CALGreen Costs Green, but will it Save Green Too?
A Case Study of 10799 International Drive, Rancho Cordova, California

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CALGreen Costs Green, but will it Save Green Too?

A Thesis

by

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Abstract

of

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Green building is not a new concept; however, the government making it a requirement is. The State of California is once again the first to mandate green building through its state building code. CALGreen requires all new construction to follow a minimum set of green building measures and provides additional green building measures that are voluntary, unless a jurisdiction mandates them. This thesis is a cost/benefit analysis of constructing a proposed office building to meet the mandatory and/or voluntary CALGreen requirements at 10799 International Drive.

The extra initial costs totaled 1.088 percent, 5.292 percent, and 22.304 percent above the baseline building for the mandatory CALGreen, voluntary Tier 1, and voluntary Tier 2 buildings, respectively. The quantifiable private benefits originated from utility savings by creating lower operating expenses in the base year, higher property values, and additional rent. The private benefits from the utility savings totaled $21,157 for the mandatory CALGreen building, $167,670 for the CALGreen Tier 1 building, and $348,584 for the CALGreen Tier 2 building. The extra initial costs and associated benefits resulted in negative results of the net present value, internal rate of return, and discounted payback period for all three green building levels of CALGreen.

_____, Committee Chair
Robert W. Wassmer, Ph.D.

_____
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INTRODUCTION AND BACKGROUND

Introduction

This Master's degree project is a case study that examines the financial aspects of constructing an office building to meet the California Green Building Standards Code (CALGreen) at 10799 International Drive in Rancho Cordova, California (Lot 36). The potential building is a two-story office building and The Evergreen Company (Evergreen) would develop it. The intent of my project is to analyze the additional costs and benefits of constructing the building under California's new green building standards code. I will calculate the costs and benefits, internal to the project's investors. Evergreen spent considerable resources while analyzing the potential project in 2008; however, decided against building it then because of unfavorable market conditions. Three years later, Evergreen is concerned that the same building will cost more because of the CALGreen code. Evergreen's shovel-ready project needs to be re-analyzed. The same scenario may be true for other real estate developers with shovel-ready projects in California. This Master's project quantifies the extra initial costs and associated benefits from constructing an office building to meet the CALGreen code. Regardless of my findings of additional costs and/or benefits, all newly constructed residential and nonresidential buildings will have to meet code, including the CALGreen code if the building's construction is on or after January 1, 2011.

After an initial meeting with Trey Gundlach, a partner with The Evergreen Company, he agreed to make available to me the necessary information to analyze the Lot 36 project. I will analyze the costs and benefits of four potential buildings constructed on Lot 36: a building constructed under the 2007 California building codes, a building constructed under the

mandatory CALGreen requirements, a building constructed under the CALGreen Tier 1 requirements, and a building constructed under the CALGreen Tier 2 requirements. I received a construction estimate dated August 29, 2008 from Mr. Gundlach that details the construction costs of a two-story 56,700 square foot building on Lot 36. The values provided will represent the baseline costs used to compare the proposed buildings that comply with CALGreen.

CALGreen has different requirements for residential and nonresidential buildings. My comparison analysis will focus exclusively on CALGreen's nonresidential requirements because the Lot 36 building will be a commercial office building. Using CALGreen's nonresidential requirements, my analysis will focus on the additional costs to comply with CALGreen, but also any benefits from the new green efficiencies. The end comparison will compare the buildings' costs and benefits and determine whether the mandatory or voluntary programs are a smart investment decision for the property owner. I will use this project's case study as an example for future projects.

The upcoming sections of Chapter 1 will explain why analyzing a building's additional costs and benefits to meet CALGreen is worthy of a thesis project. In the next section "Conventional Development," I will describe and identify typical development practices over the last few decades. In "The Environmental Consequences of Conventional Development," I will discuss two specific environmental consequences of conventional development practices. Finally, I will discuss "California's Response to the Environment Consequences of Conventional Development," which includes defining sustainable development and green building and identifying examples of progressive environmental legislation in California. The sections in Chapter 1 will describe conventional development, identify the environmental

consequences of it, and then describe some of California's state regulations used to minimize the environmental consequences.

Conventional Development

The term conventional usually means lacking originality or individuality. Therefore, conventional development would mean real estate development that is similar and dull. During the past few decades in the United States, the majority of conventional development has been constructing inefficient buildings in areas far away from central cities. The opposite of conventional development is green building, described later in the chapter.

Suburban Sprawl

Suburban sprawl is difficult to define, but as Justice Potter Stewart might say, from his concurring opinion in *Jacobellis v. Ohio 378 U.S. 184 (1964)* regarding pornography, "I know it when I see it." Most people's vision of suburban sprawl is the post-war suburbs. According to Jackson (1985), there are five characteristics of post-war suburbs: peripheral locations, low density, architectural similarity in housing, available and affordable housing, and economical and racial homogeneity. A major problem with suburban sprawl is its location because most sprawling developments are located on greenfield lands on the fringe of urban areas. In addition, suburban properties typically consume more land and have less density compared to properties in urban areas. Moreover, some developments are located much further away from centers of employment and shopping. Such isolated developments with open space between them, known as leapfrog developments, leap to outlying areas because the cheapest land is at the farthest distance from central cities.

Inefficient Buildings

Most conventional buildings consume a lot of land as well as excessive amounts of energy, water, and other resources. In the United States in 2005, buildings share of the total energy used was 40.2 percent (U.S. Department of Energy, 2011, March). Buildings are inefficient and waste valuable resources because of poor insulation, leaky windows, inefficient lighting, heating, ventilating, and air conditioning systems (HVAC), and poor construction techniques.

An office building's HVAC system is a main consumer of energy because the design of the system is to produce a cooling-dominated place**.** Therefore, most office buildings have fixed and inoperable window systems. Fixed windows are convenient when designing a building's mechanical system, but result in its occupants relying on energy-consuming equipment for ventilation and temperature control. The continuous running of a HVAC system results in additional maintenance costs and a shorter shelf life for the equipment. In addition to the replacement costs, the replaced equipment ends up in the landfill.

In the United States, many conventional developments consist of inefficient buildings in areas far away from central cities. Many of these inefficient buildings use more land, energy, and water compared to green buildings. Conventional development is popular because the building industry and the public sector are comfortable with it. Developers, lenders, tenants, and city officials know what they will get with a conventional building.

The Environmental Consequences of Conventional Development

Recently, our society has become aware of the environmental consequences of conventional development. For example, the 2006 movie, "Inconvenient Truth" starring Al Gore, brought the concept of global warming due to greenhouse gas emissions (GHGs) to the

masses. Mr. Gore described global warming as a serious threat to our planet and our society's way of life. The two major environmental consequences of conventional development are the generation of GHG emissions and natural resource depletion.

Climate Change, Global Warming, and Greenhouse Gas Emissions

Generally, climate change refers to the distinct change in measures of climate for an extended period. According to the U.S. EPA (2009, April), these measures of climate are major changes in temperature, rainfall, snow, and wind patterns that last for a decade or longer. Climate change may be a result of natural changes (e.g., changes in the ocean circulation) or human activities (i.e. burning fossil fuels). A scientific consensus appears to be developing on climate change. According to the IPCC (2007), there is a 90 percent chance that the Earth is getting warmer, a 90 percent chance that humans have caused it, and it is a virtual certainty that the warming will continue into the next century. Despite these grim conclusions, the IPCC report says there is still time to slow global warming and lessen many of its most severe consequences if we act quickly.

Global warming is an average increase in temperature near the Earth's surface and in the lower atmosphere. Global warming is a major global concern because even a 2°C or 3°C increase in the global average temperature could result in coastal flooding that would affect millions of people all over the world. Therefore, many scientists argue that we need to minimize the human factors that cause global warming. The consensus is that global warming is accelerating because human actions are adding excessive amounts of greenhouse gases (GHG) emissions to the atmosphere. According to the definition provided in Assembly Bill (AB) 32, greenhouse gases include carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. By driving cars, using electricity from coal-fired

power plants, and heating our homes with oil or natural gas, we release greenhouse gases into the atmosphere that contribute significantly to global warming. For example, the transportation sector accounts for 28 percent of GHG emissions in the United States (EIA, 2006).

Natural Resource Depletion

Our preferred mode of transportation, the automobile, affects our environment and our natural resources. Transportation is the largest energy demand sector in the United States, largely because of the petroleum demand from automobiles. In terms of oil use, transportation accounted for approximately 71.8 percent of the oil used in the United States in 2009 (EIA, 2010, May). Many scientists speculate with our current demand and available supply, the world is near, at, or past peak oil. Peak oil is the point at which we have extracted half of all the oil that has ever existed in the world – the half that was easiest to get, the half that was most economically obtained, the half that was the highest quality and cheapest to refine (Kunstler, 2005).

Our sprawling suburbs are a major environmental concern because of automobile dependence and land consumption. In the nineteenth century, before the automobile, other modes of transportation drastically changed American cities. With the introduction of the steam ferry, the omnibus, the commuter railroad, the horse car, the elevated railroad, and the cable car people were motivated to leave the dirty cities and move to the affluent suburbs (Jackson, 1985). Now people travel further distances from the workplace until they reach a community in which they can afford to buy a home that meets their ideal living standards. The automobile has become a necessity for most suburban residents. Vehicle miles traveled (VMT) in the United States has grown three times faster than population, and almost twice as fast as vehicle registrations (FHWA, 2006).

Site selection is a fundamental environmental concern when it comes to our natural resources. Even a desolate piece of land can have a delicate ecosystem with plants, animals, and organisms living together. A subdivision's construction activities, infrastructure, and buildings can permanently destroy an ecosystem. Therefore, many people are against any type of development in certain areas and believe some land should remain vacant into perpetuity.

Jim Rouse learned this lesson when he tried to develop Wye Island, a 2,800-acre island on Maryland's Eastern Shore, in the early 1970s. In a letter to all of the Queen Anne's County's residents, Rouse explained his vision for the relatively isolated and vacant island:

> "We believe the Wye River can be protected against pollution; that the oyster beds, the crab and the fish can flourish; that the shoreline can be preserved to provide feeding grounds for ducks, geese and swan; that the farmland that marks the island's use can be significantly maintained and that, at the same time, the island can become a place that supports a new waterfront village built to high standards of taste and quality unique in America (Gibbons, 2007, p.10)."

In the end, hardly anyone embraced Rouse's vision for Wye Island and eventually the State of Maryland purchased the island for a refuge.

Conventional development results in generation of GHG emissions and natural resource depletion. Our society's dependence on the automobile and its preference for single-family detached homes are major environmental concerns. In addition, conventional development results in several economic concerns. For example, a conventional building is a private good that is bought and sold and is excludable. However, its inefficiencies and location result in negative externalities that significantly affect public goods (i.e. clean air). To that extent, this situation makes a conventional building a public good, which is non-excludable and non-rival in consumption, because the public breathes the dirty air regardless if they use the conventional building.

A negative externality occurs when an individual or firm making a decision does not have to pay the full cost of the decision and the cost is imposed on a third party. For example, suburban homeowners do not pay any additional costs to commute further to work, despite affecting traffic congestion and air quality for others. Because of these negative externalities associated with conventional development, many experts believe there is a market failure that requires government intervention. As Mr. Gore argues, our current path is an unsustainable one.

