natural resources and protect the environment.”²⁴ The group sought to debunk the prevailing public attitudes, heavily influenced by industry claims, that environmental regulations resulted in job losses. They also sought to increase ties between the environmental and labor movements which had been strained due to a series of divisive issues involving environmental regulations and perceived threats to employment.²⁵

In 1977, EFFE published a report on “Jobs and Energy” which argued that energy conservation efforts were more labor-intensive and therefore created more jobs than energy production.²⁶ In 1979 they claimed that energy conservation practices utilized solely in buildings would create at least half a million direct jobs through 1990.²⁷ Specifically this claim referred to a 1977 study by The American Institute of Architects which calculated that 12.5 million barrels of oil could be saved and 500,000 jobs could be created by utilizing energy efficient building-technologies in new and existing buildings by the year 1990.²⁸ The Bonneville Power Administration corroborated these claims in another study that found that more jobs would be created through conservation programs that cut down on energy usage compared to the jobs created by building new power plants to generate an equivalent amount of energy.²⁹

²⁴ Brian K. Obach, *Labor and the Environmental Movement: the Quest for Common Ground*. (Cambridge, MA: Massachusetts Institute of Technology, 2004.) 50.

²⁵ Obach, *Labor and the Environmental Movement*.

²⁶ Sigalle Rosner, *Job Implications in Los Angeles’s Green Building Sector*. (Los Angeles: Strategic Concepts in Organizing and Policy Education, 2006). 12.

²⁷ Grossman. *Energy, Jobs, and the Economy*. 45.

²⁸ Rosner. *Job Implications in L.A.’s Green Building Sector*. 13.

²⁹ *Ibid.*, 12.

While the push for energy conservation instead of increased investment in traditional large scale energy production such as coal, nuclear, and oil was a top priority for groups like EFFE, they also advocated for increased investment in solar energy. The California Public Policy Center provided a central research finding in 1978, which concluded that installing solar collectors on California structures would result in 103,000 direct jobs from 1981-1990 and twice as many indirect jobs.³⁰ Other studies, such as a study by the Sheet Metal and Air Conditioning National Contractors Association, offered high job projections for national solar production as well. This study found that retrofitting 3 million homes to 60% reliance on solar energy for heating and cooling would lead to 12.2 million hours per year of work for ten years.³¹

These studies strongly supported renewable energy and energy efficiency, and increasing levels of investment began to put the studies' claims to test. The 1970's saw a considerable growth in solar technologies, particularly in solar water heater systems. This trend peaked in 1984 with over 100,000 solar water heater systems sold in one year.³² However, many of the advances made during this period came to a halt in 1980 when Ronald Reagan was elected president. Reagan favored a fossil fuel centered policy agenda, which contributed to an overall decline in the renewable energy industries for the next several years.³³

The renewable energy and energy efficient technologies available in the 1970's and 1980's did not live up to their potentials as described in the studies cited. A major reason for this shortcoming was a lack of government attention and commitment in the form of policy and

³⁰ Grossman. *Energy, Jobs, and the Economy*. 71.

³¹ *Ibid.*, 68.

³² Rosner. *Job Implications in L.A.'s Green Building Sector*. 16.

³³ Rosner. *Job Implications in L.A.'s Green Building Sector*. 15-16.

investment. While the current movement for green energy and jobs is taking place in a considerably different political atmosphere, the lessons about the importance of public investment from this time period remain crucial.

Recent Developments and Legislation Supporting the Green Jobs Movement

Partially due to the increasing severity of environmental and economic problems in the past decade, the green jobs movement has gathered substantial political clout and legislative support. One of the founders of the modern green jobs movement has been the Apollo Alliance. This coalition of environmental, business, labor, and community organizations was formed in 2001 to push towards clean and renewable energy and away from foreign oil imports as a primary energy source. In 2002 and 2003, groups such as the Ella Baker Center for Human Rights in Oakland, California began to rally around the call for green jobs as a way for the low-income communities that they served to gain valuable employment opportunities.

These advocates gathered momentum in preparation for the 2004 presidential elections. They pushed politicians to address the green jobs agenda in party platforms and legislative reforms. However, it was the introduction of the house bill 2847: the Green Jobs Act of 2007 that conclusively legitimized the excitement around green jobs. The bill was sponsored by California representative Hilda Solis and cosponsored by John Tierney of Massachusetts along with seven other representatives. The bill was an amendment to the Workforce Investment Act of 1998, and authorized \$125 million in annual federal funding towards grants and programs, which trained workers for jobs relating to environmental sustainability.

The bill designated funding for research and for “Energy Training Partnership Grants” to groups at both the federal and state levels. These grants made up 60% of the total funding provided by the bill and were to be awarded on a competitive basis to partnerships made between industry and labor interests.³⁴ In other words, both unions and business associations were required to work together to apply for grants. Additionally, these partnerships could include workforce investment boards, educational institutions, and community-based organizations. The bill was designed to establish a pilot program for implementing legislation on a larger scale in years to come.

The bill was signed into law on December 17, 2007 as part of Title X of the Energy Independence and Security Act, also known as the “Energy Bill.” The Energy Bill also included the Energy Efficiency and Conservation Block Grant Program which authorized \$2 billion in funding for projects focusing on the conservation of energy in building, transportation and other appropriate sectors.

Again in 2008, the presidential elections served to elevate the movement as both Democratic and Republican presidential candidates identified green jobs as important aspects of economic reforms. Shortly after Obama was elected president, he reaffirmed his support. In a November 22 speech, Obama stated his intention to create 2.5 million jobs in 2 years by putting “people back to work rebuilding our crumbling roads and bridges, modernizing schools that are failing our children, and building wind farms and solar panels; fuel-efficient cars and the

³⁴ “Frequently Asked Questions (FAQ) about the Green Jobs Act of 2007.” *Green for All*.
<http://www.greenforall.org/files/faq-greenjobsact07.pdf>

alternative energy technologies that can free us from our dependence on foreign oil and keep our economy competitive in the years ahead.”³⁵

Various groups stepped up pressure to ensure that the campaign rhetoric he used in support of green job development would come into fruition. Supporters lobbied legislators to pass an economic stimulus bill that included funds explicitly set aside for environmental programs. On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act into law. This bill authorized \$787 billion in funding over ten years. This funding includes \$48 billion for job training and education programs, \$100 billion for transportation and infrastructure, \$20 billion in tax incentives for renewable energy, and more than \$41 billion in other energy-related programs.³⁶ The economic recovery bill also authorizes \$500 million in funding for the training programs targeted by the Green Jobs Act.

Contemporary trends in the Green Jobs Movement: Mainstreaming, Labor-Environment Partnerships, and Workforce Development in Low-Income Communities

While similarities exist between the current economic climate and that of the 1970’s-1980’s, the current green jobs movement has evolved and reemerged in a much different political climate. As such, the movement incorporates several distinguishing characteristics not previously present, which warrant discussion. The first of these characteristics is the general mainstreaming of the movement through media publicity, political attention, and corporate

³⁵ Christi Parsons, “Obama pumps up his economic stimulus proposal.” *Los Angeles Times*. November 23, 2008.

³⁶ Radhika Fox, Jason Walsh and Shawn Fremstad, *Bringing Home the Green Recovery: A User’s guide to the 2009 American Recovery and Reinvestment Act*, (Oakland, CA: Green for All, 2009). 3.

interest. While environmentalists in the 1970's may have easily been portrayed as radical extremists, the current green wave is far from a fringe movement.

The current political climate, as it relates to environmental issues, has resulted in a phenomenon many have dubbed "green-washing." Turn on the television and you are likely to witness numerous commercials expounding the benefits of renewable energy. In most cases, these commercials are not paid for by environmental groups, but by some of the largest oil and utility companies in the United States such as General Electric, Chevron, and Exxon-Mobil. Many criticize public relations tactics such as these, which are designed to foster confidence in consumers and investors, but do not necessarily translate into real changes or investment on the part of the private corporations. Terms such as "sustainability" and "green" have become buzz-words that unfortunately do not carry with them much accountability in the business world.

In addition to the mainstreaming of environmental issues and awareness, the movement for green jobs has enjoyed a significant trend towards mainstream attention as well. One demonstration of this trend was the recent appointment of one of the movement's most prolific spokespersons, Van Jones, as the Special Advisor for Green Jobs, Enterprise, and Innovation at the White House Council on Environmental Quality.

Another characteristic, which distinguishes the current green jobs movement is the wider acceptance of the idea that investing in the environment can create jobs. While the corporate world may continue to staunchly fight against environmental regulations which cut into profits, public opinion is certainly more supportive of environmentally relevant job creation than it was in the past. This is exemplified by the cementing of collaborative relationships between labor and environmental organizations.

An important example of these collaborative relationships is the Blue-Green Alliance founded in 2006 between the United Steel Workers and the Sierra Club. Since its inception, the Blue-Green Alliance has grown to include the Communications Workers of America, the Natural Resources Defense Council, the Service Employees International Union, and the Laborers' International Union of North America. While groups like EFFE worked towards these kinds of alliances in the 1970's, the current potential for employment opportunities in renewable and energy efficient industries has facilitated the creation of much stronger alliances between the environmental and labor movements.

The final distinguishing aspect of the current green jobs movement is its focus on providing opportunities and benefits to low-income populations, communities of color, and people with barriers to quality employment. The most vocal advocates of the new green jobs movement are not environmental or labor groups, but instead are community and grassroots organizations working to bring quality employment opportunities to their constituents. This strong presence and tireless advocacy effort has given rise to the call for investment in "green-collar" jobs which are manual labor jobs in businesses whose products and services directly improve environmental quality.³⁷

In addition to their environmental relevance, the "green-collar" classification also refers to jobs which provide quality employment as dictated by several criteria. In the joint report "Green-collar jobs in America's cities," green-collar jobs are defined as "well paid, career track jobs" that "like traditional blue-collar jobs...range from low-skill, entry level positions to high-skill, higher-paid jobs, and include advancement in both skills and wages." Even if a job improves the environment, in order to be considered a green-collar job, it must provide a family-

³⁷ Pinderhughes, *Green Collar Jobs*. 3.

supporting wage or a career ladder which will advance low-income workers into higher-skilled occupations after gaining the necessary skills and work experience. Green-collar jobs must also provide a safe and healthy work environment, health care, and benefits such as paid vacations and sick days.³⁸

While the current economic crisis has affected access to quality employment for nearly everyone in the United States, low-income communities of color in urban areas continue to suffer from even higher rates of unemployment and job access. In urban areas like South Los Angeles, underemployment has been a problem since the 1970's when manufacturing jobs began to leave the area. This lack of income has resulted in deteriorating communities, which are often underserved in the areas of education, housing, and health care. In cities across the United States similar trends have resulted in mass underemployment and poverty primarily affecting communities of color.

