

# Green Buildings to Sustain California's Central Valley

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**ABSTRACT:** California's heartland, the Great Central Valley, is one of the most productive agricultural regions in the world. However for many years the valley has been struggling with a broad range of social, economic, and environmental challenges. Some significant concerns include water resources, air pollution, poverty rates, housing issues, etc. Another strike against the valley is the relative reluctance to embrace widespread sustainable building practices. This paper discusses the long-term and profound impact of the built environment has on the aforementioned socioeconomic and environmental issues facing the valley. It reviews exemplary practices in other states and regions regarding policy-making and regulation in the building industry as well as sustainable community development. The paper further explores viable options specifically for the Fresno metropolitan area (the largest in the Central Valley) to combat its unique multifaceted challenges.

*Keywords: Central Valley, Sustainable Building Practices, Social Economic and Environmental Challenges, Policy-making, Regulation*

## 1. INTRODUCTION

The Central Valley in California stretches from Shasta County to Kern County, about 450 miles long and 40 to 60 miles wide. The northern half of the Valley is usually referred to as the Sacramento Valley and the southern half as the San Joaquin Valley. Together they encompass about one-sixth of the population and more than two-fifths of the land area of the State [1]. The Central Valley is a large and diverse area with rapid population growth, but its economy has been centered on agriculture for decades. It's one of world's most productive agricultural areas. The rich soils and abundant precipitation from the Sierra Nevada Mountains provide growing conditions conducive to a wide range of crops.

As population keeps growing in the Central Valley, a number of significant social, economic, and environmental challenges have arisen in recent decades. In 2008, researchers at the California State University, Fresno conducted an in-depth study for the City of Fresno to assess the potential climate-related challenges facing the greater Fresno area and how the City might address them. Fresno County is located at the heart of the Central Valley and is the most productive agricultural county in the nation. The City of Fresno is the 5<sup>th</sup> largest city in the state by population. The major issues discussed in the report include water, air quality, agriculture and landscapes, transportation, and energy [2].

In 2010, researchers at Geos Institute released a report that provided local climate change projections in Fresno County and surrounding counties using model outputs

from the USDA Forest Service Pacific Northwest Research Station and mapped by scientists at the National Center for Conservation Science and Policy [3]. A follow-up Geos Institute report in 2011 further discussed the vulnerabilities of socio-economic systems of Fresno Country to climate change and summarized a list of strategies developed by local leaders and experts during a series of workshops in 2009-2010. [4]

The intent of the aforementioned research reports was to help decision-makers make educated long-term planning decisions for the region. The proposed strategies provide great insights on developing supportive programs and policies regarding public health, agriculture, water, transportation, ecosystems, etc. However, very little attention has been brought to the stakeholders about the long-term beneficial impact of a sustainable building industry in this region. This paper reviews exemplary practices in other states and regions where policies, regulations, as well as other efforts to encourage a sustainable building industry were made to tackle similar socioeconomic and environmental challenges. The paper further explores viable options for the Fresno metropolitan area.

## 2. THREE MAJOR CHALLENGES FACING THE CENTRAL VALLEY

## 2.1 Water Resources

The California water system is especially vulnerable to global warming due to its dependence on mountain snow accumulation and the snowmelt process [5]. The Fresno County and the City of Fresno have a Mediterranean climate featuring warm dry summers and cool wet winters. Researchers at California State University, Fresno foresee that with warmer temperatures, the snow levels will rise to higher elevations and rainfall intensity will increase. More immediate run-off will occur with a reduced potential to capture and store freshwater for future use. Earlier snowpack melting in the year also indicate longer dry periods and may add to the difficulty insuring reliable water supply deliveries to Fresno and surrounding communities [1]. All of these contribute to declining groundwater recharge. Greater emphasis to water conservation and water treatment must be provided.

## 2.2 Air Quality

In the San Joaquin Valley, air quality has always been a prominent social, technical, political and economic issue. Local governments, the San Joaquin Valley Air Pollution Control District, and the California Air Resources Board have taken more stringent measures to monitor and reduce fine particle emission in recent years. However in latest 2012 American Lung Association national rankings of cities most polluted, four out of the top five cities are from the Central Valley. Fresno-Madera is ranked as #4 most polluted city by ozone, #5 most polluted city by year round particle pollution, and #2 most polluted city by short-term particle pollution [6]. A recent study on the health consequences of exposure to short-term ambient fine particulate matter (PM<sub>2.5</sub>) and ozone in the San Joaquin Valley by researchers at California State University, Fresno indicate that asthma ER admissions are strongly linked to increasing PM<sub>2.5</sub> across the region, with a higher risk in children [7].