California's Response to the Environmental Consequences of Conventional Development

California has a history of implementing progressive state legislation in response to conventional development. The state's natural beauty has been a significant resource for its prosperity. Therefore, there is genuine need to maintain and enhance its natural environment because people would exploit it for profit. However, before discussing California's specific environmental laws, it is crucial to define sustainable development and green building.

The most cited definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (U.N. General Assembly, 42nd Sess., 1987). To me, that means making difficult decisions with a clear understanding that those decisions will affect the well-being of future generations. For example, the city council can require higher park fees as a condition of approval for commercial building permits. This requirement will allow future residents to enjoy more active recreation opportunities.

The concept of green building is simple; build structures to be more efficient. According to Yudelson (2008), a green building is a high-performance property that considers

and reduces its impact on the environment and human health, designed to use less energy and water and to reduce the life-cycle environmental impacts of the materials used, and achieved through better siting, design, material selection, construction, operation, maintenance, removal, and possible reuse.

The following is a chronological overview of the major environmental rules and regulations enacted at the state level in California over the last forty years. The regulations listed illustrate California's progression towards more sustainable and green development.

The California Environmental Quality Act (CEQA)

CEQA is the product of the environmental movement that consumed the United States in the late 1960s (Fulton & Shigley, 2005). In 1970, the California Legislature passed CEQA, which is similar to the federal law, the National Environmental Policy Act (NEPA) that Congress enacted the previous year.

CEQA is the foundation of environmental law and policy in California. CEQA's rules and regulations apply to all discretionary activities, public and private, seeking approval from California public agencies, including state, regional, county, and local agencies (Bass, Herson, & Bogdan, 1999). CEQA's main objectives are to disclose to decision makers and the public the significant environmental impacts of proposed activities and to require agencies to avoid or reduce these impacts by implementing feasible alternatives or mitigation measures.

CCR Title 24

In 1978, the California Legislature enacted Senate Bill (SB) 331 and effectively corrected the confusion and problems of conflicting, duplicate, and overlapping state building regulations. SB 331 granted the California Building Standards Commission (BSC) broader

powers. Effective January 1, 1980, the BSC would review and approve all proposed building regulations adopted by state agencies. In addition, the legislation removed all building standards from other titles of the California Code of Regulations and put them into a single code, Title 24, that the BSC would be responsible for organizing and publishing.

Title 24 is the 24th title within the California Code of Regulations (CCR). CCR Title 24 includes state regulations that govern the design and construction of buildings, associated facilities and equipment. Title 24's building standards apply to almost all private construction throughout the State of California. State law requires California's cities and counties to enforce the building standards. Cities and counties may adopt ordinances making more restrictive requirements than provided by CCR Title 24, because of specific local conditions.

Since 1989, the BSC has published triennial editions of Title 24. The current CCR Title 24 (2010 edition) applies to all occupancies that applied for a building permit on or after January 1, 2011. The 2010 building standards include twelve sections and have requirements for the structural, plumbing, electrical, and mechanical systems of buildings, and for fire and life safety, green building, energy conservation, and accessibility in buildings.

Executive Order S-20-04

In 2004, Governor Schwarzenegger issued Executive Order S-20-04, also known as the Governor's Green Building Initiative. This initiative requires all new and state-owned facilities paid for with state funds to receive Leadership in Energy and Environmental Design (LEED) Silver or higher certification. In addition, the initiative directs the Department of General Services and other state agencies to seek out and select, whenever cost-effective, leases for spaces of 5,000 square feet or more in buildings that can or have obtained LEED certification.

What is LEED certification? LEED is a point-based system that rates buildings according to key environmental attributes such as site impacts, energy and water use, materials and resource conservation, and indoor environmental quality.

The LEED system, established by the U.S. Green Building Council (USGBC) in 1999, awards buildings points for satisfying specified green building criteria. The six major environmental categories for review are Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality and Innovation and Design. The USGBC awards Certified, Silver, Gold, and Platinum levels of LEED green building certification based on the total number of points earned within each LEED category. LEED can be applied to all building types including new construction, commercial interiors, core and shell developments, existing buildings, homes, neighborhood developments, schools, and retail facilities.

As of April 2010, the State of California owns and/or occupies 22 LEED certified buildings (The Governor's Green Building Executive Order and AB 32 Green California Goals and Accomplishments, 2010, December). Former Governor Schwarzenegger wanted California to lead by example in green building and retrofitting existing buildings and they are doing exactly that.

Assembly Bill 32

In 2006, the California Legislature enacted AB 32, the Global Warming Solutions Act of 2006, which calls for reducing GHG emissions to 1990 levels by the year 2020. AB 32 is a landmark bill that establishes a first-in-the-world regulatory and market-based program that aims to achieve quantifiable, cost-effective reductions of greenhouse gases. AB 32 directs the California Air Resources Board (CARB), the State agency charged with regulating statewide air

quality, to develop, adopt, and monitor a plan that reduces significant greenhouse gas sources via regulations, market mechanisms, and other actions. Some early GHG reduction measures began on January 1, 2011 with all GHG rules and market mechanisms taking effect and legally enforceable beginning January 1, 2012.

Assembly Bill 1103

In 2007, Governor Schwarzenegger signed into law AB 1103. The bill requires, after January 1, 2010, that a nonresidential building owner or operator disclose Energy Star benchmarking data and ratings, for the most recent 12-month period, to a prospective buyer, lessee, or lender. The goal of AB 1103 is to utilize the existing Energy Star's benchmarking system to provide current and prospective building owners and operators with valuable energy consumption information about nonresidential buildings. They will be able to compare their building's performance to that of similar buildings and to manage their building's energy costs.

Senate Bill 375

SB 375, enacted in 2008, will help California reach its AB 32 goals by aligning planning for housing, land use, transportation, and GHG emissions for the state. Experts believe that the goals of AB 32 are unattainable without changes in land use. For example, Ewing et al. (2008) believe that transportation CO_2 reduction needs to be viewed as a three-legged stool, with one leg related to vehicle fuel efficiency, a second to the carbon content of the fuel itself, and a third to the amount of vehicle miles traveled (VMT). A stool cannot stand on only two legs, as most federal and state regulations have focused on the first two legs of the stool. Developing more fuel-efficient cars and lower-carbon fuels can reduce GHG emissions,

but reducing driving by locating housing closer to jobs, schools, and shopping centers will also be necessary.

SB 375 requires CARB to establish GHG reduction targets for passenger vehicles for each region covered by one of the state's 18 metropolitan planning organizations (MPOs). In addition, each MPO must prepare a sustainable communities strategy (SCS) that details how the region will meet its GHG reduction target through land use, housing, and transportation planning. Once the MPO adopts its SCS, there is federal transportation funds tied to its implementation.

In addition, SB 375 encourages developers to build new residential and mixed-use projects that are consistent with a region's SCS. For example, a transit-oriented development that is consistent with the SCS could have specific CEQA requirements waved. Ultimately, this provision could reduce the amount of time for entitlements and thus reduce a developer's holding costs. However, this CEQA exemption is difficult to obtain and many experts view SB 375 as just a start and a regulation that offers developers more "carrots" than "sticks" for sustainable development. I feel that SB 375 tries to encourage sustainable development more than penalizing unsustainable or conventional development.

CALGreen

In early 2010, Governor Schwarzenegger announced that the California Building Standards Commission (BSC) adopted the California Green Building Standards Code for its upcoming update to the building code (Schwarzenegger, 2010, January 12). The California Green Building Standards Code, also known as the CALGreen code or CALGreen, is Part 11 of the California Building Standards Code in Title 24 of the California Code of Regulations. CALGreen went into effect January 1, 2011.

CALGreen is the first-in-the-nation state response to develop and control green building standards for all new residential and nonresidential buildings (including all public and privately owned buildings for retail, office, schools, and hospitals). The new green building code intends to set state minimum building standards that are more environmentally conscious. In addition, CALGreen includes voluntary tiers, Tier 1 and Tier 2, which any building, city, and/or county may apply. In general, buildings that achieve CALGreen Tier 1 or Tier 2 are greener than buildings that comply solely with the mandatory measures.

CALGreen's purpose is to develop a state regulated standard similar to those developed by the private unregulated rating systems (e.g., LEED), with the intention to reduce greenhouse gas emissions from buildings, promote healthier places to live and work, and to reduce energy and water consumption. CALGreen is different from other private green rating systems because it is part of the state's building code and the public sector developed and will administer it.

Similar to other Title 24 building codes, building departments will be responsible for enforcing CALGreen. New residential and nonresidential building subject to plan review, permits, and inspections by the local building department will be subject to CALGreen's requirements and enforcement on and after January 1, 2011.

This aspect of CALGreen is important for its implementation because building permits are ministerial acts. Ministerial acts are actions in which the local government has no discretion and they usually involve the mandatory issuance of a building permit (Fulton & Shigley, 2005). For example, if the applicant has already received project approval from the city council, the local building department must issue the permit if the applicant meets the specific conditions of approval. Because ministerial decisions involve no discretion, local building departments delegate them to their staff.

The State of California has progressively enacted rules and regulation on public and private property because of the environmental consequences of conventional development. California has long been a national and international leader on energy conversation and environmental stewardship efforts, with such regulations as the initial adoption of CCR Title 24, AB 32, and SB 375. CALGreen is no exemption; however, California cannot forge ahead alone. Other state governments and other nations need to follow California's example in order to make a real positive environmental change. The future of our environment is uncertain; however, CALGreen intends to make future buildings in California more environmentally friendly.

Conclusion

This introductory chapter discussed conventional development, its environmental consequences, and several of California's state regulations that aim to minimize the effects of conventional development on the environment. In addition, this chapter illustrates the progression of environmental legislation in California and the need for a state to implement and administer a state regulated green building standard. CALGreen is California's direct response to its environmental concerns about conventional development. The regulation makes public sense because it aims to limit negative externalities from conventional development. The rest of my thesis will discuss whether CALGreen makes economic sense for a private developer.

The sections to follow will include a literature review of building regulations, the methodology I used to determine the costs and benefits of CALGreen for Lot 36, results of my analysis, and finally my conclusions and recommendations for CALGreen.

Chapter 2

LITERATURE REVIEW

Introduction

As described in Chapter 1, there can be a variety of regulations imposed on public and private property. For this thesis, it is important to have a background on the costs and benefits of these various building regulations. The majority of the research on the benefits and costs of building regulations analyzes residential, rather than commercial property because of its available information and consistency across the United States. Nevertheless, these residential concepts and ideas apply to commercial real estate because both function similarly as markets driven by supply and demand considerations. This chapter discusses previous studies that illustrate the impact of building regulations on real property, focusing first on analyses considering the private benefits and costs, and then on reports examining the public benefits of building regulations.

Private Benefits and Costs of Building Regulations

As previously described, CALGreen is a set of green building standards found in the recently implemented CCR Title 24 2010 edition. The CALGreen standards apply to all new residential and nonresidential construction that apply for a building permit on or after January 1, 2011. This case study is primarily interested in quantifying the costs and benefits of CALGreen from the private sector perspective, which is the focus of my thesis project. The most important goal of the private sector developer or investor is to maximize the return on investment. There are private benefits of building regulations that can help achieve this goal; however, building regulations can also have costs that jeopardize it.

Private Benefits

Some benefits of building regulations primarily help the developer, building owner, and tenants. I view these benefits as internal to the building, meaning that people associated with the building experience these benefits. I will first examine research discussing the private benefits of energy savings and higher property values because of building regulations.