The focused advocacy effort for green-collar jobs has been spurred on by the potential that the emerging renewable energy and energy efficiency industries represent as entry-points for communities that have long been shut out of quality job opportunities. In addition to the historical exodus of well-paying jobs from urban centers, barriers to employment such as lack of legal documentation to work, substance abuse and dependency, limited English proficiency, lack of high school diploma, GED, or basic academic skills, geographic distance from quality jobs, and criminal records all contribute to the marginalization of communities of color and low-

³⁸ Joanna Lee and Jennifer Ito, *A Greener Future for Los Angeles*. (Los Angeles, CA: Strategic Concepts for Organizing and Political Education, 2008). 3.

income communities from quality employment opportunities.³⁹ These obstacles keep people unemployed or under-employed by keeping them stuck in low-paying jobs.

The potential of green-collar jobs lies in the ability for people with barriers to employment to gain access to jobs which meet all of the established criteria for quality employment. In a study of green businesses in Berkeley, Pinderhughes established that “green-collar jobs are well suited to workers with barriers to employment.”⁴⁰ She identifies four positive aspects of green-collar jobs which contribute to their appropriateness for people with barriers to employment. First, she claims that many green-collar jobs can be considered entry-level and do not require considerable experience in the given field. Further, many of the employers provide on-the-job training for both entry-level and more advanced employees. The training support from employers combined with training provided through institutionalized pathways, such as labor unions’ apprenticeship programs, which many green-collar jobs can utilize, offer considerable opportunities for advancement for workers. Finally, the growth of the job sector is important in ensuring sustained access to employment.⁴¹

The focused effort to connect low-income communities with green jobs has necessitated the development of training and educational opportunities which provide access to otherwise unqualified individuals. Many of the workforce development strategies being utilized in this effort expand on existing programs and institutions and focus on connecting and updating these institutions to include the environmental fields that show the greatest potential for job growth. These institutions include union apprenticeship training programs, public works career

³⁹ Lee, *Greener Future for Los Angeles*. 4.

⁴⁰ Pinderhughes, *Green Collar Jobs*. 4.

⁴¹ *Ibid.*

advancement pathways, and community colleges as centers for career preparation. Two examples of career ladders which demonstrate the kind of opportunities for advancement green jobs offer include the careers of “Green Building Trades Worker” and “Green Public Sector Worker” as outlined in the following diagram.

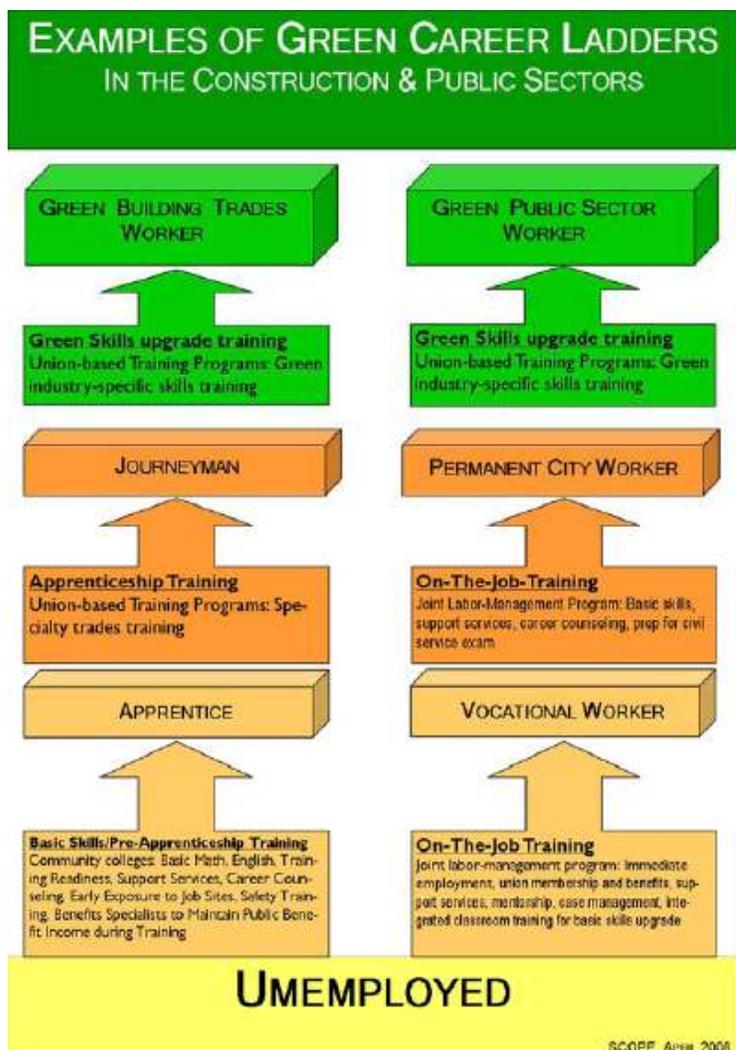


Figure 2: “Examples of Green Career Ladders in the Construction and Public Sectors.” *A Greener Future for Los Angeles*. (Los Angeles, CA: SCOPE, 2008.) 3.

These career pathways are often referred to as “pathways out of poverty” because they provide a set infrastructure for those with very little previous training or education to obtain quality employment. These models are often targeted at young adults who did not graduate from

high school. Providing opportunities for young adults without a high school diploma is a top priority for the green-collar jobs movement.

However the movement also aims to include opportunities for students still in high school to gain access to new employment fields. This is especially true for students at high schools with track records of failing to providing relevant educational experiences that prepare students for college and quality employment. The green technology academy model for high school students is a fundamental element of increasing the access of young adults to the new opportunities outlined thus far in the green jobs movement.

II. Integrating Green Technology in Career-Technical Education and Career Academies

Green technology academies prepare students for quality employment in careers that improve environmental quality. In doing so, they utilize the educational model of the career academy, which, in turn, can be classified as belonging to the larger category of vocational or career-technical education. The 1990 Perkins Act defined vocational education as “organized educational programs offering a sequence of courses which are directly related to the preparation of individuals in paid or unpaid employment in current or emerging occupations requiring other than a baccalaureate or advanced degree.”⁴²

Vocational education programs have been utilized in the public education system in the United States since its inception and have the unfortunate distinction of contributing to the oppression of certain populations by tracking minorities and women into courses lacking academic rigor and the necessary preparation for advancement into post-secondary education or quality careers. Minorities, especially African-Americans, have historically been discriminated against and placed at high rates into vocational education rather than academically rigorous courses. This has contributed to the perpetuation of socioeconomic immobility and economic and racial injustices. These deficiencies, led to a series of reforms, starting in the 1970’s, to the vocational education model.

Partly because of the stigma around vocational education and the connotation that this term carries as being a sub-par form of education, the term “career-technical education” has replaced vocational education in describing educational programs which focus on preparing students for career opportunities. An important aspect of the shift from vocational to career-

⁴² Karen Levesque and others, “Vocational Education in the United States: The Early 1990s,” 2

technical education is the implementation of the “multiple pathways” model. This model attempts to eliminate the divide between career training and academics by providing students the necessary education to continue in either post-secondary institutions or meaningful skilled employment. Career academies are one of the most long-standing and prevalent models for integrating multiple pathways. By definition, career academies use a specific career focus to orient academic instruction and therefore attempt to confront the pedagogic division between career training and academics.

Graduation Rates and the Response of Career Academies

Despite the painful history and unjust implementation of vocational education, career-technical education and the career academy models have both been proven as effective educational tools in their contemporary forms particularly in their ability to increase graduation rates at the high school level. Nationally, and in California, about 70% of students graduate with their class. According to a 2007 report by the Alliance for Excellent Education, this graduation rate translates into roughly 1.2 million high school students dropping out of the education system annually.⁴³ Graduation rates do not necessarily correlate in an inverse relationship with drop-out rates because of the option for obtaining Graduation Equivalency Degrees (GED) graduation rates. However, low graduation rates especially impact students of color and students from low-income backgrounds. In a brochure on the need for a building-trades academy in South Los Angeles, Community Coalition describes how “two-thirds of South Los Angeles students

⁴³ “The High Cost of High School Drop-Outs” (Washington, D.C.: Alliance for Excellent Education, 2007). 1.

‘disappear’ before graduation.”⁴⁴ The brochure goes on to explain that this high population of students who are predominantly Latino and African-American are faced with limited options without a high school diploma or relevant career training. “After graduation, the ‘lucky’ ones end up in stagnant low wage jobs because they lack skills and training. The others find more lucrative, but unlawful means to maintain a living. These youth end up in gangs, in prison or dead.”⁴⁵ While the prospects for high-school dropouts may not be as drastic everywhere as it is in South Los Angeles, young adults without high school diplomas face undeniable challenges. According to the 2005 census, the average annual income for a high school dropout in 2004 was \$16,485 compared to \$26,156 for high school graduates.⁴⁶

A recent survey of high school dropouts provides some insights into the reasons that these students decided to terminate their high school careers despite the potentially negative consequences outlined above. The study found that “respondents indicated that they felt alienated at school and that no one even noticed if they failed to show up for class. High school dropouts also complained that school did not reflect real-world challenges. More than half of respondents said that the major reason for dropping out of high school was that they felt their classes were uninteresting and irrelevant.”⁴⁷ These complaints point to shortcomings in traditional high school environments, which career academies directly attempt to resolve.

In a “Review of high school reform strategies,” author Jennifer Husbands provides a literature review of various studies demonstrating the higher rate of graduation at career

⁴⁴ “ACE academy.” (Los Angeles, CA: Community Coalition, 2008).

⁴⁵ Ibid.

⁴⁶ “High Cost of High School Dropouts. 1.

⁴⁷ Ibid., 2.

academies than at traditional, comprehensive high schools. These studies include a 1997 study of California partnership academies, a 1995 study of New York academies, a 1987 study of Philadelphia academies, and a 2000 study by the Manpower Demonstration Research Corporation. This final study was highlighted because it found that the positive effect of career academies on graduation rates was most evident for students at high risk of failure.⁴⁸ In an evaluation of California career academies, Nan Maxwell finds that career academy students are 2.5 times less likely to drop out of high school than those who are not in academies.⁴⁹

A 2005 comprehensive study of the California Partnership Academies demonstrated additional evidence of the success of the CPA's in improving high school education. This study not only showed higher graduation rates among 12th graders at CPA's than for 12th graders at other high schools, but also showed a significant increase in the preparedness of academy participants for entry into post-secondary education. While only 35% of graduating seniors across the state graduated having taken the necessary "A-G" courses for eligible entry into the University of California or California State University systems, 50% of academy participants satisfied these requirements.⁵⁰

⁴⁸ Jennifer Husbands and Stacy Beese, *Review of High School Reform Strategies*. (Aspen, CO: Aspen Program of Education, 2001). 15.

⁴⁹ Nan L. Maxwell and Victor Rubin, *Career Academy Programs in California: Outcomes and Implementation*. (Berkeley, CA: Regents of the University of California, 2001). 11.

⁵⁰ *A Profile of the California Partnership Academies 2004-2005*. (Berkeley, CA: California Academy Support Network, 2007). 21.