## 2.3 Poverty

As the largest city in the Valley, the population in the Fresno metropolitan statistical area (MSA) more than doubled between 1970 and 2005 mostly due to net migration during the expansion of agriculture. However the regional economy has not kept pace with the rapid growth rate. Fresno has been struggling with severe poverty. According to U.S. Census data in 2000, Fresno ranked No.4 among the 50 largest cities in the U.S. on its overall poverty rate, and No.1 on concentrated poverty, the degree to which its poor were clustered in high-poverty neighborhoods [8]. As of Aug 2012, the unemployment rate in Fresno was 14%, compared to 10.6% in the State of California and 8.1% for the national average [9]. The Valley's population is projected to double again by 2040. At this point agriculture and related services still represent a disproportionately large share of the region's economy relative to the state's [10]. The challenge is to develop an economy with more diverse industries to accommodate the additional growth.

## 3. EXEMPLARY PRACTICES IN OTHER REGIONS AND STATES

Various cities across the country have established programs with the goal of fighting poverty and environmental degradation at the same time. These programs all offer some type of "green collar" job training with the help of different non-profit, industrial, and government partners. As the programs are fairly young, their true and far-reaching impact has yet to be seen, but the initial results are promising and indicate that programs of this nature are worthwhile.

### 3.1 Oakland, California: Green Jobs Corps

The City of Oakland was one of the first to establish a green construction program with the intent of fighting poverty. The Green Jobs Corps was founded in 2006 as part of the Ella Baker Center's goal to "create opportunities and provide training for low-income people, people of color, and people with barriers to employment" [11]. Three organizations were selected to run the Corps: Cypress Mandela Training Center, Laney College, and Growth Sector. The Mayor of Oakland awarded \$250,000 to fund the program and praised it as "a very elegant idea—elegant in its simplicity, to fight pollution and fight poverty simultaneously" [12].

The program is divided into four stages. Outreach, recruitment, and assessment of low-income young adults take place in the first stage. General academic, social, and professional skills are taught during stage two. Often, students are required to complete a sixteen-week "bootcamp" before beginning any actual job training where they learn a wide range of skill that help them become more productive members of society [13]. "Green collar" job training begins in stage three, where students learn about solar installations, building efficiency, and green construction practices while also earning community college credit. Other topics such as ecology, environmental sustainability, and environmental justice are covered as well. Finally, stage four gives students the opportunity to receive job training from industry partners. Companies like Swinerton Builders, Sustainable Spaces, and Solar City have the opportunity to work with these newly trained workers and both employees and employers receive support services from the Corps to maximize retention and success [14].

The Oakland Green Job Corps' first class of forty-two students graduated in 2009, most of which headed to jobs as solar installers, energy auditors, carpenters, and other entry-level positions. The job retention rate for students that successfully complete the training program is 75% [15].

The cost of the program is considerable—approximately \$12,000 per student. The City of Oakland provided about half of this cost while the rest of the funding came from grants, donations, and other sources. City officials view the program as a way to fight poverty and crime, and try to make use of some of the 500 million stimulus dollars specifically earmarked for green job training [16].

### 3.2 Dayton, Ohio: Pathways

Another program that uses green construction to tackle social issues is Pathways; a program spearheaded by the National Association of Regional Councils in an attempt to serve disadvantaged (low-income individuals, high school dropouts, individuals with limited English proficiency) and dislocated (unemployed and underemployed individuals) populations in various regions across the country [17].

The Miami Valley Regional Planning Commission of Dayton, Ohio was one of four organizations to implement a Pathways program in their area with NARC and a grant from the United States Department of Labor. Participants were trained in green construction and remodeling, building performance, and building deconstruction with the vast majority of participants working in the latter. The MVRPC used the program to confront a serious local problem: an abundance of abandoned, deteriorating houses in the City of Dayton. The vacant homes increased crime and arson rates and drove down neighboring property values. Participants in the Pathways program were trained to dismantle these structures, salvage as much of the material as possible, and prepare that material for resale or reuse. Local program partners hope to soon start a furniture manufacturing operation to make use of the salvaged materials.

Numbers from the MVRPC Pathways project are encouraging. At least 173 disadvantaged individuals worked through five weeks of unpaid training and earned multiple certificates. Ninety-one individuals entered unsubsidized employment and seventy-one of those individuals remain working [18].

### 3.3 New York, New York: PlaNYC

The City of New York has made considerable efforts to remedy a wide range of regional problems with green solutions. Mayor Michael Bloomberg's Office of Long Term Planning and Sustainability has produced PlaNYC; the 2007 plan meant to prepare New York City for an additional one million residents while making a "greener, greater" city and reducing greenhouse gas emissions by 30% from 2005 levels by 2030. This plan covers many of the same issues facing the Fresno area, including poverty, housing availability, water supply, and air quality [19].

Part of PlaNYC is the Greener, Greater Building Plan (GGBP). This plan establishes a mandatory program for the largest 15,000 properties in New York City responsible for 45% of all energy consumed by buildings. The program requires that all major renovations must comply with the New York State energy code, annual benchmarking data be made available to the public, energy auditing/retro-commissioning take place at least every ten years, and that specific lighting upgrades be made while submetering large nonresidential tenant spaces [20].