Piette, Nordman, Buen, and Diamond (1995) analyzed the benefits of energy savings from the Energy Edge (EE) project. The EE was a demonstration project consisting of 28 new commercial buildings designed, and constructed throughout the United States in 1986, to use 30 percent less energy than a hypothetical baseline building. The project's primary objectives were to assess the overall energy performance of the EE buildings (varying from small office to fast food restaurants) and examine the energy savings and cost-effectiveness of over 200 individual energy-efficiency measures. The EE project was expensive, time consuming in terms of collecting and processing the energy data, and many energy-efficiency measures did not perform as well as predicted, with only 41 percent meeting the cost of conserved energy (CCE) target. The EE project primarily analyzed 18 buildings that required post-occupancy tuned simulations models (the buildings constructed were different from what was initially designed) and found the average energy savings from those buildings was roughly 17 percent. The small offices (between 2.1 kft^2 – 16.2 kft^2) performed even better by using 30 – 50 percent less energy than the baseline small office building (Piette et al., 1995).

The EE project analyzed buildings designed to be more energy efficient than the building code requirements; however, having building codes results in energy savings. Aroonruengsawat, Augghammer, and Sanstad (2009) studied the impacts of having a state level residential building code on residential electricity consumption. The researchers found that if

all new residential construction is under an active state building code, per capita electricity consumption is 5 percent less compared to residential construction in a state without a residential building code. Similarly, Jacobsen and Kotchen (2010) analyzed the effects of Florida's statewide energy code on electricity and natural gas usage for homes in Gainesville, Florida. The study compared the differences in energy usage for residential homes built within three years before and three years after the energy codes' implementation in 2002. The researchers used monthly residential billing data from the local utility company for both electricity and natural gas and found the statewide energy code was associated with a 4 percent decrease in electricity consumption and a 6 percent decrease in natural gas consumption (Jacobsen & Kotchen, 2010). The financial benefit of energy savings is even greater when accounting for rising energy costs. Average U.S. retail electricity prices for commercial building has increased by 6 percent per year (EIA 2010b) and natural gas prices have gone up by 7 percent per year (EIA 2010a) from 2004 to 2008. In addition, municipal water rates increased 27 percent from 2002 to 2007 (Clark, 2007).

In some office leases, reducing a building's energy costs increases the property owner's net operating income (NOI), which increases the appraised value of the building during a refinance or sale (Jewell, 2003). In addition, building regulations, particularly in high-risk hazard area, can increase the value of the building. Research by Dumm, Sirmans, and Smersh (2009) compared the values of homes in Florida built before and after the implementation of the strict 1994 South Florida Building Code. The strict building code was a direct response to the 25,000 homes destroyed and 100,000 homes damaged by Hurricane Andrew in 1992 (Dumm, Sirmans, & Smersh, 2009). The researchers found that homes built under the 1994 South Florida Building Code sold for roughly 10.4 percent more, on average, than comparable homes

built under the old code. In addition, the homes in Florida's coastal zones exhibited the greatest premium of the stricter building code because they had the greatest risk exposure to hurricanes.

Consistent with the primary goal of the private sector developer or investor, the benefits of building regulations can provide financial benefits to the private sector. Typically, the private benefits of building regulations included energy savings and higher property values. However, private benefits do not come without private costs.

Table 2.1: Private Benefits of Building Regulations

Author(s) and Year	Number of Observations	Method	Findings
Piette, Nordman, Buen, and Diamond (1995)	28 new commercial buildings across the country, but mostly analyzed 18 buildings that required post-occupancy tuned simulation models	Detailed monitoring plans were developed and data acquisition systems installed to collect information about energy usage in each building	The 18 buildings had an average energy savings of about 17%. The small office buildings used 30-50% less energy than the baseline small office building
Aroonruengsawat Augghammer, and Sanstad (2009)	Housing data for 48 U.S. states from 1970–2006	Regression estimating the per capita residential energy consumption in a state, depending on whether there was a state building code	If all homes built under an active state building code, per capita electricity consumption is 5% less compared to residential construction in a state without a residential building code
Jacobsen and Kotchen (2010)	Housing data from 2,239 residences in Gainesville, Florida	Regression comparing energy consumption between 1,293 residences built before the changes in Florida's 2001 energy code, and 946 built after the energy-code change.	New energy code resulted in a 4% decrease in electricity consumption and a 6 % decrease in natural-gas consumption. In addition, the private payback of additional costs is 6.4 years for the average residence.
Dumm, Sirmans, and Smersh (2009)	57,100 owner-occupied, single-family home sales and includes those houses built between 1970 and 2007 in Miami-Dade County in Florida	Regression estimating housing prices based on building codes, year constructed, and spatial characteristics (using GIS).	Homes built under the 1994 South Florida Building Code sold for 10.4% more, on average, than comparable homes built under the old code; homes in Florida's coastal zones exhibited the greatest premium.

Private Costs

Most people would agree that before a building regulation's approval, there should be a discussion about how it could financially affect the private sector. For instance, how much will this new building regulation affect the community's new or existing housing prices; businesses from locating or staying here; or potential projects from breaking ground? These types of questions should take place in discussions before a building regulation's approval; otherwise, there could soon be higher priced homes and fewer job opportunities in the community. Although, many communities may desire higher priced homes and include NIMBYs (not in my backyard) that oppose any proposed low-income housing projects, not many communities want fewer job opportunities. I will examine reports discussing how building regulations affect the cost and supply of new construction in the private sector.

The Cost of New Construction

The National Commission on Urban Problems (often referred to as the Douglas Commission) in 1968 conducted one of the most comprehensive building code studies of all time. The Douglas Commission found that new homes had a variety of additional costs because of building codes. These additional costs were in construction delays, prohibited use of more efficient and modern materials, mandating outdated provisions, preventing large-scale conventional development and mass production of mobile homes, and administered questionably. In addition, many communities added their own prohibitions, over and above the model code and these additional requirements could potentially add $1,838 (in 1968 dollars), or 13 percent, to the price of a basic home (then estimated at $12,000) (as cited in Listokin & Hattis, 2004, p.17). Similarly, Noam (1982) found that strict building codes established in over

1,100 localities across the United States raised housing values, in 1970, by about one thousand dollars.

Although many low-income housing projects receive public funds and provide public subsidized housing for low-income individuals and families, private sector entities develop and own these projects and face costly regulations. For example, California legislators enacted SB 975 in October 2001, which amended Labor Code §1720 to expand prevailing wage obligations to include any new construction in California that is financed using public funds. Dunn, Quigley, and Rosenthal (2005) analyzed the labor costs for 205 low-income housing projects subsidized by the California Tax Credit Allocation Commission between 1997 and 2002. The analysis found that prevailing wage requirements increased the cost of low-income housing between 9 and 11 percent.

Moreover, the number of approvals required to construct a new building is costly. Quigley and Raphael (2006) analyzed common regulations in California cities and their effects on housing prices, using 1990 and 2000 Census data. The researchers found that each additional regulatory measure implemented by a city is associated with a 3 percent (1990) and 4.5 percent (2000) increase in the prices of owner-occupied housing, and a 1 percent (1990) and 2.3 percent (2000) increase in the price of rental housing.

Table 2.2: Private Construction Costs of Building Regulation

Author(s) and Year	Number of Observations	Method	Findings
Noam (1982)	+1,100 American cities	Regression using data from a survey to city managers across the nation, to find housing prices based on the strictness of building codes.	Strict building codes in jurisdictions raised housing values, in 1970, by about one thousand dollars.

Dunn, Quigley, and Rosenthal (2005)	205 low-income housing projects subsidized by the California Tax Credit Allocation Commission during the 1997–2002 period	Regression estimating the additional construction costs because of prevailing wage (additional labor cost).	Prevailing wage requirements increased the cost of low-income housing construction between 9% and 11%. In addition, a 9.5% increase results in 1,361 fewer low-income units built because of the additional labor costs associated with prevailing wage.
Quigley and Raphael (2006)	Home prices for owner- and renter occupied dwellings for 407 California cities in 1990 and 2000.	Regression using 1990 and 2000 census data to estimate the market price in each city based on common regulations in CA.	Each additional regulatory measure implemented is associated with a 3% (1990) and 4.5% (2000) increase in the prices of owner-occupied housing, and a 1% (1990) and 2.3% (2000) increase in the price of rental housing.

The Supply of New Construction

The cost of new construction directly affects the supply of new construction. As previously described, Quigley and Raphael (2006) analyzed common regulations in California cities and their effects on housing prices; however, they also analyzed the effects of those common regulations on housing supply. The researchers compared the supply of housing, via residential building permits, in California cities based on survey of California land use officials in 1992 (completed by Madelyn Glickfeld & Ned Levine, 1992, citied by Quigley and Raphael, 2008). The survey of 407 California cities measured the incidence of fifteen growth control regulations widely adopted throughout California. The measure of regulatory stringency for a city was the number of the fifteen possible growth-control measures adopted by the city at the time of the survey. According to the researchers' analysis, the number of restrictions for a city has a negative effect on the growth in the housing stock. In addition, the more regulated cities have a weaker responsiveness, via new construction, to changes in housing demand than less regulated cities (Quigley & Raphael, 2006).

Zabel and Paterson (2006) studied the effects of the U.S. Fish and Wildlife Service's critical habitat designation, under the Endangered Species Act, on the supply of residential housing in California. The researchers used a dataset consisting of the number of building permits issued in California municipalities for 1990 – 2002, which they adopted as a measure for the level of construction activity. Using in the data spatially in a Geographic Information Systems model and running an econometric model, the researchers found that a median-sized critical habit (in terms of acreage) resulted in a 23.5 percent decrease in the supply of housing permits in the short-run and a 37.0 percent decrease in the long-run.

Glaesar and Ward (2009) examined the man-made barriers of new construction in and surrounding Boston, Massachusetts. Over the last few decades, the Boston area, similar to other major areas in the United States, experienced increasing housing prices and a decrease in the number of new units built. The researchers found that a lack of land was not the issue, but was primarily a town's lot size requirements for new development. As a town increased the average lot size needed to build by one acre, the number of new permits decreased by 40 percent between 1980 and 2002 (Glaesar & Ward, 2009). A possible explanation is that towns desire less density and use building regulations (e.g., large minimum lot sizes) to limit the supply of new construction in the community.

In addition to jurisdictions, community organizations attempt to control the supply of new construction in their neighborhoods. These homeowners or neighborhood organizations usually have a stake in less new construction because if successful the property values of the existing homes increase. Some of these organizations and individuals, often referred to as NIMBYs, are able to influence, or in some instances stop, development projects. For example, Glaeser, Gyourko, and Saks (2005) discovered a reduction in the number of building permits

issued in Manhattan over the past two decades, despite house prices increasing over 2 percent per year. Their findings are contradictory to the economic theory that an increase in housing prices would lead to more new construction projects. However, their research suggests that organizations have been more successful in delaying, changing, and/or blocking residential projects in the last few decades than ever before. For example, the "Battle of Carnegie Hill" (labeled by the local press) in the early 2000s involved several famous actors and affluent neighbors that opposed a seventeen-story residential tower on the corner of 91st Street and Madison Avenue in Manhattan. The people opposing the project persuaded the Landmarks Preservation Commission to approve a scaled down, nine-story building, even though there were seven condominium buildings constructed in the Upper East Side of Manhattan (Carnegie Hill's neighborhood) during the same period, ranging in height from 1 to 32 stories (Glaeser, Gyourko, & Saks, 2005).