FIGURE 18: SENIORS REPORTED TO MEET A-G SUBJECT REQUIREMENTS

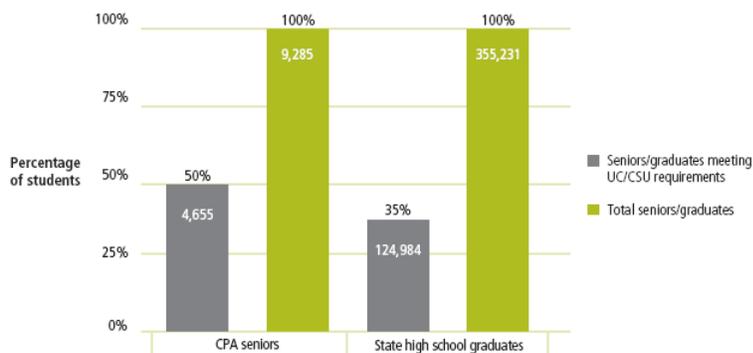
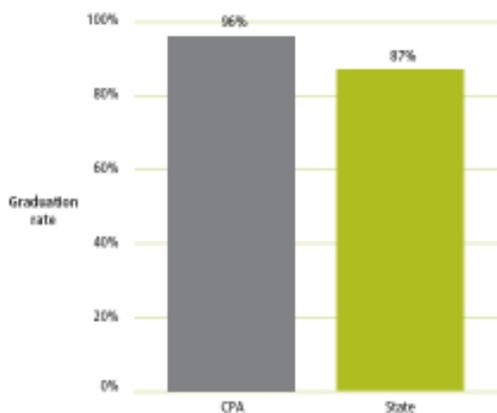
Figure 3: “Seniors Reported to meet A-G Subject Requirements,” *A Profile of the California Partnership Academies 2004-2005*. (Berkeley, CA: California Academy Support Network, 2007). 21.

FIGURE 14: CPA AND CALIFORNIA 12TH-GRADE GRADUATION RATES

Figure 4: “CPA and California 12th-Grade Graduation Rates,” *A Profile of the California Partnership Academies 2004-2005*. (Berkeley, CA: California Academy Support Network, 2007). 18.

The successes of career academies and career-technical education in recent years have prompted their widespread inclusion into the educational system. In an issue brief on the role of career-technical education in energy and environmental sustainability, the Association for Career-Technical Education (ACTE) explained that there are currently 2100 career technical education high school academies across the nation, and that 14,000 public high schools include career-technical as one of their offered programs.⁵¹ In California over 32,000 students are

⁵¹ *CTE's Role in Energy and Environmental Sustainability*. 8.

enrolled in California Partnership Academies. The following segment will provide further background on this model and the career academy model in general.

Career Technical Education in California: California Partnership Academies

In 1984, the California state legislature passed a bill that established the California Partnership Academy program. This program was established to promote the development and implementation of high schools in the state of California that followed a certain model proven to be effective through pilot programs in California as well as programs in other states. The California model was based on the Philadelphia Academies established in the 1960's and also incorporated several elements of the high school reform movement of this time period.⁵²

Schools following the partnership academy model share several general characteristics. First, they are three year programs for students in grades 10-12 and generally function as separate schools within a larger institution, also known as the "school within a school" model. While an academy might share a campus with a larger school, they are encouraged to limit their classes to students attending the individual academy. One goal of this smaller school size is to create a closer knit community of students and teachers at each academy.

Another fundamental characteristic of each academy is the integration of academic preparation with a broadly defined career theme or focus. The career themes of each academy generally fall under one of the seventeen industry sectors established for career technical education by the California Department of Education. An important aspect of these industry

⁵² "Program Overview." (Sacramento, CA: *California Department of Education*, 2008.)
<http://www.cde.ca.gov/ci/gs/hs/cpaoverview.asp>

sectors is that each sector includes many types of jobs. Examples of the three most common industry sectors in partnership academies are Health Sciences and Medical Technology, Finance and Business, and Arts, Media, and Entertainment.

The career focus is integrated into each academy by organizing and framing school-wide curricula around the career focus. The teachers in each academy work together to plan and implement the inclusion of the career focus into general academic subjects such as math, sciences, and language. In addition, academies offer technical courses which more directly relate to the career field. The general goal of the career focus is to better engage students by showing them the connection between coursework and life outside of high school.

The career element of the academies is furthered by partnerships with businesses and other outside entities which contribute a variety of resources to the educational process. Examples of these types of contributions include guest speakers and in-class instruction, field trips, job-shadowing opportunities, student internships and summer jobs, one-on-one mentoring programs, and participation in advisory boards or steering committees involved in the process of school planning and curriculum development.

In order to qualify for funding, California Partnership Academies must abide by a series of guidelines and requirements. One requirement particularly worth noting is the method by which the academies must select students for participation. First, selection must be based on voluntary interest. Students are not forced into attending any academy and typically must undergo an application process to demonstrate this interest. Further, at least half of each incoming class must be students who are considered “at-risk.” While this phrase is used broadly in working with youth, in this context, it refers specifically to those students who are at-risk of “dropping out” or being pushed out of the educational system. The partnership academy

guidelines establish criteria for the “at-risk” classification. The factors resulting in this classification include irregular attendance, low level of motivation, coming from an economically disadvantaged background, and underachievement (as evidenced by low test scores, low grade point average, or being significantly behind in credits).

The targeting of at-risk student population for enrollment reveals one of the fundamental goals in establishing partnership academies. Through their engaging curricula, the academies aim to increase graduation rates for high school students. Further, the academy program emphasizes post-secondary success by better preparing students for college and promising careers.

The Movement for Green Technology in the CPA's

The movement for creating green technology academies through California Partnership Academy grants has been pushed forward by a series of state legislative initiatives. Several bills have been introduced in years past and have either not passed or have not had funding appropriated. However, in 2008 and 2009, several new versions of these bills have pushed the creation and funding of green technology academies closer to reality.

On September 30, 2008, California Governor Arnold Schwarzenegger signed Assembly Bill 2855 into law. AB 2855 was introduced by former Assembly Member and now California Senator Loni Hancock. This bill established two new industry sectors for California Partnership Academies, which are the Green Technology Partnership Academies and the Goods Movement Partnership Academies. This bill called for the funding of nine new academies; one in each of California's economic regions..

While the passage of AB 2855 was significant in setting a clearly outlined precedent for Green Technology Academies, the implementation effort has been boosted to include a much larger number of academies. AB 519 was the trailer bill affecting the 2008 California education budget. This bill allocated funds from the Public Interest Research, Development and Demonstration Fund, which is actually a special fund from the state community college budget, for 61 “Clean and Green” high school partnership academies starting next year and continuing through the 2011-2012 school year. The funds amount to \$3 million for the 2009-2010 school year, and a total of \$12.5 million for the three year period of implementation.⁵³ This increase in the number of green technology academies funded for the 2009-2010 school year, from 9 to 61, reflects a rapidly shifting awareness of the importance of implementing environmental technology in the California Partnership Academies.

Another California bill with the potential to significantly stimulate the inclusion of environmental technology in career-technical education at the high school level is SB 675: the Clean Technology and Renewable Energy Job Training, Career Technical Education, and Dropout Prevention Act. This bill was authored by Senator President Pro Tempore Darrell Steinberg and establishes a fund “to provide competitive grants for the purpose of constructing or reconfiguring new facilities...to provide program participants with skills and knowledge necessary for successful employment related to clean technology, renewable energy, or energy efficiency.”⁵⁴ Although this bill could potentially provide funding for a variety of institutions including middle schools, community colleges, apprenticeship programs, or conservation corps, the bill primarily targets high school education and decreasing drop-out rates of high school

⁵³ Jack O’Connell, “2008 Budget Act and Legislation.” *California Department of Education*. 10/30/2008.

⁵⁴ “SB 675 Senate Bill – Bill Analysis.” *Senate Committee on Education*. 4/1/2009

students. The bill recently passed the education committee and could go a long way to implementing the goals of green technology academies on a large scale in California if it is signed into law.

School Profiles

The following school profiles are organized into several sections highlighting the key elements of each academy. The first element is community setting and student population demographics. This set of information includes the geographic location of the academy, information about the district and larger high school that each academy pertains to, the school size, and demographic information regarding ethnicity and socioeconomic status, indicated by students' eligibility for free or reduced lunch. Following this introduction of the general setting, each profile tells the story of the origins of the academy.

The profiles then describe the most important school elements of each academy. School elements refer to curriculum development, course offerings, professional development, and student support services. Post-secondary elements and community partners are discussed to provide examples of each academies connections to colleges, training programs, internship providers, and community partners supporting the academy in other ways. Finally the challenges for each academy as identified by interviewees are outlined.

While schools across the country were identified and included in this study, the in-depth interviews were primarily completed for California Partnership Academies. The profiles for these schools include the most detailed information in all key elements listed above. Several other schools outside of the CPA's were identified and investigated to varying degrees in the

research process. These schools included charter schools, public schools re-opening with a green-technology focus, or small academies within larger schools similar to the CPA model. Many of the schools investigated did not yet have fully implemented programs, but had ambitious plans for development. These schools are also presented, albeit in a more limited form.

California Partnership Academies

Alhambra High School – Alhambra, CA

Green Construction Academy

Community Settings/Student Population

The city of Alhambra is in Los Angeles County about 8 miles northeast of downtown Los Angeles in the western region of the San Gabriel Valley. Alhambra High School is located in the downtown area of Alhambra. The student population is 3,310 students and includes high percentages of Latino (44%) and Asian (47%) students. 59.5% of students are eligible for free or reduced lunch. The academy population represents these demographics and is fairly evenly distributed between males and females as well as across levels of academic ability.

Approximately 40 tenth graders are currently enrolled in the green construction academy and the planned enrollment is for 150 10-12 graders.

Origins

The Alhambra Green Construction Academy began operations in February 2009 after receiving a California Partnership Grant in October 2008. The academy was created by a team of teachers including English, social studies, photography, and chemistry/wood shop teachers who had a history of collaboration. The administration of Alhambra High School then asked this

team to apply for a CPA grant. Students were recruited in 9th grade classrooms and were selected based on interest.

School Elements

Much of the curriculum for the Green Construction Academy has not yet been established and is waiting on the larger school's Master Calendar subject assignments. With that said, some curriculum, especially in the wood shop, design, and construction courses, has been planned for all three years of attendance. In 10th grade, students are placed in an introductory level wood shop course to build foundational skills and familiarity with tools and safety procedures. One of the highlighted projects in this course is that students build high-quality useable wooden sailboats. This process includes reading from detailed plans, constructing the apparatus on which the boats are pieced together, enamel and epoxy finishing techniques, and a host of other skills.

In the 11th grade students will focus on drafting and design of boathouses to house the 10th grade projects. This project relates more strongly to the Green Construction focus because the construction plans take place in two units. The first unit requires students to design the boathouse using traditional methods and resources. The second unit builds on the work completed in the first unit, but challenges students to modify the plans to use more environmentally sustainable materials and techniques. Finally in the senior year, students will actually construct the boathouses according to the modified plans made in the previous year. This final project will require students to put to use many of the skills and experience they have gained in the previous years and will be the first opportunity for most students to actually complete a real construction project.