The benefits of this program are expected to be considerable, both for the environment and for the people of New York City. An estimated greenhouse gas reduction of 2.72 million metric tons is expected to be achieved by 2030 with GGBP due to more efficient buildings and less energy demand. The negative impacts caused by the extraction of energy resources will also be lessened by decreased demand. Finally, even though water usage is not ordered to be lowered by the GGBP, making performance records for these properties available to the public will encourage cuts in all consumption areas.

Through the implementation of GGBP the community will benefit as well. An estimated 17,800 jobs will be created in construction and related fields due to new requirements for audits and public disclosure and the renovations that follow [21]. Reductions in energy demand should improve air quality which in turn improves public health. It is important to note that this air quality improvement is not only outside; building improvements and a greater awareness of indoor environmental quality improve the health of building occupants and increase their productivity. The lifetime costs of this program are considerable at \$5.2 billion, however an estimated savings of \$12.2 billion yields \$7.7 billion in net savings [22].

New York City is also tackling poor air quality by requiring changes in the way its buildings operate. Heating oil used by properties in the City account for nearly 14% of fine particulate matter pollutants— more than vehicles or power plants. These energy sources contain heavy metals and other pollutants that damage the respiratory and circulatory systems, contribute to asthma, and decrease life expectancy. PlaNYC requires buildings only use low sulfur oil or natural gas, which is expected to reduce the amount of fine particles emitted by buildings by 63%. This reduction translates to the prevention of approximately 200 deaths, 100 hospitalizations, and 300 emergency room visits for illnesses caused by air pollution each year [23].

Indoor air quality is also specifically addressed by PlaNYC because of the many building and finishing materials that emit VOCs. New York City has enacted laws that create an environmentally preferable purchasing program which require City buildings to only use products that meet the standards of the Carpet and Rug Institute. As research and industry standards on these and other building materials evolve, the City of New York will propose regulations to reduce exposure to toxins released by other building materials, including paints, glues, and carpets [24].

With a population of more than 8 million people, securing a safe and reliable source of water is of utmost importance for New York City. Most of the requirements of PlaNYC call for upgrades or additions to infrastructure. The Croton Water Filtration Plant and the Catskill/Delaware Ultraviolet Disinfection Facility are estimated to be able to treat 2.3 billion gallons of water per day and repairs to the Delaware Aqueduct will ensure a ready supply of water. However, the practices most relevant to Fresno involve improving efficiency.

Improving efficiency reduces the stress on water infrastructure and simultaneously reduces demand and increases supply. This also makes water more affordable for City residents. PlaNYC will improve efficiency through technology. Real-time usage data will be available to consumers when automatic meter reading (AMR) devices are installed [25]. Consumers will be alerted when usage appears to deviate from normal, and since spike in use can indicate costly leaks, this service will save money and water.

#### 4. A GREEN BUILDING INDUSTRY BRINGS OPPORTUNITIES TO THE VALLEY

Although Leadership for Energy and Environmental Design (LEED) is not the only available rating system for the design, construction, operation and maintenance of high performance green buildings, homes and neighborhoods, it's by far the most widely accepted in the nation. Table 1 shows the current number of LEED projects in the top 10 largest incorporated cities in the State of California ranked by population, based on the reported results from the United States Census (2010) and the U.S. Green Building Council [26] [27].

Table 1. LEED Projects in Top Ten Largest California Cities

Rank by Population	City	Population	Number of LEED Projects
1	Los Angeles	3,792,621	155
2	San Diego	1,307,402	131
3	San Jose	945,942	57
4	San Francisco	805,235	223
5	Fresno	494,665	13
6	Sacramento	466,488	81
7	Long Beach	462,257	13
8	Oakland	390,724	46
9	Bakersfield	347,483	17
10	Anaheim	336,265	12

As the fifth largest city in California, Fresno has nearly the fewest LEED projects among the list. The industry is barely awake here. The aforementioned Dayton, OH has a population of 141,527, less than one fifth of the size of Fresno, yet is home to 18 LEED projects [27]. A strong green building industry not only brings true environmental benefits to the Valley residents, enforces water conservation and treatment as well as air quality control through the built environment, but also presents enormous job opportunities. A study by the Lawrence Berkeley National Laboratory indicated employment in the energy efficiency services sector will increase by a factor of two to four, accounting for approximately 1.2 million workers in 2020, in which building and construction contractors and trades will account for about 65-75% of the jobs, whereas professional occupations such as engineers, architects, managers, and energy efficiency program managers will account for about 25-35% of the workforce [28]. This shift will have a lasting

positive impact on sectors such as renewable energy production, retrofitting, and services supporting the building industry.

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