The research suggests that building regulations provide private benefits with energy savings and increased property values. However, building regulations also have private costs, such as additional construction costs and limiting the supply of new construction. Typically, if the private benefits are greater than the private cost, then the private individual should improve the property without government invention. However, if there is a substantial public benefit there may be a justification for a government to encourage, or require, a private individual to improve the property even if the private costs are greater than the private benefits. In that situation, implementing such a regulation is for public benefit.

Table 2.3: Private Supply Costs of Building Regulation

Author(s) and Year	Number of Observations	Method	Findings
Quigley and Raphael (2006)	Supply of owner- and renter occupied dwellings for 407 California cities in 1990 and 2000	Regression using 1990 and 2000 census data to estimate the supply of housing in each city based on common regulations in CA	The number of restrictions for a city has a negative effect on the growth in the housing stock. The more regulated cities have a weaker responsiveness, via new construction, to changes in housing demand than less regulated cities
Zabel and Paterson (2006)	358 FIPS where the counts of building permits are issued in California municipalities between 1990 – 2002	Regression using the data spatially in GIS and the number of critical habitat designations over time to see if the number of permits change based on whether the municipality has designations or not.	A median-sized critical habit designation (in terms of acreage) resulted in a 23.5% decrease in the supply of housing permits in the short-run and a 37.0 % decrease in the long- run
Glaesar and Ward (2009)	187 cities in towns in the Greater Boston area	Regression to estimate the man-made land shortage created by building regulations; using local officials interviews. Data from the MassGIS system, which details for 1999–2000 the minimum lot size requirements throughout the state	As a town increased the average lot size needed to build by one acre, the number of new permits decreased by 40% between 1980 and 2002
Glaeser, Gyourko, and Saks (2005)	23,060 condominiums in Manhattan	To measure the "Regulation Tax" between real estate prices and housing production costs, and using that differential to measure the differences in the Manhattan housing market	For the median Manhattan condominium in our sample ($455 psf) and assuming a $200 psf construction cost, the regulatory tax amounts 56 % of the total price of the unit

Public Benefits of Building Regulations

A main goal of building regulations, from the public perspective, is to improve our quality of life. Building regulations have changed over the last few decades in response to new technologies and our continuing awareness of the environmental consequences of conventional building.

This section describes the public benefits of building regulations. I view these benefits as external to the building, meaning that people who benefit from them may not own, live, or work in the building. In essence, the public benefit from a building regulation is the effectiveness of the regulation. For example, how well does CEQA help maintain or enhance our environment? Are seismic building codes effective in keeping buildings from collapsing during an earthquake? I will examine reports discussing the public benefits of a cleaner environment and safer buildings because of building regulations.

Some building regulations focus on providing the public environmental stewardship. These types of building regulations, also known as environmental regulations, aim to protect the environment for the benefit of the public. For example, the CEQA enacted in 1970 is foundation of the state's environmental law and policy. An important component of the CEQA process is a project's Environmental Impact Report (EIR), which is the local jurisdiction's responsibility to commission. Tang, Bright, and Brody (2008) analyzed the quality of 40 Environmental Impact Reports (EIR) for local jurisdictions' land use general plans. The researchers measured the quality of the EIRs by studying the EIR documents and assessing whether the plans addressed specific indicators within five plan components: 1) factual basis, 2) goals and objectives, 3) tools, approaches, and methodologies, 4) coordination and communication, 5) implementation, monitoring, mitigation, and alternatives. Within these five

components, each indicator received a score on a 0-2 scale. A score of "0" means there was no mention of the indicator, a score of "1" means that the indicator is somewhat considered but not thoroughly, and a score of "2" means the indicator is fully considered. The study's mean score for the EIR quality was 29.73, on a scale of 0-50. The study's mean score suggests that local jurisdictions' work is slightly above average quality for EIR; however, there were large variations in the EIR quality found across jurisdictions. The three major factors that influence the local use plan's EIR quality are the number of planners, plan updating ability, and development pressure (Tang, Bright, & Brody, 2008).

One of CEQA's main objectives is to disclose to decision makers and the public the significant environmental impacts of proposed activities and to require agencies to avoid or reduce these impacts by implementing feasible alternatives or mitigation measures. In 1991, Olshanksy (1991) distributed a survey questioning the effectiveness of CEQA to all of the 513 local governments in California. The survey, which received a high response rate (70.9 percent), concluded that local planners believed CEQA was most successful in informing governmental decision makers and the public about the potential significant environmental effects of proposed activities. A major concern identified by the planners was that although CEQA is effective in reducing the environmental impacts of individual project, CEQA is not as effective in improving environmental quality on an area wide scale (Olshanksy, 1991).

CEQA encourages the protection of all aspects of the environment; however, there are also other federal, state, and local single-topic regulations that protect the environment for the public's benefit. For example, Lyon and Stein (2008) studied the effectiveness of the Federal Clean Water Act at improving water quality throughout the Southern California Bight (SCB), which is the 400 miles of recessed coastline from Point Conception, in Santa Barbara County to

Cabo Colnet, south of Ensenada, Mexico (Southern California Coast Water Research Project, 2011). The SCB is an important ecological, recreational, and economic resource adjacent to one of the mostly densely populated coastal regions in the United States. The researchers used a unique long-term regional dataset of the SCB from 1971 to 2000 and found that although the coastal population grew by 56 percent and total effluent volume increased 31 percent since 1971, mass emissions of nearly all contaminants decreased since passage of the Clean Water Act, most by greater than 65 percent (Lyon & Stein, 2008).

Improving air quality is another environmental goal receiving special attention, by way of environmental regulations. California has the most polluted air in the nation, mainly because of smog created by vehicle emissions (Fulton & Shigley, 2005). Recently, the American Lung Association's State of the Air 2010 ranked the Sacramento Metropolitan Statistical Area as the nation's fifth most polluted ozone (American Lung Association, 2010). However, according to Sacramento Metropolitan Air Quality Management District (SMAQMD), there has been a significant overall reduction of peak ambient ozone and region-wide exposure to unhealthy concentrations since 1988 (implementation of the California Clean Air Act) (SMAQMD, 2009). In addition, voluntary air quality programs have helped to improve local air quality. Cutter and Neidell (2009) analyzed individuals transportation choices during the San Francisco Bay Area's "Spare the Air" (STA) advisories, which are voluntary notices issued by the Bay Area Air Quality Management District to the public when the ozone levels will exceed a particular threshold. During a STA notice, the total traffic volumes decreased by 3 to 3.5 percent and there was a slight increase in public transit ridership (Cutter & Neidell, 2009).

A main goal of building regulations, or more specifically building codes, is to protect the public. It is in the public's best interest to have safe buildings; however, at what cost? Most

people would agree it is not economically feasible to mandate costly safety precautions on every product that could potentially make a building safer. If we did so, over-regulating could make everything too expensive. Therefore, there needs to be a balance between public safety and financial reasoning. However, the difficult question for the public sector is what should be required to make buildings safer?

In California, the California Building Standards Commission adopts building codes that local governments must use, allowing for local variations in climatic, geological, or topographical conditions. Building codes help facilitate safer buildings by requiring minimum standards for buildings, including foundation, roofing, plumbing, electrical, and other specifications for safety and sanitation (Friedman, Harris, & Linderman, 2004). Safety and sanitation are important elements of building codes; however, there are other goals of building codes. According to the Sacramento County Code (SCC 1376 §3 (part), 2007), building codes "safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, use and occupancy, location and of all buildings and structures within this jurisdiction, and certain equipment specifically regulated herein."

Many universities spend considerable resources testing building materials in labs for the next generation of building codes, particularly building materials to withstand earthquakes. In California, there is special consideration for the structural integrity of a building because of the risk of earthquakes. Unfortunately, it is not until an earthquake happens that we know whether seismic code requirements are entirely effective. For example, one the most surprising results of the Northridge earthquake on January 17, 1994 was the damage to numerous steel buildings. A case study of several damaged, steel buildings found that there were widespread brittle

fractures in welded steel moment-resisting frame (WSMF) buildings. Fortunately, there were no causalities or complete collapses because of these structure fractures and many of the case study buildings proved to be stronger than the design forces incorporated in building codes (Mahin, 1998).

Another aspect of safer building is the presence of fire protection equipment in buildings. Hall (2010) analyzed statistics from fires reported to U.S. municipal fire departments and found that fire sprinklers save lives and are effective and reliable. For example, the statistics indicate that the death rate per fire in homes fully equipped with sprinklers is lower by 83 percent. In addition, in reported structure fires large enough to activate them, sprinklers operated and were effective in 87 percent of fires in such properties (Hall, 2010). With these results, many jurisdictions estimate the cost per life saved from installing fire sprinklers. For example, California recently found it beneficial to require homebuilders to install fire sprinklers in all new residential construction (2010 California Residential Code, R313.2).

Table 2.4: Public Benefits of Building Regulations

Author(s) and Year	Number of Observations	Method	Findings
Tang, Bright, and Brody (2008)	40 EIRs of local jurisdictions' land use plans in California	Measured the quality of the EIRs by studying the EIR documents and assessing whether the plans addressed specific important indicators (given a score 0 to 2) of a successful EIR document.	The mean score for the EIR quality was 29.73, on a scale of 0-50.
Olshanksy (1991)	513 local governments in California in 1991	Survey sent to all local government planning departments in CA asking about CEQA.	CEQA is most successful in informing the government and the public about the potential significant environmental effects of proposed activities at project level, but not effective at improving the environment on an area wide scale.

Lyon and Stein (2008)	Within the Southern California Bight (SCB), 60 point sources discharging into the ocean.	Compared the SCB's regional mass emission data before implementation of the Federal Clean Water Act (1972) to afterwards (two other key time points - late 80/ early 90s and 2000).	Total effluent volume increased 31% since 1971 (despite the coastal population increasing 56 %) and mass emissions of nearly all contaminants decreased since passage of the Clean Water Act, most by greater than 65%.
Cutter and Neidell (2009)	23 Spare the Air (STA) advisories issued by the BAAQMD for the San Francisco Bay Area between 2001 and 2004.	Studied whether the STA advisories changed individual's transportation choices by analyzing traffic flow monitors and BART ridership number	During a STA advisories, the total traffic volumes decreased by 3 to 3.5% and there was a slight increase in public transit ridership.
Mahin (1998)	12 steel constructed buildings damaged in the Northridge earthquake on July 14, 1994.	Analysis of ground motion characteristics of the Northridge earthquake included: gathering strong motion records in or near the subject buildings, constructing a fault dislocation model, and generating time histories at other heavily shaken areas to assess the effect of location on damage.	The main issue with the case study's numerous fractures was in the welded steel beam to column connections, which essentially invalidated historic design approaches and building code provisions.
Hall (2010)	16,600 structure fires (where sprinklers were present in the bldg.) in the U.S. between 2004 and 2008	Structure fires reported by U.S. municipal fire departments into the National Fire Incident Reporting System (NFIRS) Version 5.0 database.	In all structures that had fire sprinklers and a big enough fire to activate them, fire sprinklers operated and were effective in 87% of fires.

The research suggests that building regulations benefit the public by pursuing a cleaner environment and safer buildings. Private builders often overlook these public benefits when analyzing projects. Compared to conventional buildings, efficient buildings can have public benefits that are positive externalities. For example, when a homeowner improves their home, neighbors benefit. However, the homeowner will not generally consider these spillover advantages to others and will only improve the home to his or her benefit. As previously

discussed, there may be a justification for a government to encourage or require efficient building regulations that provide public benefits that are external to a private building.