Professional development has thus far been a high priority and teachers involved as well as Alhambra's head counselor and school principal have gained from attendance at CPA conferences. Students benefit from more individual attention, and personal relationships with teachers as well as their classmates. Students are engaged by exposure to a variety of careers, including those which require 4-year college degrees including construction management and architecture.

Post-secondary Elements/Community Partners

The primary relationship between the Green Construction Academy and post-secondary opportunities is with Los Angeles Trade Technical College. The green construction department at this college is undergoing a curriculum mapping process with Alhambra in an effort to assure that students have all the skills and required classes to easily enter after graduation. This relationship was developed largely due to personal relationship between teachers at both institutions. Other agreements are planned with energy partners Southern California Energy, a public utility, and Solar City, a private company.

Challenges

Scheduling and establishing a separate identity within the larger high school are some of the main challenges facing the academy. Even though classes at the academy are only open to academy participants, the academy is still required to schedule classes within the larger school's master calendar system. This top-down system has stalled curriculum development and planning because teachers are unsure of which classes they will actually be able to teach. Pressures from teachers outside of the academy have also created conflicts. One example of these types of conflicts is the debate around changing from a traditional six period schedule to a modified block

schedule. Many are strongly against changing schedule formats because of the effect this would have on the athletics department.

Another challenge is fitting the academy's curriculum to students with different needs and abilities. Math is one of the core subjects offered within the academy setting for tenth graders. Despite the fact that students arrive at the academy with varying levels of ability in math, all students are currently enrolled in Algebra II. The needs of struggling students are met with constant support services and intensive instruction so that all students can succeed in this advanced course.

The academy is also in need of an evaluative process. The extra funding required for the academy, which thus far serve a small percentage of students, requires justification and accountability. An important gauge for evaluation is to analyze the outcomes of students who were previously struggling upon entering the academy

John F. Kennedy High School – Fremont, CA

Green Tech Academy

Community Setting/Student Population

Kennedy High School has a student population of 1,424 students and is part of the Fremont Unified School District. Fremont is the fourth most-populous city in the San Francisco Bay area with over 200,000 residents, and is located in Alameda County.

Origins

The Green Tech Academy was created in Fall 2008.

School Elements

The series of courses at Green Tech includes science classes such as Biotech 105 and Chemistry 109 for 10th and 11th grade students respectively, in which students can receive dual credit at nearby Ohlone Community College District. 12th grade students are able to take Biology 100, Human Ecology 108, and Biotech 113/114B which are also equivalent to classes at Ohlone. This course series allows students to graduate from high school well on their way to the Biotech certification at Ohlone. 12th graders are also offered a construction tech/solar course.

John Marshall High School – Los Angeles, CA

School of Environmental Studies

Community Setting/Student Population

John Marshall High School is located in Los Angeles's Los Feliz district, north of downtown, and is part of the Los Angeles Unified School District. The school operates year-round on a multiple track enrollment system and serves approximately 4000 students. The student body is made up of primarily Latino (66%), Asian (18%), and White (13%) students. 75% of students are eligible for free or reduced lunch. 240 students currently attend the School of Environmental Studies which is open to 9-11 graders and will include 9-12 graders in the 2009-2010 school year.

Origins

The School of Environmental Studies (SES) began operations in 2007. It is a California Partnership Academy and is one of eight small-learning communities which make up John Marshall High School. Students are recruited from two feeder middle schools and are required to submit separate applications for SES.

School Elements

This academy is split into two tracks; one for students going on to 4-year colleges, which includes honors and Advanced Placement (AP) courses and the other track for students entering 2-year institutions or the workforce. The same environmental career pathway sequence is required for all students, however the A-G courses required for entering California public universities are not required for students on the second track.

The environmental curriculum is administered through a series of courses offered at each grade level. In 10th grade students are required to take environmental studies and woodshop; in 11th grade a design course is required which focuses on landscape, architecture and other design fields which are relevant to environmental skills; in 12th grade all students take AP Environmental Science.

Aside from these elective classes, environmental education is integrated into several other course areas. Biology courses include a biomes project which introduces students to the ways in which different environments affect each other. One teacher also includes education on nanotechnology and the effects both positive and negative that the field of nanoscience can have on the environment. History classes focus on environmental history and consequences of various historical events and time periods. The life skills course for incoming 9th graders exposes students to careers in green industries. Finally, many students are involved in community service projects that provide additional exposure to work in environmental fields.

Various services at SES support student achievement. An important aspect of the small learning communities, and particularly of SES, is that all classes including English and social sciences are made up of only students in that academy. This fosters a closer-knit school environment and also allows teachers to tailor general subject courses to environmental-related materials. In addition, all teachers at the academy are certified to teach Specially designed

academic instruction in English (SDAIE) and Limited English Proficiency Learners (LEPL). John Marshall's after-school tutoring program is open to interested academy attendees and is offered three times a week. Finally students at SES gain from a mentoring and intervention program which involves older students at the academy partnering with younger students

Post-Secondary Elements/Community Partners

The school benefits from a relationship with UCLA and Los Angeles Trade Technical College, which provide access to resources. The academy also benefits from agreements with several environmental groups including Tree People, The California Coastal Commission, the Sierra Club, and the ACE Mentor program. These groups provide internship opportunities for 11th graders.

Groups such as Tree People and the California Coastal Commission also involve students in off-campus projects and activities. Tree People's Mountain Forestry Team has involved students in reforestation efforts in nearby Griffith Park and in the Angeles National Forest. The California Coastal Commission Adopt-a-Beach program and the organization Heal the Bay have involved students in collecting data on beach and water pollution.

Challenges

Some of the major challenges ahead of the SES at John Marshall are the current funding status of the school district which is likely to put staffing and overall funding in flux for the next few years. A decline in enrollment at the school will likely be exacerbated by a new high school which is opening in the area. The school also faces challenges in fulfilling its promise as an environmental career-technical academy. The dual mission of satisfying standards for general academics as well as the environmental curriculum is a challenge. Although biology courses, for example have had great success in incorporating environmental curriculum, other subject areas

such as chemistry, English, and social studies struggle to make strong connections to the environmental focus of the school.

Laguna Creek High School – Elk Grove, CA

Green Energy and Technologies Academy

Community Setting/Student Population

Laguna Creek High School is part of the Elk Grove Unified School District. Elk Grove is a suburban city south of Sacramento in Sacramento County. 30 different languages are spoken at the school and the population is roughly 26% white, 24% African American, 20% Asian, and 15-16% Latino, while with 41% of students are eligible for free or reduced lunch. The high school has a total enrollment of about 1950 students and has several other career academies including Manufacturing Production Technology Academy and the Sports Career Academy. A starting class of 36 sophomores currently attend the Green Energy and Technologies Academy (GETA), but 9-12 grade classes will be added in the next two years to create a total student body of 130-140 students.

Origins

GETA started operations in fall of 2008. Students were recruited for the academy through presentations at 9th grade homeroom classes. The development of the academy is largely due to the initiative of Eric Johnson, an AP physics teacher at Laguna Creek. Johnson was able to apply his expertise in the field of renewable energies to the creation of an in-depth project-based curriculum and extensive partnerships with collegiate and community allies.

School Elements

GETA benefits from a well-developed curriculum pathway in the field of renewable energy technology. In the 9th grade, students enroll in an introductory course to energy technology. The curriculum used in this course includes resources provided by the National Energy Education Development Project (NEED). This program includes booklets and kits that introduce students to the many fields which will be studied in more depth in their series of courses in the next three years. 10th graders take a class on solar energy in the fall and on wind and hydropower in the spring. 11th graders focus on biofuels and then hydrogen fuel cells. Finally, seniors are paired up projects specific to their interests which include the opportunities to participate in outside internships and training certification programs accessible through GETA's partnerships.

Johnson pieced together the curricula for the 10th and 11th grade courses on renewable energies by taking a project-based approach borrowed from online research and personal experience. An example of the type of projects completed by students include a solar cart project which was then used for demonstrations at middle schools. Johnson used his own solar cart project as a teaching tool and model for the student projects.

Because of the small size of the academy, the teachers involved have been able to closely relate curriculum materials to the green energy theme. Examples include the incorporation of energy efficiency calculations into math courses and environmental geography into social studies courses. In an interview with Johnson, the science teacher stressed the importance of an enthusiastic and knowledgeable teaching staff in the development of a successful green technologies academy. According to Johnson, the green technology focus "can't come from administrators. There have to be enthusiastic teachers."⁵⁵ The academy serves the needs of

⁵⁵ Eric Johnson. Phone interview with author. 3/26/09.

students by providing a small learning community where students receive individual attention from a dedicated group of teachers.

Post-secondary elements/Community Partners

GETA has articulation agreements with several colleges and industry partners. The primary existing partnership is with the Cosumnes River Junior College of the Los Rios Community College system. By matching curriculums and exams at the high school with the corresponding classes offered at the community college, students are able to receive dual credit for several classes such as a bio-fuels course. GETA is also developing an articulation agreement with the engineering department of Sacramento State University. In this agreement, students will take an architecture, construction, and engineering class at the high school and receive credit from the California State University system. The engineering department at Sacramento State has a green energy component, which is allowing for the development of this program. GETA also has plans to partner with UC Davis, however this partnership is more likely to involve UC Davis graduate students rather than professors and will mainly provide students with independent research opportunities.

GETA has also developed articulation agreements with several employers. Through a partnership with Pacific Gas and Electric, (PG&E,) students will have the opportunity to participate in the Power Pathways program which prepares students for entry into a lineman training program and other career opportunities. With a further developed articulation agreement, students may actually be able to begin the training program while still in high school. Through a partnership with the Sacramento Municipal Utility District (SMUD,) students will be able to enter a solar installer certification program as part of the high school experience. The opportunity to gain certifications with SMUD and PG&E will be available to students in their

senior year. Many other employers have also expressed interest in partnering GETA to provide internships for students in their junior or senior years. Some of these employers include the Chevron mentor program, Johnson Controls, the California Energy Commission, and Optisolar, the largest solar manufacturer in the United States. These employers are likely to each offer 2-5 internship slots for interested students.

Industry allies have also pledged their support of the academy in other ways. Most notably, SMUD provided \$10,000 in initial funding for after-school programs for the academy and provided \$7,000 this year for the development of new programs at the school such as the bio-fuels program. The business and industry partners also provide speakers and field trip locations.

Challenges

One of the main challenges that currently faces the academy is recruiting middle-school students who are actually interested in the renewable energy technology focus. Many students have not seriously considered this type of career at the middle school age, and may be reluctant to pledge their commitment to enrolling in the school. However, Johnson indicated that interest in the academy is likely to grow as incoming students become more aware of the types of projects and opportunities available to GETA participants.