Conclusion

This literature review chapter discusses the costs and benefts of building regulations from the public and private perspective. Building regulations can benefit both the public and private sectors; however, there can be financial consequences. The private benefits of building regulations are energy savings and higher building values; however, too many or costly regulations can affect the cost and supply of new construction. Nevertheless, a government could choose to implement a costly regulation on private property for the greater public benefit, regardless of the private costs and benefits of the regulation. These public benefits of building regulations are a cleaner environment and safer buildings.

From this literature review, I feel confident using specific costs and benefits to analyze CALGreen because other researchers found that those costs and benefits are significant in previous analyses. Therefore, I will compare CALGreen's additional construction costs to the benefits of energy savings and higher property values for a proposed office building on Lot 36. In the next section, I will discuss the methodology for my CALGreen analysis.

Chapter 3

RESEARCH METHODOLOGY

Introduction

This chapter describes the process I used to analyze the private costs and benefits of constructing an office building to meet CALGreen standards. I will discuss my reasoning for this case study, define key terms relevant to my research, outline CALGreen's mandatory and voluntary green building measures, describe my data collection methods, and finally describe how I will conduct the analysis to determine the costs and benefits of CALGreen for an office building on Lot 36.

Justification for this Case Study

As detailed in the previous literature review chapter, there are a variety of costs and benefits of building regulations. However, throughout my research for the previous chapter, I did not find a single study on CALGreen, only memos and articles detailing its requirements. Even in recent professional discussions about CALGreen, as early as February 2011, I found many people in the real estate industry who have not heard about it, researched it, or knew of any of its requirements. This case study offers what may be the first quantifiable analysis on this new building regulation.

The case study does not attempt to justify the additional costs for CALGreen (like analyses on LEED certification) because there are mandatory requirements for all new construction under the CALGreen code. Nevertheless, I will examine the financial attractiveness of pursuing the voluntary CALGreen Tier 1 and Tier 2 for the Lot 36 project.

First, I feel it is necessary to define and discuss some relevant real estate development and financial terms.

Key Terms

In a new construction project, there are "hard" and "soft" construction costs. Hard costs include the materials and labor used to improve the property. For example, hard construction costs include the site improvement costs (e.g., grading, paving, and landscaping) or structure improvement costs (e.g., framing, electrical, and plumbing) of the project. In contrast, soft costs are the non-physical components of the project. Soft construction costs include fees to provide architectural and engineering planning, local building permits, legal representation, and construction management services necessary to entitle and construct the project. For my CALGreen analysis, I will concentrate on both the hard and soft construction costs associated with constructing a two-story office building on Lot 36.

I will use the concept of present value (PV) of money in my CALGreen analysis. The PV of money is an important concept in real estate finance because it shows that money has a time-value. In its simplest form, the PV means a dollar today is worth more than a dollar tomorrow. A sophisticated investor prefers to receive a dollar today, rather than tomorrow, because the investor can make more money by investing the dollar. If the investor has to wait to receive the dollar tomorrow, he will require compensation (i.e., discount rate) for the lost opportunity of investing the dollar owned today.

Many investors prefer the simple nature of the payback method for evaluating capital expenditures. The payback method calculates the time required to recoup the initial investment. There are two methods of calculating the payback period: the discounted payback period (DPP) method and the simple payback period method. In my analysis, I will use the DPP method,

which is the preferred method because it uses the present value of money concept. However, the DPP's biggest weakness is that it ignores all cash flows that occur after the payback period.

Therefore, I will also use the discounted cash flow (DCF) models in my analyses. Most investors use the DCF models because they are the most reliable for evaluating the attractiveness of a real estate investment. The DCP models discount all future cash flows back to the present by using the initial investment amount, a series of estimated yearly future cash flows, and a discount rate determined by the investor. A negative DCF value indicates that the investment does not meet investor expectations. By contrast, a positive DCF value indicates that the investment meets investor expectations, with the best investments having a highest DCF value.

Applying the correct discount rate (i.e., real discount rate) to an investment can be a difficult task, and usually represents two different things. The real discount rate must first represent the time value of money as well as a risk premium. The risk premium reflects the extra return investors demand for the risk that the cash flow might not materialize at all. Higher risk premiums correlate with riskier projects. Another way to look at the discount rate is to choose a rate that would earn the company a similar return if the company invested the money elsewhere. For example, if an investment of $100,000 will earn 5 percent interest somewhere else, the company should use 5 percent as the discount rate.

There are two basic DCF methods for analyzing investments: the net present value (NPV) method and the internal rate of return (IRR) method, both of which take into account the time-value of money. The NPV method multiplies the anticipated total cash flows by a discount rate to bring the total of all future cash flows back to their present value. Then, the NPV of the investment equals the initial investment less the present value of total cash flows. As indicated

above, a positive NPV (presented in dollars) indicates a desirable investment project. In contrast, the IRR method produces a value in percentage terms. The IRR method is the discount rate that results in a NPV of zero for a series of future cash flows. An IRR higher than the minimum acceptable rate of return (known as the hurdle rate) indicates a desirable investment project.

CALGreen for Non-Residential Buildings

CALGreen has different requirements for new residential and nonresidential buildings. My case study focuses exclusively on the nonresidential requirements of CALGreen because there will be a future office building on Lot 36. The following is a categorical summary of CALGreen's nonresidential mandatory and voluntary green building measures.

Mandatory CALGreen Requirements

CALGreen's mandatory green building measures focus on five categories of sustainable development: Planning and Design, Energy Efficiency, Water Efficiency and Conservation, Material Conservation and Resource Efficiency, and Environmental Quality. Many of CALGreen's mandatory requirements depend on specific characteristics of the building, such as site acreage, building square footage, and occupancy type. In addition, some of the requirements fill gaps in other agencies' regulations. For example, the State Water Resources Control Board requires a storm water pollution prevention plan (SWPPP) for a State Storm Water NPDES Construction Permit 99-08-DWQ for projects over one acre; however, before CALGreen, projects less than one acre did not need to have such a plan. The following is a brief summary of CALGreen's mandatory requirements:

1. Planning and Design

    a. Site Development includes:

        - preparing a storm water-soil loss prevention plan for projects under one acre;
        - providing short- and long-term bicycle parking spaces based on the anticipated number of tenants, employees, and visitors;
        - providing and marking a specific number of designated parking spaces for fuel-efficient and carpool vehicles based on number of total parking spaces;
        - installing exterior lights that contain shields and automatic controllers; and
        - designing the site's drainage system to move surface water away from the building.

2. Energy Efficiency

    CALGreen does not have any specific mandatory requirements for this category. CALGreen explains that the California Energy Commission (CEC) will continue to adopt mandatory building standards; however, the code notes that the California Energy Commission believes that a green building should achieve at least a 15 percent reduction in energy use when compared to the State's mandatory energy efficiency standards. I will not include a 15 percent reduction in energy use when analyzing the mandatory CALGreen green building measures because the CEC has not yet set a 15 percent reduction

mandated for commercial buildings. However, I will include an analysis on reduced energy for Tier 1 and Tier 2.

3. Water Efficiency and Conservation
    a. Indoor Water Use includes:
        - installing separate sub-meters for each individual office or retail tenant space within a building (greater than 50,000 square feet) that is projected to consume more than 100 gallons/day;
        - reducing the overall use of potable water within the building by 20 percent with more efficient plumbing fixtures; and
        - reducing wastewater by 20 percent with more efficient toilets and/or using non-potable water systems (e.g. graywater).
    b. Outdoor Water Use includes:
        - preparing a water budget that is consistent with local water efficient landscape ordinances;
        - installing a separate meter or submeter (for landscaped areas between 1,000 and 5,000 square feet) for indoor and outdoor potable water use; and
        - installing weather- or soil moisture-based irrigation controllers for properties with between 1,000 and 2,500 square feet of landscaped area.
4. Material Conservation and Resource Efficiency
    a. Water Resistance and Moisture Management includes:

- providing a weather-resistant exterior wall and foundation envelope; and
- designing and maintaining sprinklers to not spray on structures and constructing overhangs over exterior entries.

b. Construction Waste Reduction, Disposal and Recycling includes:

- preparing and adhering to a construction waste management plan for the diverted materials;
- recycling and/or salvaging for reuse a minimum of 50 percent (calculated by weight or volume) of the non-hazardous construction and demolition debris; and
- reusing or recycling 100 percent of trees, stumps, rocks and vegetation, and soils resulting from land clearing.

c. Building Maintenance and Operation includes:

- providing areas labeled for recycling non-hazardous materials including (at a minimum) paper, cardboard, glass, plastics and metals;
- building commissioning process for buildings that are 10,000 square feet and over; and
- testing and adjusting of systems for buildings less than 10,000 square feet.

5. Environmental Quality

a. Pollutant Control includes:

- installing only a direct-vent sealed-combustion gas or sealed wood-burning fireplace, or a sealed woodstove or pellet stove;

- covering all ducts and other air distribution openings with tape, plastic, or sheet metal during construction;
- applying finish materials (e.g. adhesives, sealants, caulks, paints, coatings) that meet specific local or regional air pollution control measures or air quality management district rules;
- installing carpet and wood products that meet specific industry requirement standards;
- installing HVAC filters that have a Minimum Efficiency Reporting Value (MERV) of at least 8; and
- prohibiting smoking within 25 feet of building entries, outdoor air intake, and operable windows.

b. Indoor Air Quality includes:

- meeting the minimum requirement of Section 121 (Requirements For Ventilation) of the California Energy Code, CCR, Title 24, Part 6, or the applicable local code (whichever is more stringent) and Chapter 4 of CCR, Title 8; and
- installing carbon dioxide (CO_2) sensors and ventilation controls for building equipped with demand control ventilation.

c. Environmental Comfort includes:

- constructing wall and roof-ceilings assemblies making up the building envelope with an Sound Transmission Coefficient (STC) of at least 50, and exterior windows with a minimum STC of 30 for buildings near freeways, busy airports, and other noisy uses; and

- constructing wall and floor-ceilings between tenant spaces and tenant spaces and common area with material which a STC of at least 40.

d. Outdoor Air Quality includes:

- installing HVAC, refrigeration, and fire suppression equipment that does not contain Chlorofluorocarbons (CFCs) or Halons.

Voluntary CALGreen Tier Requirements

The green building measures in the voluntary tiers are not mandatory unless adopted by a local government. CALGreen has two voluntary tiers, labeled CALGreen Tier 1 (Tier 1) and CALGreen Tier 2 (Tier 2). Both tiers require the project to satisfy the mandatory CALGreen green building measures and additional green building thresholds, which depend on the voluntary tier. Both Tier 1 and Tier 2 require a building to satisfy "elective" green building measures in each division. Tier 1 requires complying with one elective measure per division, whereas Tier 2 requires complying with three elective measures per division. The following is a brief summary of the voluntary green building measures needed to achieve Tier 1 or Tier 2 status:

<u>CALGreen Tier 1</u>

1. Planning and Design

a. Site Development includes:

- providing and marking a minimum of 10 percent of parking capacity for a combination of low-emitting, fuel-efficient and carpool vehicles based on number of total parking spaces; and

- installing a cool roof that meets specific thermal emittance, solar reflectance, or SRI values (see codes' table A5.106.11.2.1).

b. Comply with one elective green building measure in the division.