Montgomery High School - Santa Rosa, CA

Green Building and Design Technology Academy

Community Settings/Student Population

Montgomery High School serves 1900 students and is one of the Santa Rosa City Schools. Santa Rosa is located in Sonoma County north of the San Francisco Bay area.

According to Len Greenwood, the coordinator for the Green Building and Design Technology Academy, the school demographics are made up of a roughly 85% white and upper-middle class student population. The Latino presence on campus accounts for approximately 10% of the student population. The academy, however, serves a diverse population and students are recruited from the other four high schools in the Santa Rosa High school district to attend the academy. Recruitment is done in all ninth-grade science classes, and to enroll in the academy, students must demonstrate their interest through an application and interview process. The beginning class at the academy consists of 30 tenth graders. The school is planned for 150-180 students from 10-12 grades.

Origins

The Green Building and Design Technology Academy at Montgomery High School in Santa Rosa, California opened in fall of 2008. The academy was founded by Mr. Greenwood who saw a need for the academy in the atmosphere of the growing green jobs movement and convened several teachers to apply for the CPA grant.

School Elements

Currently, the majority of instruction around environmental themes takes place in the 10th grade biology class. This class emphasizes environmental science and ecology and includes activities such as creek restoration and permaculture. The school has plans to use a one to one-and-a-half acre lot as the site for a demonstration garden which will include a nursery and location for the academy's horticulture activities. Another exciting project starting this year is the forest health project for Sonoma County which is a 3-year long project including photography, soil sampling, and water sampling. At the end of the three-year project, students will report to the County Board of Supervisors. As students progress on to chemistry in their

junior years, the focus again will be on environmental applications while meeting all of the state standards for chemistry curriculum.

In the junior year, a construction class will be offered at the academy which focuses on environmentally friendly building materials and in their senior year, students will be required to enroll in an apprenticeship program. The curriculum developed for English and World History classes includes readings on current environmental issues, resume-writing, and working with Congresswoman Lynn Woolsey on advocacy campaigns. World history courses focus on the role of natural resources over the course of human development.

The eight staff members involved with the academy include five teachers, a counselor, an administrator, and the academy coordinator. These staff members have benefited from several professional development activities including weekly lunch meetings and monthly after-school meetings for collaboration on curricula and planning. Three of the five teachers are currently enrolled in a 6-month course leading to a professional certificate through the United States Green Building Council. All staff members will benefit from a weeklong conference called “Solar energy for teachers.” Finally staff will be involved in the annual “Bioneers” conference in October 2009, as well as additional conferences for teachers with the Climate Protection Campaign.

One innovative practice at the Green Building and Design Technology Academy is the pairing of each staff member with four students for weekly one-on-one mentoring check-ins in the morning before school starts. Mr. Greenwood cited this activity as integral to providing support for students who were struggling and unmotivated academically upon entry to the program. The small investment in one-on-one mentoring by the staff seems to have a dramatic effect on student motivation.

Post-Secondary Elements/Community Partners

The Green Building and Design Technology Academy benefits from a strong relationship with nearby Sonoma State University's Environmental Studies department. Upon graduation from the academy, students will have the opportunity to directly enter this department. Additionally, in 11-12th grade, students will have the opportunity to work with Sonoma State college students on projects such as energy audits that may enable students to gain college credits. Another college partner is Santa Rosa Junior College which is now organizing their own environmental studies and green building program.

The academy also benefits from various partnerships in the community which provide internship opportunities, part-time jobs, field trip locations, and incentives for the completion of student projects. These organizations include the Climate Protection Campaign, Occidental Arts and Ecology Center, Sonoma Mountain Village, the Sierra Club, and Solar Sonoma. Solar Sonoma recently hired four students at the academy for part-time, ten hour per week positions as GPS roof-top surveyors for solar installation. Students will benefit from a training valued at \$350 per person to become solar installers and will gain experience in the process of assessing the types of solar energy systems need for Solar Sonoma's residential clients. Another exciting opportunity is the planned involvement of academy students in the PLANet Youth summit this summer where students will take part in a panel describing their experiences at the academy.

Challenges

Funding beyond the CPA grant is an anticipated challenge for the academy. Sonoma County recently cuts its funding of career-technical programs in half resulting in the loss of forty formerly existing classes across the county. The CPA funded Green Building and Design

Technology program presents a model for the survival of these under-funded programs across the district and county.

Oxnard High School – Oxnard, CA

Green Technologies Academy

Community Settings/Student Population

Oxnard High School serves approximately 3000 students and is located 55 miles northwest of Los Angeles. Students at the school are 66.2% Latino, 17.6% White, 6.0% African American, 3.8% Filipino, 3% Asian/Pacific Islander, and .5% Native American. 45.9% of students are socioeconomically disadvantaged; 23% are English learners; 9% of students have disabilities. The demographics of G-Tech are representative of the total student population; however males are more strongly represented than females and make up 2/3 of the class. 26 tenth graders make up the beginning class at G-Tech and the academy is planned for a total of 105 10-12 grade students.

Origins

The Green Technologies Academy at Oxnard High School opened in January 2009. The academy was created with the goal of engaging students in math and science courses by connecting these courses to a relevant and exciting field. The initial team that developed the academy included a now-retired math teacher and industrial arts woodshop teacher who hoped to create a large academy within the school that would provide students with the skills to install and monitor solar and wind power. This plan then shifted to focus on a much smaller group of students through the CPA program. In the case of Oxnard Green Technologies Academy, (or G-Tech, as it is commonly referred to,) the advisory board was especially instrumental in the

development of the academy. The advisory board consisted of a variety of employers and professionals including engineers from a nearby naval base, local community colleges, a geologist, and an architecture firm. One initial challenge that the academy faced was recruiting students. This was partially due to the late notice and mid-year starting date for the academy. Students are recruited through presentations to classes and at parent nights for incoming ninth-graders. Students at the academy play an important role in these presentations.

School Elements

The curriculum developed to date at G-Tech includes the two introductory courses which are “Exploring green technologies,” and “Green Tech core.” The curricula for these introductory courses were developed by teachers at the academy who pulled materials from several textbooks to form their own instructional plan. The next course in this pathway is “Environmental Design,” which will focus on residential construction. This course was previously offered at Oxnard High School, but is now incorporated into the academy. The other courses offered will be titled “G-Tech wood shop,” “G-Tech English,” and “G-Tech World Civ.” The curricula for these courses will be based on the modules currently being developed for the California Department of Education through the Education and the Environment Initiative.

Post-Secondary Elements/Community Partners

In its first year of existence, G-Tech has focused more on curriculum development and less on building partnerships with other organizations which can provide students with post-graduation opportunities. However, several partnerships are in the planning stages. The two local community colleges, Oxnard Community College and Ventura Community College, are just beginning to develop their own green technology departments, and are the primary

educational partners with Oxnard G-Tech. Another possible partner is Cal-Poly San Luis Obispo.

The strongest community allies for the academy thus far have been the Port Hueneme Naval Base, the City of Oxnard, and the county geology department. These partners, and others, have contributed by providing guest speakers, field trip locations, and serving on the academy's advisory board.

Challenges

Some of the main challenges facing the academy are scheduling conflicts with the Oxnard High School Master Schedule, and the lack of appeal that construction technology has to the entry age-level students. A likely future problem is continuing the program once the state grant has been discontinued. The teachers and counselors involved with G-Tech would like to see the program increase in scale, if effective, to serve a larger percentage of the school population. In this scenario the academy would fit into the small learning community model and would contain multiple pathways for students interested in a variety of careers. However, in its current form, the academy will serve primarily to teach a fundamental skill base for participants and an overview of the main topics of instruction.

Windsor High School - Windsor, CA

Windsor Institute for Sustainability and the Environment

Community Setting/Student Population

The city of Windsor is a small-sized town of approximately 25,000 inhabitants in Sonoma County. 1500 students attend Windsor High School, and the student population is predominantly white (72%) and Latino (25%). 20% of students are eligible for free or reduced

lunch. Windsor High School opened in 1995 with an alternative approach. The school is made up of seven “Focus Areas” which function as small-learning communities for students in grades 11-12. Some of these focus areas in the past included business, culinary arts, humanities, Advanced Placement, Digital, and Arts. 65 students, in grades 10-12, are currently enrolled in the Windsor Institute for Sustainability and the Environment (WISE).

Origins

WISE started in 1999 as the Environmental Studies focus areas at Windsor High School for 11-12 grade students. This focus area was started by two teachers with “an intense interest in environmental awareness.” The academy has received previous funding from the Specialized Secondary Program and CPA grants. The academy, in its current form, was created in Fall of 2008.

School Elements

The environmental science course at WISE utilizes the main themes of system thinking and sustainability to explore the issues of resource management including California water management, energy acquisition and consumption, land use planning, agriculture, and consumerism. Social studies and English are also taught at the academy and starting next year the academy will offer a “green design” course.

In an email correspondence, environmental studies teacher, Stephan Klakovich described the types of projects which facilitate the integration of environmental studies into all course materials.

“Large projects help us tie all the curriculum together. Students are presently working on putting on a school energy fair. Each group is responsible for a booth at the fair where they will demonstrate many different kinds of energy sources. But in addition to the model or demonstration, they will be producing video promos that will air during our video announcements. Scripts need to be written for this video. A pamphlet will also be produced which involves another writing style as well as a fair amount of research. Students will also write

press releases. For this particular project, students have been asked to specifically use mathematics to explain an important aspect of their project content. Our best large projects contain elements of writing, presenting, research as well as some sort of public service.”⁵⁶

Klakovich then goes on to describe other student projects that integrate environmental studies across subjects including the facilitation of a campus-wide recycling program; an environmental awareness campaign on-campus; monitoring water quality at a local creek; design and construction of a school garden, a pedal generator, a solar power generator, and a solar water heater. Other students to take on a leadership role in the community by providing energy audits to nearby schools and teaching sixth-grade students about ecology.

Students at WISE are able to take advantage of services at Windsor High including a daily math lab and library study center staffed with teachers. Students with section 504 disability status are also able to get help in the learning center and teachers at the academy are available at lunch and after schools to help students. Another aspect of the WISE program is the A/B block schedule, which allows for increased flexibility for the academy. Students alternate from day to day between their academy classes and outside classes at the larger school. This allows teachers to easily implement field trips or extended learning activities without running into scheduling conflicts.

The current staff is highly trained and enthusiastic about the environmental focus at WISE, and another teacher who has taught as part of the Regional Occupation Program (ROP) has recently been brought onto the staff. Professional development activities include attendance at conferences including the “Green Schools Conference” in Anaheim.

Post-Secondary Elements/Community Partners

⁵⁶ Stephan Klakovich. Email correspondence with author. 4/9/2009.

While WISE does not currently have fully-developed articulation programs in place, they are working on developing agreements with Sonoma State University, Santa Rosa Junior College, and with local business partners. Some of the most important community partners for WISE are non-profit community organizations such as Land Paths and the Climate Protection Campaign. Land Paths is currently training a group of 16 students to be environmental educators, while the Climate Protection Campaign has supplied an intern for WISE who is facilitating the campus environmental awareness campaign. The Town of Windsor, which has incorporated students in tree-planting projects, is another important partner. Corporations such as BP and Pacific Gas and Energy have also contributed to WISE by funding energy grants amounting to \$15,000.

Challenges

One of the greatest challenges at WISE is attracting students with strong interest. The program has a reputation among students that Klakovich considers “entirely different than what we are about.”⁵⁷ Klakovich identifies the need to make a more concerted effort in outreach and publicizing WISE’s work in the school and community. Another challenge identified was teacher workload management. This challenge becomes especially evident as teachers work to coordinate projects with community partners.

Non-CPA Schools and Academies

Academy of Construction and Design at Cardozo High School – Washington D.C.

⁵⁷ Klakovich. 4/9/09.

This academy is in its fourth year of operation and its second year in their newly constructed facility. The new facility includes five labs. The academy was created through a partnership with the DC Students Construction Trades Foundation which was founded by some of the major construction companies in Washington, D.C. One of the ways this academy has given students hands on experience has also been through a partnership with DC Habitat for Humanity. Many of the students are more skilled than other Habitat for Humanity volunteers and were therefore able to assist greatly with the organization's projects while gaining valuable experience. Another important part of this academy's success was their strong middle school recruitment.

This academy is incorporating environmental themes by using the recently published curriculum "Your role in the green environment" from the National Center for Construction Education and Research (NCCER.) This curriculum is also used in nearby construction training programs thereby allowing students to enter these programs at an accelerated level.

Aiken University High School – Cincinnati, OH

Origins

The Aiken University High School in Cincinnati, Ohio was created in 2002 after a grant from the Bill and Melinda Gates foundation split the larger Aiken High School, which had been operating since 1962, into three smaller academies. Despite the new funding and smaller school environment, the school experienced a decline in overall academic performance, very low science test scores, and discouraged faculty. In the 2006-2007 school year, the school underwent a planning process that included a dialogue with parents, students, and teachers about how to

better engage the students. In late winter of that year, those involved in the planning process made the decision to adopt an environmental studies focus for the following year.

The environmental focus was decided upon for a combination of reasons; however, the main goals were to rejuvenate science instruction and proficiency at the high school level and to offer relief from urban stresses, which left many students with very little access to natural environments. Other reasons cited for the environmental focus include the growth of careers and college majors in science, technology, engineering, and mathematics, support from environmental organizations, the need to build college and career pathways, social and emotional learning needs, district plans for a new building, and the shortage of African-American math, science, and technology-trained students and teachers.

School Elements

In the 2007-2008 school year, the career technical pathway in environmental science was put into place for the 450 9-12 grade students at Aiken University High School. Several partnerships contributed to the success of the first year of this program. One of the most important partnerships was a strong articulation agreement with Cincinnati State Technical and Community College located near the high school campus. This college offers a two year degree in Environmental Engineering. Students at Aiken were provided the opportunity to take courses in their senior year which went towards this degree. One example of these courses was a DC circuits course led by a college professor who came into the class twice a week.

Another important partnership was with the Cincinnati Metropolitan Sewer District. This city utility is a major employer in Cincinnati and is currently undergoing changes in an effort to improve water quality. Students participated in summer internships with MSD as well as in science labs at area colleges. Other important partners included Ohio Tech Prep Consortium and

the GE Scholars program which provided one-on-one mentoring and tutoring among other resources.

Challenges

Despite the first-year success of the environmental studies program at Aiken, budget cuts and decisions by the Cincinnati school board and superintendent have impeded the possibility for replication and continuation of this success. Principal Virginia Rhodes, who was instrumental in the development of the program was transferred to another school after the 2007-2008 school year. Although the school continued operations for the 2008-2009 school year, the entire Aiken High School will close after spring of 2009.

Fortunately, another group of Cincinnati schools is under development and will open in Fall of 2009. The Ohio Science, Technology, Engineering, and Mathematics (STEM) learning network consists of five start-up high schools. The Hughes STEM high school will open in Fall of 2009 for a class of 300-350 ninth-graders. Students from anywhere in the Cincinnati school district were able to apply to Hughes and were selected based on lottery. Due to increasing interest, a waiting list is expected. Hughes will offer five career pathways including bioscience, engineering, STEM education, zoo academy, and the sustainable urban environmental program.

For the 2009-2010 school year a STEM overview course will provide an introduction to each of the five pathways. When students reach the 11th grade they will select a pathway as their focus for their remaining two years. For students who choose the sustainable urban environmental program, the bulk of career-focused instruction will be in science courses, including water quality, and electricity basics to prepare students for careers in environmental engineering and environmental chemistry.

Partnerships with the University of Cincinnati, Cincinnati State, Procter and Gamble, STRIVE and the Ohio Governor's office, among other groups, are providing funding and other support for the opening of the new school. A steering committee is currently involved with planning and professional development which will include the hiring of 15 new teachers for the first year. A variety of technological resources will be available to the incoming class of ninth-graders including a program which will provide each student access to a laptop on campus. Some of the classes will be taught unconventionally with 100 students team taught by six teachers. Additionally, the classes will utilize Blackboard, an online resource used heavily by the Cincinnati colleges. The hope is that familiarity with programs used at the post-secondary level will encourage students to continue their education and will ease the transition out of high school.

Environmental Charter High School – Lawndale, CA

Founded in 2000, the Environmental Charter High School integrates environmental education through environmental science class offerings, extracurricular activities, and community service. One of the programs offered as an extracurricular activity is the "Green Ambassadors" program. This program operates through a partnership with Los Angeles Trade Technical College and has plans to expand to ten other California schools this year.

Hartford Public High School: Engineering and Green Technology Academy – Hartford, Connecticut

The Engineering and Green Technologies Academy is one of the four academies that opened as part of Hartford Public High School in September of 2008. The school is currently

functioning primarily as an engineering academy, and is waiting on the release of new curricula from Project Lead the Way and from the National Academy Foundation to introduce the green technology focus. The Connecticut Business and Industry Association and the United Technologies Corporation are both corporate sponsors of the academy.

Henry Ford Academy: Power House High –Chicago, Illinois

Power House High is a charter school located in the North Lawndale community of Chicago's west side. What makes this school especially unique is the fact that it is being constructed on the site of the former energy generating facility for the Sears, Roebuck and Co. original worldwide headquarters. The powerhouse was constructed in 1905 and operated until 2004 when it was decommissioned. Utilizing grants from several different sources, the school opened in August 2008 with an initial class of 112 ninth graders. The primary partners in opening this school include Homan Square, the Henry Ford Learning Institute, and the Chicago Public Schools Renaissance 2010 program. Homan Square is a development project which started in 1988 to redevelop the site of the Sears headquarters into a community facility. This facility provides housing, community services, as well as being the site for the new school. The Henry Ford Learning Institute is a non-profit organization founded by the Ford Motor Company, which has plans to open schools in urban centers across the United States. It has opened a school in Dearborn, Michigan, which will be one of the primary models for the Chicago academy. Finally, the Chicago Public Schools Renaissance 2010 program was an initiative launched by the Mayor of Chicago in 2004 to promote the development of new charter schools by 2010, which will be held accountable by a set of city-wide standards.

Locke High School – Los Angeles, CA

Locke High School is located in the Watts area of South Los Angeles and was founded in 1967. In 2007, the Los Angeles Unified School District (LAUSD) turned over operational control of the school to Green Dot Public Schools. Green Dot is a corporation which operates twelve other charter high schools in Los Angeles. The opening of Locke as a Green Dot school was a major shift for both LAUSD and Green Dot which had yet to take on the challenge of running a high school of Locke's size. Green Dot's other high schools are much smaller with approximately 140 students each.

In September 2008, under Green Dot control, Locke was split into six smaller schools to operate more closely to the typical Green Dot model. One of these schools that is set to open in September 2009 is the Architecture, Construction, and Engineering Academy or ACE. The inclusion of the ACE academy at Locke is largely due to the organizing and advocacy work of South L.A.'s Community Coalition. This organization has been campaigning for the creation of the ACE academy in South L.A. high schools especially because of the opportunities that the building-trades offer for high school graduates in the Los Angeles region. Community Coalition convened Youth and Workforce Development Alliance, an alliance of thirty community, labor, and business organizations, which contributed to the advocacy effort for ACE academy. Now that the academy is set to open, these organizations and others will operate in collaboration with the academy to provide internships, employment opportunities, and other resources for the academy.

III. Research Findings: Comparisons, Themes, and Recommendations

The information on the green technology academies presented in this study reveal issues confronting these academies and provide some important themes to consider as programs are expanded and improved at the individual school level as well as at the state and national policy level. A comparative model is utilized to highlight some of the most innovative practices at each academy, as well as some of the characteristics they share. These insights will be important in understanding the necessary elements for the creation of new academies. The challenges faced by each academy will also be given special attention as areas for improvement and potentially weak points in the educational model.

Aside from the comparison of the academies included in this study, these research findings also aim to present a more holistic perspective on the subject matter informed by not only interviews with teachers, counselors, and administrators, but also by the broad range of perspectives gained in the process of developing this study. Families, activists, organizers, social service providers, and educators in urban areas across the country have a vested interest in improving the lives and futures of young people. The deficiencies in current educational and social institutions are evidenced by the lack of response to the myriad of challenges that young people face. Green technology academies can have a role in confronting these challenges, but they don't necessarily provide a single answer. For this reason, the concrete findings in this study must, once again, be seen in a broader social context.

Geographic Orientation:

Blue Markers = California Partnership Academies
Red Markers = Non-California Partnership Academies



Figure 5: Location of Green Technology Academies, United States.



Figure 6: Location of Green Technology Academies, California

The location of the academies included in this study points to a need for a greater presence of green technology academies in urban areas. None of the California Partnership Academies included in this study are located in inner-city areas. In California, the cities of Los Angeles and Oakland are taking the lead in establishing green jobs pipelines and pushing their city governments to fund projects such as municipal building retrofits and public renewable energy development projects which will generate employment opportunities through local-hire project-labor agreements. While these types of projects are not exclusively being implemented in Los Angeles and Oakland, inner-city communities in these regions are making a strong push to implement the type of proactive environmental awareness, regulations, investment in infrastructure and business growth which has previously only been advocated for in wealthier, as well as, less densely populated areas. In urban regions, which are undergoing environmental transformation themselves, green technology academies are especially well positioned to provide relevant opportunities for their students, and to prepare their students to become valuable contributors to their communities.

Another important theme evident in the geographic layout of the academies is the opportunity for increased levels of cooperation between academies in specific regions. For example the proximity of the Montgomery Green Building and Design Technology Academy, and the Windsor Institute for Sustainability and the Environment, both located in Sonoma County, could allow for increased cooperation, particularly in the development of partnerships with interested community organizations and educational institutions.