2. Energy Efficiency

The California Energy Commission will continue to adopt mandatory building standards; however, it is the intent of this voluntary measure to encourage green buildings to achieve exemplary performance in the area of energy efficiency. Therefore, a Tier 1 building must exceed California Energy Code requirements, based on the 2008 Energy Efficiency Standards, by 15 percent and meet the requirements of Division A45.6.

3. Water Efficiency and Conservation

a. Indoor Water Use includes:

- reducing the overall use of potable water within the building by 30 percent with more efficient plumbing fixtures.

b. Outdoor Water Use includes:

- reducing the use of potable water to a quantity that does not exceed 60 percent of ETo (Reference Evapotranspiration) times the landscape area.

c. Comply with one elective green building measure in the division.

4. Material Conservation and Resource Efficiency

a. Materials Source includes:

- using materials with postconsumer or preconsumer recycled content value (RCV) for a minimum of 10 percent of the total value, based on estimated costs of materials on the project.

b. Construction Waste Reduction, Disposal, and Recycling includes:

- recycling 65 percent of on-site construction and demolition debris.

c. Comply with one elective green building measure in the division.

5. Environmental Quality

a. Pollutant Control includes:

- installing specific resilient flooring material (complying specific VOC-emission limits) for 80 percent of floor area receiving resilient flooring; and
- complying with thermal insulation meeting 2009 CHPS low-emitting materials list.

b. Comply with one elective green building measure in the division.

6. Comply with one additional elective green building measure selected from any division.

<u>CALGreen Tier 2</u>

1. Planning and Design

a. Site Development includes:

- providing and marking a minimum of 12 percent of parking capacity for a combination of low-emitting, fuel-efficient and carpool vehicles based on number of total parking spaces; and
- installing a cool roof that meets specific thermal emittance, solar reflectance, or SRI values (see codes' table A5.106.11.2.2).

b. Comply with three elective green building measures in the division.

2. Energy Efficiency

   The California Energy Commission will continue to adopt mandatory building standards; however, it is the intent of this voluntary measure to encourage green buildings to achieve exemplary performance in the area of energy efficiency. Therefore, a Tier 2 building must exceed California Energy Code requirements, based on the 2008 Energy Efficiency Standards, by 30 percent. Also required is field verification and documenting the measures and calculations used to reach the desired level of efficiency.

3. Water Efficiency and Conservation

   a. Indoor Water Use includes:

      - reducing the overall use of potable water within the building by 35 percent with more efficient plumbing fixtures.

   b. Outdoor Water Use includes:

      - reducing the use of potable water to a quantity that does not exceed 55 percent of ETo (Reference Evapotranspiration) times the landscape area.

   c. Comply with three elective green building measures in the division.

4. Material Conservation and Resource Efficiency

   a. Materials Source includes:

      - using materials with postconsumer or preconsumer recycled content value (RCV) for a minimum of 15 percent of the total value, based on estimated costs of materials on the project.

b. Construction Waste Reduction, Disposal, and Recycling includes:

- recycling 80 percent of on-site construction and demolition debris.

c. Comply with three elective green building measures in the division.

5. Environmental Quality

a. Pollutant Control includes:

- installing specific resilient flooring material (complying specific VOC-emission limits) for 90 percent of floor area receiving resilient flooring; and
- complying with thermal insulation meeting 2009 CHPS low-emitting materials list and no added formaldehyde.

b. Comply with three elective green building measures in the division.

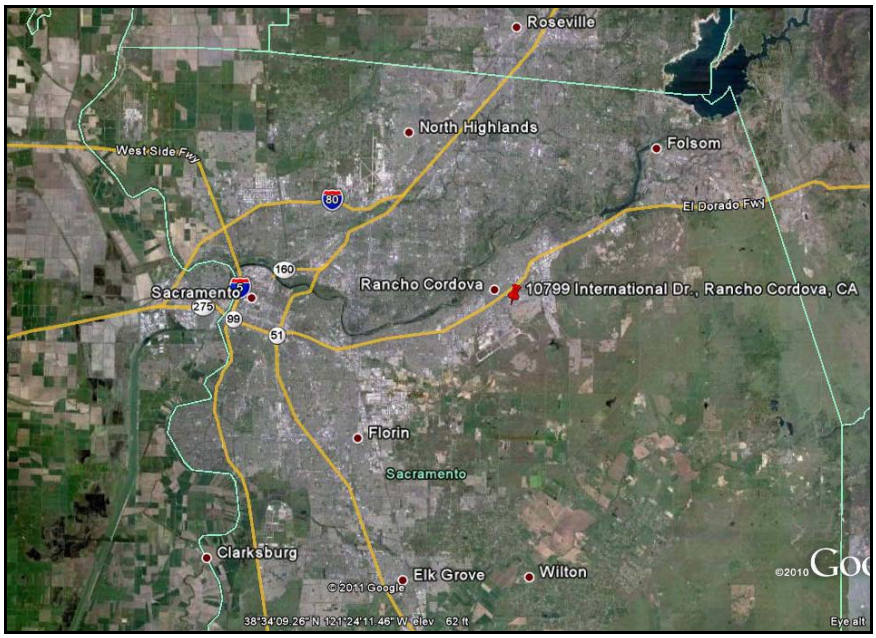
6. Comply with three additional elective green building measures selected from any division.

Data Collection

My first task was to find a nonresidential building for a CALGreen analysis. I am fortunate to work for The Evergreen Company, a private real estate developer that specializes in developing and managing office and retail buildings in the Sacramento Region. Evergreen has a large portfolio of nonresidential buildings. However, it was important to find the ideal one for this analysis. I remembered a proposed office-building project that did not move forward a few years ago because of a declining office market. Nevertheless, Evergreen analyzed the project enough to commission architectural building plans and receive a construction bid from a general contractor.

The project's site, owned by Evergreen and a partner, is a vacant piece of land at the corner of International Drive and Capital Center Drive in Rancho Cordova, California. The lot, known as Lot 36, is unique because it has site improvements, such as a parking lot and landscaping, but a building has never been there. Lot 36 is an infill site, surrounded by existing residential and office buildings, and zoned and entitled for an office building. My motive for choosing Lot 36 is that I can focus the analysis on the proposed building structure, which is the most regulated aspect of CALGreen.

Figure 3.1: Location Vicinity of Lot 36



Source: Google Earth

Trey Gundlach, a partner with Evergreen, was the lead on the proposed Lot 36 project a few years ago. We discussed using the Lot 36 project as the basis for my analysis on CALGreen and he agreed it was a good fit for the analysis. Mr. Grundlach provided me with access to the project's available resources, specifically the architectural building plans from

Perkins, Williams & Cotterill Architects (PWC) dated June 11, 2008 and a construction bid from Brown Construction (Brown) dated August 29, 2008.

Figure 3.2: Site Layout of Lot 36

Source: Google Earth

The next step was to collect the extra initial costs estimates and associated benefits for the proposed building on Lot 36. First, I had a discussion with the original project's construction manager, Dan Kowaleski of Brown, about receiving revised estimates based on the changes necessary to satisfy the different levels of CALGreen. Mr. Kowaleski agreed to assist me with the revised cost estimating process. I provided Mr. Kowaleski with an excel spreadsheet detailing his original construction bid and the line items that required revisions to satisfy CALGreen. I also contacted PWC and the City of Rancho Cordova's Building

Department to discuss CALGreen and its additional soft construction costs for the proposed project on Lot 36. Then, I collected utility data from the California Northstate College of Pharmacy (CNCP), which is the tenant that fully occupies the building next door to the project site. The building at 10811 International Drive, also known as Lot 37, is roughly the same size (56,00 square feet) and its utility data provides a good baseline measure to compare to the proposed office building on Lot 36.

Present Value of CALGreen

The project's architectural building plans and construction bid provide me with a baseline building. The baseline building constructed in 2008, under the previous California building codes, is the proposed building that PWC designed and Brown bid on. Brown's construction bid, dated August 29, 2008, now has outdated prices. Therefore, I will convert the prices for the baseline building into current dollars using the changes in the consumer price index. I am analyzing the additional construction costs and monetary benefits associated with CALGreen's nonresidential requirements. Therefore, I performed a cost/benefit, discounted payback period, and discounted cash flow analyses in order to compare the baseline building to a building constructed in 2011 under the CALGreen code. My analyses include costs and benefits in today's dollars.

First, I performed a cost/benefit analysis on implementing CALGreen's mandatory and voluntary green building measures by building upon the baseline building's hard costs, which Brown provided in its construction bid. The first step in the cost/benefit analysis was to identify the line items in the baseline building's bid affected by CALGreen. Next, I determined, with the help of the project team, the extra initial costs for the office building constructed in 2011 under CALGreen. Finally, I determined the monetary benefits of any of the costs identified

earlier. I define a monetary benefit as any cost savings because of increased efficiency when compared to the baseline building. The estimated costs and benefits are specific to implementing CALGreen and not implementing any of the other new state building code requirements in the recent Title 24 update (despite CALGreen being part of the latest update).

With the values found in the cost/benefit analysis, I took the analysis further to calculate the financial aspects of the CALGreen's requirements on the proposed office building. First, I used a discounted payback period method to find the payback of extra initial costs from CALGreen's mandatory green building measures. The DPP method is helpful for analyzing the mandatory green measures because Evergreen might not be able to increase a potential tenant's base rent (because of CALGreen's requirements) during a weak office market; however, Evergreen will want to know the payback of the extra initial costs. Finally, I used the discounted cash flow methods to find the NPV and IRR of CALGreen's green building measures. The DCF methods are helpful in analyzing the financial attractiveness of Tier 1 and Tier 2 because the NPV and IRR values will indicate whether either of the voluntary tier programs are a good economic decision for the proposed office building on Lot 36.

Project Assumptions

I made four general assumptions for the analysis. First, I assumed the future construction of an office building on Lot 36 because of the land's existing zoning designation (OIMU - Office Industrial Mixed Use) (source: City of Rancho Cordova's GIS Zoning map at gis.cityofranchocordova.org). Moreover, Evergreen and its partner built more than a dozen similar office buildings on International Drive, including the office building directly adjacent to Lot 36. Second, I assumed Evergreen and its partner would retain ownership of the building for ten years (holding period).

Third, I assumed that the proposed building is a speculative office building, which means the developer constructs the building without a tenant committed with a lease. Fourth and finally, I assumed that Evergreen would construct only the building shell, or building envelope, which includes all the building components that separate the exterior of the building from the interior. Typically, for a speculative (and possibly a multi-tenanted) building in the market, the building shell will include common area improvements such as a lobby, restrooms, and elevators. My four assumptions are consistent with Evergreen's architectural building plans and previous analysis for a proposed office building on Lot 36.

The next chapter shows detailed analyses on CALGreen's mandatory and voluntary green building measures and their associated present values compared to the baseline building.

Chapter 4

CALGREEN COST/BENEFIT ANALYSIS

Introduction

This chapter describes the cost/benefit analysis for satisfying CALGreen for a proposed office building on Lot 36. The analysis looks at three different levels of a CALGreen office building: the mandatory CALGreen building, the voluntary Tier 1 building, and the voluntary Tier 2 building. Each green building level has separate costs and benefits compared to the baseline building, which is the building constructed in 2008 per the architectural plans and original construction bid.