The academies which are not CPA's, show the widespread interest in green technology academies across the country. It is important to note that this study does not attempt to provide a comprehensive profile of all schools with relevant characteristics. High schools across the

country are enthusiastically launching new programs and integrating environmental technology materials into existing career-technical programs. Even during the course of the research period for this study, new schools have opened or have announced plans to open in the near future. However, the academies included in this study show a concentration in the western region of the country, and the need for further expansion in all regions.

Comparative Analysis

In order to better facilitate the comparative analysis of the academies which were researched in-depth, the following table outlines some of the main characteristics at each school. This table is mainly to be used as a reference point for information about each academy. More information related to the particular role that each academies' community partners play, for example, can be found in the school's profile.

Community partners and post-secondary connections in *italics* denote planned relationships opposed to firmly established agreements between the institutions.

School Name	Year Opened	Origins	CPA	Student Pop. (Current/Planned)	A-G reqd.	Professional Development	Student Support	Post-Secondary Connections	Community Partners	Challenges
Alhambra Green Const.	Spring-09	teacher collaboration	Y	40/150	Y	CPA Conferences		LATTC, Cerritos College	SCE, Solar City	Scheduling, Varying student abilities
John Marshall SES	Fall-07	originally SLC	Y	240	N		SDAIE, LEPL, After-School Tutoring, Peer Mentoring	UCLA, LATTC	Tree People, Cal. Coastal Comm., Sierra Club, ACE Mentors	Incorporating curriculum, Funding status, Declining Enrollment
Laguna Creek GETA	Fall-08	teacher initiative	Y	36/140				Consumnes River J.C., Sac State, UC Davis	PG&E, SMUD, Chevron, Johnson Controls, Cal Energy Comm., OptiSolar	Recruiting students with strong interest
Montgomery Green Building and Design	Fall-08	teacher initiative	Y	30/180	Y	USGBC 6-month Course, "Solar Energy for Teachers,"	Weekly One-on-One with Staff	Sonoma State, Santa Rosa J.C.	Climate Protection Commission, Occidental Arts&Ecology, Sonoma Mountain Village, Sierra Club, Solar Sonoma	Funding beyond CPA Grant
Oxnard Green Tech	Spring-09	teacher collaboration/ advisory board	Y	26/105	Y			Oxnard C.C., Ventura C.C., Cal Poly San Luis Obispo	Port Hueneme Naval Base, City of Oxnard	Scheduling, Recruitment, Funding
WISE	Fall-09	started as SLC in 1999/ teacher collaboration	Y	65	Y	Green Schools Conference	Daily Math Lab, Library Study Center, Center for Disabilities	Sonoma State, Santa Rosa J.C.	Land Paths, Climate Protect. Commission, Town of Windsor, BP, PG&E	Recruiting students with strong interest, Teacher workload management

Aiken Univ. H.S.	Fall-07	community planning/ strategizing parents, students, teachers	N	450	N/A		GE Scholars Mentoring	Cincinnati State	MSD, Ohio Tech Prep, GE	Funding Cuts, Top-down decision making
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As shown in the table above, all of the academies studied were less than two years old. Many had opened in the past year. In this early stage, a high level of experimentation and innovation by teachers and individual schools is taking place. There is not yet an established model to follow for starting an academy, and, as a result, many are creating their own models. However, this also causes obvious difficulties as teachers struggle to set up curricula and community partners without much precedent about the most effective practices for engaging in this process.

The majority of interviewees cited teacher initiative and collaboration as the origins of their academies. This trend points to the importance of knowledgeable and enthusiastic instructors in green technology academies, especially at the start-up stages. As teacher Eric Johnson from Laguna Creek commented, and as several other teachers confirmed, the initiative for green technology academies “can’t come from administrators. There have to be enthusiastic teachers.” This strong assertion poses particular problems, if and when green technology academies become implemented on a wide-scale. Both federal and state governments are providing incentives, such as the 61 CPA grants awarded this year, for the development of green technology academies. Despite these top-down mandates, the responses of the interviewees emphasize the importance of a more teacher-led, grassroots development process.

The question then arises as to whether or not exceptional teachers at every new academy will rise to the challenge of leading the development of their respective programs. The teachers interviewed certainly did rise to this challenge. They each had differing backgrounds, some with more experience in construction, others with more experience in renewable energies. However, most of the teachers shared the common trait of having experience with green technology outside

of the educational setting and then transferring this experience and knowledge to their classrooms and academies.

Closely related to the importance of teacher enthusiasm and knowledge in the creation of the academies is the theme of professional development as academies expand. While professional development was not emphasized in the research process, the absence of a set professional development process at many academies was evident. The main professional development activities identified were attendance at relevant conferences. The Montgomery Green Building and Design Technology Academy provided one example of an academy taking an active role to prepare its instructors. At Montgomery, three of five instructors are currently enrolled in a 6-month green building certification course through the US Green Building Council. Professional development activities such as these will be especially important as academies expand and a greater number of instructors become involved. The 2009 “Summer institute” will provide an opportunity for professional development for academies opening next school year. However, continued professional development activities throughout the school year may also be necessary.

Many of the academies studied had starting classes of less than 50 students. This small size proved to be important especially in accomplishing the goal of a tight-knit community. These academies all have plans to grow to schools for 105-180 students. However, some of the schools, such as the John Marshall School for Environmental Studies, demonstrate the differences and challenges which arise when a larger school size is implemented. At SES, two tracks were created, one for students planning on entering a four-year college after graduation, and another track for students electing other plans for the future. This tracking system created a situation in which not all students were required to complete the A-G course requirements. SES

was the only academy interviewed which did not require completion of A-G requirements for all students.

This type of dual-track system should be avoided in green technology academies. These academies should incorporate rigorous instruction, which prepares all students for continuing in post-secondary institutions and entering post-graduation job training opportunities. However, the situation at SES illustrates a potential obstacle as academies seek to expand and include greater numbers of students. While it may be possible to in academies with less than 100 students to keep all students on the same educational track, larger academies may find this goal more difficult to achieve.

Interviewees at all academies emphasized the importance of taking advantage of the larger school's student support services, as well as the inherent support which is provided for students by placing them in the smaller context of the academy. Additionally, several academies developed unique methods for ensuring that their students received proper support. One of these methods included the peer-mentoring and intervention program at John Marshall SES which pairs older students up with younger students at the academy. This type of support service could be replicated at other academies as upper grade levels are added on in the next two years.

Another standout student support service was the weekly one-on-one meetings with assigned staff member which all students receive at Montgomery Green Building and Design Technology Academy. These fifteen minute sessions significantly increased students' sense of being cared for by the academy staff. Currently, each staff member at the academy is assigned to four students who they can each see once a week without any major scheduling commitment. However, with the potential growth of six times as many students at the academy in two years, this student support service may require a greater commitment on the part of the staff.

Finally, the General Electric scholars program at Aiken University High School presents an enviable resource for any green technology academy. This program paired students with one-on-one mentors from GE to focus on improving students' math and science learning. This program proved to be one of the biggest reasons why Aiken was successful, and, if replicated, could greatly contribute to the success of green technology academies on a larger scale.

The programs of instruction and curriculum development process, as well as connections to post-secondary opportunities are the most thoroughly researched aspects of each academy in this study. Curricula opportunities include technical courses (i.e. wood shop, metals technology, drafting and design, renewable energy lab, etc.) as well as the integration of environmental themes into other subject areas such as math, science, English, and social studies.

The connections to post-graduation opportunities for each academy include articulation agreements with colleges, including community colleges, trade schools, and 4-year colleges. They also include agreements with other institutions such as joint training institutes, trade unions, employers, and other training programs. Related to this discussion is a more general discussion of the role of outside partnerships for the academies with business and labor organizations. While the ultimate goal of many of these agreements is to provide students with opportunities such as internships and post-graduation entry into employment or continued education, partners also contribute through funding, job shadowing, field trips, guest speakers and instructors, participation on advisory boards, one-on-one mentoring, and professional development.

Curriculum Development:

The development of appropriate curricula is a fundamental element in establishing any academy with a career focus. This is especially true for environmental technology academies, which are forging new educational fields. To assist academies in the development of new curricula various institutions have published materials including lesson plans, teacher resources, and textbooks. These institutions include government entities such as the U.S. Department of Energy and the California Environmental Protection Agency, as well as private entities. These private organizations include the National Energy Education Development (NEED) project, the National Center for Construction Education and Research (NCCER), and the Ford Partnership for Advanced Studies. Some of these organizations, such as NCCER, have previously provided curriculum materials for various areas of building trade or career-technical education, and are now developing new curricula or modifying existing curricula to meet the demand for green technology academies.

Profiles of Curriculum Providers:

NCCER – Contren Connect:

The National Center for Construction Education and Research provides curricula, assessments, and certification for instructors and students in the construction educational field. In the past year, NCCER released a landmark curriculum focused around environmentally sustainable construction practices and rating systems. An important aspect of the curriculum is that, upon completion of the program, students receive a certification which has been endorsed by both the United States Green Building Council and Green Advantage, a corporation that awards commercial/residential environmental certification.

National Energy Education Development Project:

The NEED project has compiled a collection of lesson plans and curriculums about energy and renewable energy for grades K-12. These resources are organized into complete educational “kits” which include curriculum guides, “infobooks,” which basically function as textbooks for the courses, and price lists for the necessary equipment

U.S. Department of Energy:

The Energy Efficiency and Renewable Energy branch of the U.S. Department of Energy has compiled more than 350 lesson plans for grades K-12. The categories of study for the ninth through twelfth grade lesson plans include energy basics, energy efficiency and conservation, transportation fuels, hydrogen and fuel cells, and separate categories on wind, solar, and biomass energies.

Another important aspect of curriculum development is teacher innovation and collaboration. In several of the schools investigated, teachers are taking the lead in developing student projects and background curriculum materials. At both the Alhambra Green Construction Academy and at Laguna Creek Green Energy Technology Academy, individual teachers have developed three-year progressions of classes leading to mastery of each academy's career theme. At Laguna Creek, this series includes semester long courses focusing on specific renewable energy sources. Instruction progresses from solar energy to wind/hydroelectric turbines, to biofuels, and finally to hydrogen fuel cells. In contrast, the teacher developed curricula at Alhambra focuses around construction technologies. First year students learn woodshop fundamentals; second-year students learn drafting and environmental design; third year students move on to construction techniques. Course series, such as these, provide the core of environmental career education that students receive at each high school academy.

Also important to the theme of curriculum development is the incorporation of environmental themes into traditional subject areas necessary for meeting educational requirements and entry into post-secondary education. Again, various sources contribute to curriculum development in these areas. Through the Education and the Environment Initiative (EEI), the California Protection Agency has developed and published draft versions of curriculum units for grades 9-12 which integrate environmental themes into earth science and biology, as well as social sciences courses for grades 10-12 which include units on history, government, and economics. While these are the only curricula that have been drafted thus far,

the EEI will also incorporate its “environmental principles and concepts” into the high school subjects of mathematics and language arts.⁵⁸

In the schools investigated in this study, the incorporation of environmentally relevant materials into areas such as English, social sciences, mathematics, and sciences proved to be a challenge generally taken on by the teachers of those subjects. Teachers did gain support by participating in collaborative planning sessions to incorporate materials, however in some cases full planning for methods of incorporating the school’s theme had not yet taken place. At Laguna Creek GETA, teacher Eric Johnson described examples of the incorporation of energy technologies into mathematics courses, in which students could learn about energy efficiency calculations and into social science courses.