The baseline building has costs; however, it does not have benefits. The extra initial costs for the CALGreen buildings are the difference between the CALGreen construction estimates and the baseline building construction estimates. While, any additional benefits captured by the CALGreen buildings are exclusive to the CALGreen building because I assume there are no benefits for the baseline building.

The reminder of the chapter will include first listing the extra initial costs and associated benefits. Then, I will report the results from the discounted payback and discounted cash flow analyses of each green building level of CALGreen. Finally, I will discuss a lease rate revision and address the sensitivity of two important assumptions, discount rate and construction costs.

Extra Initial Costs of CALGreen

This section describes the extra initial costs of the CALGreen buildings (i.e., mandatory, Tier 1, and Tier 2), compared to the construction estimate for the baseline building.

I refer to the extra initial costs of CALGreen as the "CALGreen Premium." The CALGreen Premium reflects the increase in the extra initial costs because of the new building regulation. As previously described in Chapter 3, I am analyzing the extra initial hard and soft construction costs, or CALGreen Premium, in the estimates provided to the developer.

Comparing Construction Costs

First, I needed the prices for the baseline building. I started with Brown's original construction bid dated August 29, 2008. My analysis uses prices in today's dollars; therefore, Brown's original construction bid has outdated prices. To correct for this problem, I used the National Consumer Price Index (CPI) to converted Brown's original prices (in 2008 dollars) into 2010 dollars. There have been two full years (2009 and 2010) of CPI adjustments since 2008. I cannot bring the estimated costs into 2011 dollars because the CPI for the full 2011 year is not available yet. I used the overall (labeled "all items") CPI adjustments, which includes a -0.4 percent increase for 2009 (percent change from 2008 to the end of 2009) and 1.6 percent increase for 2010 (percent change from 2009 to the end of 2010). In total, the CPI adjustment from Brown's 2008 prices to 2010 prices is a 1.2 percent increase (-0.4 + 1.6 = 1.2). Using this CPI method, I can compare the estimated prices for the hard construction costs of the baseline building to the CALGreen buildings.

Next, I needed the price estimates for the CALGreen buildings. Dan Kowaleski, a construction project manager from Brown, provided me with hard construction cost estimates for constructing an office building to satisfy the different levels of CALGreen. Then, I received the estimates for architectural and building permits and fees (i.e., soft construction costs) from PWC and the City of Rancho Cordova, respectively. The estimate totals for the baseline, mandatory CALGreen, Tier 1, and Tier 2 buildings are in Table 4.1.

The CALGreen Tier 1 and Tier 2 buildings also include the extra initial costs for the mandatory CALGreen building because the Tier 1 and Tier 2 buildings also have to satisfy the mandatory CALGreen green building measures. In essence, the Tier 1 and Tier 2 buildings have a green premium (additional costs from voluntary green building measures) on top of a green premium (additional costs from mandatory green building measures).

Table 4.1 Estimated Baseline and CALGreen Buildings Construction Costs

Item No.	Description	Baseline Building Total	Mandatory CALGreen: Added Cost	Tier 1 CALGreen: Added Cost	Tier 2 CALGreen: Added Cost
SITE DEVELOPMENT:					
1	Surveying	$8,096			
2	Erosion Control	$7,084			
3	Winter Access / Conditions	$6,072			
4	Grading, Paving, & Utilities	$61,732	$3,500	$6,000	$6,000
14	Striping and Signage	$4,554	$250	$320	$320
16	Site Concrete	$55,831			
18	Landscaping & Irrigation	$40,480		$3,000	$3,000
19	Bike Racks and Lockers	$6,578	$825	$825	$825
	SITE DEVELOPMENT SUB TOTAL	$190,427			
BUILDING:					
20	Building Concrete	$413,017			
21	Reinforcing Steel	$117,898		$4,000	$8,000
24	Structural Steel	$584,936			
25	Metal Decking & Joists	$193,292			
26	Aluminum Handrail	$14,168			
27	Panelized / Stell Joist Roof Structure	$113,445			
28	Rough and Finish Carpentry	$41,492			
29	Marlite Wainscot	$607			
30	Wood Paneling	$26,312			
31	Wood and Cable Handrail	$21,252			
32	Doors, Frames and Hardware	$32,789			
33	Sheet Metal Flashing and Trim	$36,432			
34	Insulation	$28,088		($16,000)	($16,000)
35	Sound Attenuation	$4,453		$1,000	$1,000
36	Built Up Roofing	$70,536		$60,800	$60,800
37	Caulking and Sealants	$7,894			
38	Roof Hatch	$835			
39	Storefront, Window Walls and Glazing	$249,964			
	Automatic Sliding Door	$12,144			

	Calwall Canopies	$18,216			
40	Entrance Canopies	$9,513			
41	Skylights	$1,822			
42	Painting	$62,744			
43	Tile	$86,020			
44	Bead Blast Floor	$3,542			
45	Flooring Coverings	$14,168			
46	Acoustical Ceilings	$11,582		$1,000	$1,000
47	Metal Studs and Gypsum Board	$350,152			
48	Acrylic Stucco	$62,744			
49	Plastic Laminate Counters	$6,882			
50	Signage	$2,277			
51	Walk-off Pedi-Grid	$4,250			
52	Fire Extinguishers and Cabinets	$546			
53	Lockers	$4,655			
54	Toilet Partitions	$12,650			
55	Toilet Accessories	Included ↑			
56	Bathroom Mirrors	$4,048			
57	Elevator	$67,804			
58	Fire Sprinklers	$96,140			
59	H.V.A.C.	$849,857	$29,400	$193,200	$1,155,200
60	Plumbing	Included ↑	Included ↑	Included ↑	Included ↑
61	Electrical	$137,247	$1,600	$2,600	$2,600
	BUILDING SUB TOTAL	$3,776,415			
MISCELLANEOUS:					
62	General Conditions	$320,258	$22,050	$29,750	$38,500
63	Testing	$42,504			
64	Structural Engineering Review	$3,542			
65	Liability Insurance	$16,405			
66	Overhead and Profit	$239,226			
	MISCELLANEOUS SUB TOTAL	$621,934			
	TOTAL ESTIMATED HARD COSTS	$4,588,775	$4,646,400	$4,875,270	$5,850,020
	EST. ADDITIONAL HARD COSTS	N/A	$57,625	$286,495	$1,261,245
SOFT CONSTRUCTION COSTS:					
	Architectural/Engineering (5% of Hard)	$229,439	$232,320	$243,764	$292,501
	Building Permits and Fees	$871,659	$873,063	$875,196	$884,286
	TOTAL ESTIMATED SOFT COSTS	$1,101,098	$1,105,383	$1,118,960	$1,176,787
	EST. ADDITIONAL SOFT COSTS	N/A	$4,285	$17,862	$75,689
	TOTAL ESTIMATED COST	$5,689,873	$5,751,783	$5,994,230	$7,026,807

*Not all of the green building "electives" measures and their additional costs are included for Tier 2.

Table 4.2 Summary of Estimated Construction Costs

Level of Building	Estimated Construction Costs	Extra initial costs of CALGreen	Percentage Increase in Cost
Baseline	$5,689,873	N/A	N/A
Mandatory	$5,751,783	$61,910	1.088%
Tier 1	$5,994,230	$304,357	5.292%
Tier 2	$7,026,807	$1,336,934	22.304%

Associated Benefits

This section describes the associated benefits of the extra initial costs for each green building level of CALGreen. The private benefits from CALGreen all come from utility savings. First, I list the estimated extra initial costs and any associated benefits. Then, I will discuss the utility savings from the extra initial costs and finally how those utility savings result in higher property values and additional rent for the property owner.

Each line item in Brown's construction estimates does not list the associated benefit. Therefore, the estimated extra initial costs and the associated benefits for each level of CALGreen are in the tables below.

Table 4.3 Summary of Mandatory CALGreen Building's Costs and Benefits

Task	Extra Initial Costs	Operational Savings per Year
recycling all the trees, stumps, rocks, and vegetation and soils resulting from land clearing	$3,500	None
stenciling nineteen (19) "CLEAN AIR VEHICLES" parking spaces	$250	None
three additional Type II bicycle racks	$825	None
upgrading the building's plumbing fixtures	$1,200	$1,214
building commissioning	$25,000	None

upgrading the HVAC filters to MERV 8 quality	$3,200	Unknown
adding CO2 sensors to the building	$1,600	None
construction waste recycling program	$8,550	None
additional general contractor services for CALGreen compliance	$13,500	None
additional soft costs (architectural and building permits and fees)	$4,285	None
MANDATORY CALGREEN TOTALS	$61,910	$1,214 / yr.

Table 4.4 Summary of CALGreen Tier1 Building's Costs and Benefits

Task	Extra Initial Costs	Operational Savings per Year
recycling all the trees, stumps, rocks, and vegetation and soils resulting from land clearing	$6,000	None
stenciling twenty-three (23) "CLEAN AIR VEHICLES" parking spaces	$250	None
plant local adaptive and/or noninvasive vegetation in landscape areas damaged during construction	$3,000	None
three additional Type II bicycle racks	$825	None
purchasing material with 10 percent recycled content	$4,000	None
reduction in baseline's insulation estimate because less is needed because of the upgraded roof	($16,000)	N/A
upgrading the remaining insulation	$1,000	None
upgrading the roof to a single ply roofing with rigid foam insulation	$60,800	Unknown
upgrading the flooring glue	$1,000	None
upgrading the building's plumbing	$1,200	$1,821
building commissioning	$33,000	None
upgrading the HVAC filters to MERV 11 quality	$9,000	Unknown
15 percent more energy efficiency than 2008 Energy Efficiency Standards	$150,000	$10,599
adding CO2 sensors to the building	$2,600	None
construction waste recycling program	$9,500	None
additional general contractor services for CALGreen compliance	$20,250	None
additional soft costs (architectural and building permits and fees)	$17,862	None
TIER 1 TOTALS	$304,357	$12,420 / yr.

Table 4.5 Summary of CALGreen Tier2 Building's Costs and Benefits

Task	Extra Initial Costs	Operational Savings per Year
recycling all the trees, stumps, rocks, and vegetation and soils resulting from land clearing	$6,000	None
stenciling twenty-eight (28) "CLEAN AIR VEHICLES" parking spaces	$250	None
plant local adaptive and/or noninvasive vegetation in landscape areas damaged during construction	$3,000	None
three additional Type II bicycle racks	$825	None
purchasing material with 15 percent recycled content	$8,000	None
reduction in baseline's insulation estimate because less is needed because of the upgraded roof	($16,000)	N/A
upgrading the remaining insulation	$1,000	None
upgrading the roof to a single ply roofing with rigid foam insulation	$60,800	Unknown
upgrading the flooring glue	$1,000	None
upgrading the building's plumbing fixtures	$1,200	$2,125
building commissioning	$45,000	None
upgrading the HVAC filters to MERV 11 quality	$9,000	Unknown
30 percent more energy efficiency than 2008 Energy Efficiency Standards	$1,100,000	$21,197
adding CO2 sensors to the building	$2,600	None
construction waste recycling program	$11,500	None
additional general contractor services for CALGreen compliance	$27,000	None
additional soft costs (architectural and building permits and fees)	$75,689	None
TIER 2 TOTALS	$1,336,934	$23,322 / yr.