In conclusion, several areas emerged as challenges in curriculum development and implementation. The first challenge is a lack of curriculum development for advanced studies in the green technologies. Various sources provide introductory materials on renewable energies and environmental issues, which may be used for grades 9 or 10 at a green technology academy. However materials for advanced studies are less common and curriculum development in these areas often falls to individual teachers and schools. In order to prepare students for high-level careers in environmental fields, further curriculum development is necessary around specific renewable energies, construction techniques, and other relevant technologies.

A similar theme is apparent in the development of curriculum for general academic subjects. While incorporated curricula may be developed for more basic sciences such as earth science and biology, there is a lack of curriculum relating to chemistry and physics which are

⁵⁸ “Education and the Environment Homepage.” *California Environmental Protection Agency*.
<http://www.calepa.ca.gov/education/eei/>

important subjects in preparing students for employment and further education. A similar lack is apparent in mathematics courses ranging from algebra through calculus. These are the types of courses which must be emphasized to increase student achievement in target careers like environmental engineering.

Connecting Students to Internships, Post-Graduation Opportunities, and Community Partners

High School students at green technology academies are connected to internships and post-graduation opportunities for employment and education through articulation agreements and collaborative relationships with community colleges, four-year universities, public utilities, investor owned energy companies, private solar companies, construction businesses, and environmental groups, among other entities. These partners are very important in making the career focus of each academy relevant and enriching to the overall educational experience. While this study gained information on a variety of post-secondary opportunities and programs with community partners, which are accessible to students at green-technology academies, the information on these partnerships should be considered preliminary. Especially for those academies which have recently begun operations, students have not yet been paired up with internship assignments or summer employment opportunities. The role of outside organizations and companies will become much more evident in the academies as students progress towards this portion of their experience at the academy. Nevertheless, the existing partnerships and plans for partnerships are outlined here to give an initial idea of the types of collaborative relationships that green technology academy must foster to be successful.

Articulation agreements allow students to apply credits earned in high school toward advanced standing, equal transfer, or direct entry into another institution. The articulation agreements that the academies in this study were able to build, in just one year or less, offer an encouraging outlook for the potential for a more seamless transition from green technology academies into post-secondary institutions. The current moment provides a unique opportunity for the development of strong articulation agreements. Colleges mentioned in this study such as Oxnard Community College, Santa Rosa Junior College, and others are in the midst of developing their own programs green building and green technology programs to adapt to new demand from students. This surge of growth provides the opportunity for high school academies to be integrally involved in the development of these programs to assure their students will be prepared and that the colleges implement programs relevant to the focus of each academy.

One of the more fully developed articulation agreements included in this study was the agreement between Kennedy Green Technology Academy in Fremont and Ohlone Community College. Agreements like this one that allow students to enter a college with advanced standing provide greater encouragement for students to continue their education after graduation. Community colleges can also provide resources for high school academies by acting as a jumping-off point for further connections. For example, Los Angeles Trade and Technical College has positioned itself as a leader and central coordinator of green job training for the entire region.

This study reveals the necessity of stronger connections to four year colleges. To truly provide multiple pathways for graduates of green technology academies, these relationships must be established. Of the four-year institutions that were identified as partners in this study, Sonoma State University and Sacramento State University were the most well established

partners. Academies were able to make connections to these institutions by partnering with specific departments within the university. At Sonoma State, the academies partnered with the environmental science Department and at Sacramento State, the academy partnered with a specific part of the engineering department focusing on renewable energy. These connections to specific departments could prove to be the best pathways for creating strong articulation agreements with four-year colleges.

Some of the strongest partners for green technology academies were public and investor-owned utilities. California is home to two of the largest energy companies, (in terms of annual revenue,) in the nation: Southern California Edison (SCE) and Pacific Gas and Electric PG&E). These companies already have established job training programs and can be an excellent resource for internships. Public utilities and municipal government entities can provide similar opportunities.

In many of the academies included in the study, the majority of partnerships were made with non-profit organizations, especially environmental organizations. These groups are making a concentrated effort to include education as one of their top priorities. While these groups offer activities which definitely enrich the academic experience, they tend to provide experiences more in line with a traditional environmental studies focus, and may be less likely to provide employment or paid internship opportunities to a large number of students. Another source of strong community partnerships came from private solar manufacturers, photovoltaic installers, and solar thermal construction companies. This sector offers some of the most promising private opportunities for students.

One notable absence among community partners with the green technology academies were labor unions. Labor unions could potentially provide an invaluable resource to these

academies because of their existing training infrastructure. Labor and trade unions often employ apprenticeship programs which allow those with little or no experience in the trade to gain the skills necessary while simultaneously getting paid. Labor unions such as the International Brotherhood of Electrical Workers (IBEW) are also very involved in green technology development. At the least, unions should expose students to their opportunities, and work with the green technology academies to make sure that students graduate with the proper level of education to enter apprenticeships.

Challenges

Certain challenges arose during the early stages of development of the green technology academies. While many of these challenges have already been mentioned in the discussion of curriculum and community partnerships as well as in the discussion of other general school elements, the interviewees tended to share similar concerns when asked about major challenges at their academies, and these concerns warrant discussion.

The main challenge apparent was lack of funding outside of the California Partnership grants. While these grants are instrumental in providing the initial funding to start an academy they do not always meet their full needs. Most of the academies received similar CPA grants in terms of monetary value. Typically the academies receive three-year grants amounting to 42,000 the first year, 72,000 the second year, and 81,000 the third year. These grants are dependent on maintaining a minimum level of student participants (typically 35 students per grade level.) These grants sunset after three years and require the academies to reapply for funding at this point. An important element of these “partnership” grants is the requirement that they be

matched by both the school district and by industry partners. The matching funds by industry partners typically are made through in-kind donations of services and trainings rather than monetary support.

Many interviewees expressed concerns about sustaining their academies beyond the CPA grant three-year period. Others expressed concern about whether or not the district would continue to fund the academies due to budget cuts. The closing of Aiken University High School in Cincinnati provided an especially disappointing story of an academy experiencing initial success and then being unable to continue operations due to budget cuts and top-down decision making.

Another challenge cited by multiple interviewees was the difficulty of scheduling academy courses and functioning as part of the larger school environment. Although the career academy model provides the advantage of letting students achieve the career focus while still maintaining options to take important courses outside of this context. However, conflicts tend to arise around scheduling issues. Especially because of the varying levels of academic ability which are represented in the academies, it may be difficult to keep schedules open for students to take specialized classes outside of the academy, which are only offered at certain times, such as AP classes. One possible solution to this challenge is to utilize the A/B block schedule used at WISE. This schedule alternates between four classes on one day and four different classes on the next day, which allows the academies to operate every other day and more easily plan field trips and other activities which require more than one class period to complete.

Finally, several academies cited the difficulty of recruiting students with a strong interest in the subject of green technology. However, most interviewees pointed out that this was mainly a challenge for recruiting the starting class of students. As students attending the academies

become involved in the recruitment process at feeder middle schools, for example, and the reputation of the opportunities provided at green technology academies grows, a high level of student interest in the academies is expected by many of the instructors. An example of this pattern is already apparent at Montgomery Green Building and Design Technology Academy which started with thirty students and plans to grow to 150-180 due to increased interest. Nevertheless, academies should keep their career focuses relatively broad to attract more students.

Conclusions

Green technology academies are an important element of change needed in high school education. They engage students by deepening their understanding of environmental issues while also exposing students to an economic sector currently undergoing considerable growth and transformation. Furthermore, this study finds that these academies have experienced initial success in developing curriculum, providing student support services and professional development programs, establishing community partners, and connecting students to post-graduation opportunities. Students can benefit greatly from green technology academies, however they currently provide opportunities for a very limited student population. In order to serve more students and develop the generational movement necessary for addressing environmental challenges, they must be deployed on a larger scale with increased investment from both public and private sources.

This study has already provided various recommendations for the expansion of green technology academies based on the experiences of the academies included in this study as well

as previous empirical studies. This final segment presents these recommendations in a condensed form for ease of reference. The current political climate generates considerable potential for increasing the level of support for green technology academies from federal, state, and local sources. To implement green technology academies on a larger scale, federal and state policy makers must allocate additional funds for the development and maintenance of these programs. Policymakers should:

- **Encourage Green Technology Academies in inner-city areas** with strong movements for investment in green jobs.
- **Utilize the California Partnership Academy model** for the development of green technology academies in other states.
- **Continue to encourage growth in the green economy** with a specific focus on industries which produce quality employment opportunities.
- **Encourage curriculum development for advanced subjects** relating to technical courses as well as the integration of environmental themes into advanced mathematics and sciences. While a significant amount of curriculum development has been done for basic courses, the advanced courses will go farther in engaging students with career related activities and preparing them for post-graduation opportunities.
- **Implement a process for evaluating the success** of green technology academies as a cohort. This evaluation will be especially necessary in justifying the expansion of the academies on a large scale. The academies are uncovering new territory in education and will require a thorough assessment.

Legislative initiatives like the California Partnership Academy grants can go far to direct the way that academies are developed by dictating required elements which must be in place to guarantee funding. However, much of the responsibility for leveraging supportive policies and funding and guaranteeing that all of the necessary elements for operating a successful academy are present falls back on the educators and community members involved on the individual academy level. Educators and community members involved on the individual academy level should:

- **Emphasize professional development.** Identify and recruit teachers with exceptional experience and enthusiasm in green technologies outside of the realm of high school education to take a leadership role in the development of new academies.
- **Cooperate with other academies** in the development process. Cooperative efforts can be especially beneficial for green technology academies which are in close proximity to one another. This collaborative effort could be advanced through a nationwide network of green technology academies
- **Avoid dual track systems**, which divide students based on their career plans. All students should be required to take the necessary courses for entry into the public university system. Student support services should be emphasized so that all students can achieve the high level of educational rigor necessary for entry into green technology careers.
- **Take advantage of the current groundswell of post-secondary programs** developing in the arena of green technology programs. The current developmental period of these programs in colleges provides a unique opportunity to make articulation agreements with these institutions.

- **Encourage labor union participation** in the development of green technology academies, while continuing to take advantage of the enthusiasm of private solar businesses, non-profit environmental groups, and community organizations in establishing partnerships.

APPENDIX 1. ACADEMY PHOTOS

Alhambra High School: Green Construction Academy



(Photo by author)



(Photo by author)

Laguna Creek High School: Green Energy Technology Academy



(Photo Courtesy of Eric Johnson)



(Photo courtesy of Eric Johnson)

Windsor High School: Windsor Institute for Sustainability and the Environment



(Photo courtesy of Stephan Klakovich)



(Photo courtesy of Stephan Klakovich)

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