There are several additional "elective" requirements and their associated costs not included in the Tier 2 building analysis. Mr. Kowaleski and I found it very difficult to determine the feasibility and additional costs of additional elective green building measures for an already designed building. We concluded that a Tier 2 office building's design must integrate specific Tier 2 green building measures from the beginning of the design development stage.

We found that the proposed project on Lot 36, which includes existing architectural drawings and site improvements, does not lend itself well to comply with the Tier 2 requirements. Regardless, the additional estimated costs for the Tier 2 building that I did have were too costly anyway. For example, the energy reduction requirement for a Tier 2 building (A5.203.1.2) would require the project to redesign the mechanical (HVAC) system to include a full plant system, which is a boiler/chiller system in a machine yard, which could roughly cost an additional $1,100,000, compared to the cost of the baseline's HVAC system. In addition, including more elective green building measures, which probably would not provide any private benefits, would have not made a difference in the economic decision to bring this building to Tier 2 compliance. Table A20 in the Appendix lists the sections that had elective measures not included in the Tier 2 building analysis.

Utility Savings

All of the measurable private benefits of CALGreen come from the utility savings. The utility savings are in water and electricity expenses. Therefore, I collected actual water and electricity bills from the existing office building next to Lot 36. The building at 10811 International Drive, also known as Lot 37, is roughly the same size (56,000 square feet) and fully occupied by the California Northstate College of Pharmacy (CNCP). CNCP provided me with the actual utility (i.e., water and electricity) bills for 2010 for the purposes of my analysis. Although Evergreen constructed and manages the building, CNCP, per the lease, pays the utility expenses directly to the utility provider.

I used the actual water and electricity bills, and included a 6 percent increase (based on the assumption there will be a 3 percent increase in January 2011 and 2012), from Lot 37 as the utility expenses for the baseline building (see Table A2 and A3 in the Appendix). From the

baseline utility expenses, I subtracted the percentage reduction required to satisfy each level of CALGreen. For example, the mandatory CALGreen building requires a 20 percent reduction in water usage. Therefore, I estimated the annual water savings for the mandatory CALGreen building by taking 20 percent from the baseline's annual water bill. I calculated the estimated water savings for the Tier 1 and Tier 2 buildings using the same method. The Landlord's utility savings from CALGreen is the savings in the first year's expenses, known as the base year. In most full service gross leases, the Landlord is responsible for the base year expenses and the Tenant(s) is responsible for any additional expenses over the base year after the first year of the lease. Table 4.6 is a summary of the utility savings and a detailed spreadsheet is in the Appendix section (see Table A4 and A5).

Table 4.6: Summary of Utility Savings for the Landlord

Level of Building	Water Bill Amount	Electricity Bill Amount	Annual Total	Utility Savings in the Base Year
Baseline	$6,070	$70,658	$76,728	N/A
Mandatory	$4,856	$70,658	$75,514	$1,214
Tier 1	$4,249	$60,059	$64,308	$12,420
Tier 2	$3,945	$49,461	$53,406	$23,322

* Utilities bills includes a 6% increase from 2010 actual expenses
** Does not take into account discounting for present value

Increased Property Values from Utility Savings

As indicated above, a CALGreen building has utility savings compared to the baseline building. Lower utility costs lower the building's operating expenses and increase the Landlord's net operating income (NOI). When the NOI is higher, the property value is higher. I used this relationship between utility savings, NOI, and property values as a benefit of

CALGreen. First, I gathered the estimated market lease rate (i.e., for a single tenant user with a full service gross lease) from Ted Messner, a partner with Evergreen, and the actual 2010 operating expenses for Lot 37 from Evergreen Management Company. Next, I took the building's income minus expenses to find the estimated NOI and then discounted the NOI by 8 percent to find the present value of NOI. Then, I calculated the present value of NOIs for the baseline, mandatory CALGreen, Tier 1, and Tier 2 buildings for ten years (based a ten year holding period on the property). Next, I took the discounted NOI at Year 10 and divided it by an 8 percent capitalization rate to find the estimated property value. Finally, I compared the CALGreen buildings' property values to the baseline building's property values. Clearly, these calculations include several assumptions on my part and there is a list of them in Table A1 in the Appendix. Table 4.7 summarizes the increased NOI and property values for each level of CALGreen compared to the baseline building.

Table 4.7: Summary of Increased Property Values

Level of Building	PV of Net Operating Income (NOI)		PV of Property Values	
	Total 10 Years	Difference from Baseline	Year 10	Difference from Baseline
Baseline	$5,919,043	N/A	$5,437,698	N/A
Mandatory	$5,927,433	$8,390	$5,444,937	$7,240
Tier 1	$5,997,251	$78,207	$5,505,182	$67,484
Tier 2	$6,083,549	$164,505	$5,579,648	$141,950

Additional Rent from Utility Savings

The Landlord could also benefit by slightly increasing the Tenant's rent because the Tenant will have utility savings from an efficient building. As described previously, in a typical

full service gross lease, the Landlord is responsible for the expenses in the first year (a.k.a. the base year) and the Tenant is responsible for their pro-rata share of the expenses over the base year expenses after the first year. A Tenant occupying a CALGreen building will benefit each year from lower operating expenses, because of CALGreen's utility savings, compared to the baseline building.

The Landlord benefits from lower operating expenses in the base year and the Tenant benefits from lower operating expenses in Years 2 through 10. Therefore, the Landlord could negotiate for additional compensation, equal to the Tenant's annual utility savings that the Tenant would not receive in a non-CALGreen building. In my analysis, I calculated the additional rent as an annual lump sum payment from the Tenant to the Landlord for the utility savings. Table 4.8 illustrates the additional annual rent paid to the Landlord for each level of CALGreen building.

Table 4.8: Summary of Additional Annual Rent from Tenant's Utility Savings

Level of Building	Additional Rent per Year									
	1	2	3	4	5	6	7	8	9	10
Mandatory	$0	$36	$74	$113	$152	$193	$236	$279	$324	$370
Tier 1	$0	$373	$756	$1,152	$1,559	$1,978	$2,410	$2,855	$3,313	$3,785
Tier 2	$0	$700	$1,420	$2,163	$2,927	$3,715	$4,526	$5,361	$6,222	$7,108

Discounted Payback Period and Cash Flow Analyses for the Costs and Benefits of CALGreen

My analysis focuses on the costs and benefits of the green building measures for the three green building levels of CALGreen. Above, I identified the extra initial premium of the

mandatory CALGreen building as $61,910, the voluntary Tier 1 building as $304,357, and the voluntary Tier 2 building as $1,336,934. I also identified that the Landlord's annual utility savings would be $1,214 for the mandatory CALGreen building, $12,420 for the Tier 1 building, and $23,322 for the Tier 2 building. The Landlord would also benefit with increased property values of $7,240 for the mandatory CALGreen building, $67,484 for the Tier 1 building, and $141,950 for the Tier 2 building. In addition, the Landlord could charge the Tenant, over the term (i.e. 10 years) of the lease, additional rent of $1,777 for the mandatory CALGreen building, $18,181 for the Tier 1 building, and $34,140 for the Tier 2 building. I used a zero percent discount rate for the mandatory CALGreen analysis because the green building measures are mandatory and the money for the additional costs could not be an investment elsewhere. I used an eight percent discount rate for my voluntary Tier 1 and Tier 2 building analyses because Evergreen used eight percent in their original pro forma analysis in 2008. However, the results of any analysis are sensitive to a selected discount rate. Therefore, I provide a table (Table 4.11) that calculates the NPVs of various discount rates later in this chapter.

In my discounted payback period (DPP) analysis (which assumed the property sold in Year 10), the total benefits did not repay the extra initial costs for any of the three levels of CALGreen. The DPP results show a loss of $40,754 for the mandatory CALGreen building improvements, $136,687 for the Tier 1 building improvements, and $988,350 for the Tier 2 building improvements. The Net Present Value (NPV) is -$40,754 for the mandatory CALGreen building,-$189,795 for the Tier 1 building, and -$1,046,528 for the Tier 2 building. In addition, the internal rate of return (IRR) is -12.88 percent for the mandatory CALGreen building, -7.56 percent for the Tier 1 building, and -15.54 percent for the Tier 2 building.

Table 4.9: Summary of the Discounted Payback Period and Cash Flow Analyses

Level of Building	Extra Initial Costs	Total Private Benefits	Holding Period (years)	Discount Rate	DPP	NPV	IRR
Mandatory	$61,910	$21,157	10	0.0%	None	($40,754)	-12.88%
Tier 1	$304,357	$167,670	10	8.0%	None	($189,795)	-7.56%
Tier 2	$1,336,934	$348,584	10	8.0%	None	($1,046,528)	-15.54%

Assumptions and their Sensitivities

The results from the cost/benefit analysis illustrate that not any of the CALGreen building levels are a good economic decision from the private developer's perspective. However, my results rely on several important assumptions. First, the lease rate would not change despite the extra initial costs for CALGreen. Using this assumption, my results suggest the Landlord would lose money on the CALGreen green building improvements without increasing the Tenant's base rent even more than charging the Tenant for the utility savings. Therefore, what would the Tenant's base rent need to be so the Landlord could break-even on the extra initial costs? Table 4.10, illustrates the revised lease rates for the CALGreen buildings, using a straight-line approach, to cover the Landlord's extra initial costs over the life of the Tenant's lease term.

Table 4.10: Increased Lease Rate Calculations

	Baseline	Mandatory CALGreen	CALGreen Tier 1	CALGreen Tier 2
CALGreen Premium		$61,910	$304,357	$1,336,934
Divide by Building SF		56,700	56,700	56,700
Extra Rent PSF for CALGreen (lease term)		$1.09	$5.37	$23.58
Owner's required rate of return		8%	8%	8%
Extra Rent PSF for Owner (entire term)		$1.18	$5.80	$25.47
Divide by Lease term (YR)		10	10	10
Extra Rent PSF / yr.		$0.118	$0.580	$2.547
Divide by 12 months		12	12	12
Extra rent PSF / mo.		$0.01	$0.05	$0.21
Add market rent PSF / mo.	$1.75	$1.75	$1.75	$1.75
Total Required Lease Rate	$1.75	$1.76	$1.80	$1.96

Another important assumption in my analysis is the discount rate. I used an 8 percent discount rate to analyze the voluntary tier programs; however, other investors may use a different one. Therefore, I feel it is important to illustrate the sensitivity of the discount rate and how changing it, changes the results of my case study analysis. Table 4.11 illustrates the sensitivity of the discount rate on the NPV of each level of the CALGreen buildings.

Table 4.11: Discount Rate Sensitivity Analysis

Discount Rate	Level of Building & Associated NPV		
	Mandatory	Tier 1	Tier 2
0%	($40,754)	($112,676)	($961,765)
1%	($42,497)	($130,457)	($989,156)
2%	($43,935)	($145,551)	($1,011,471)
3%	($45,116)	($158,370)	($1,029,503)
4%	($46,080)	($169,258)	($1,043,913)
5%	($46,859)	($178,502)	($1,055,250)
6%	($47,484)	($186,342)	($1,063,977)
7%	($47,976)	($192,980)	($1,070,482)
8%	($48,355)	($198,587)	($1,075,091)
9%	($48,638)	($203,307)	($1,078,082)
10%	($48,838)	($207,262)	($1,079,689)

Another sensitivity issue is with the estimated extra initial costs of the different levels of CALGreen. How would my results change if the extra initial costs were higher or lower? For example, what would be the NPV of the CALGreen buildings if the extra initial costs were 10 percent higher or lower than what I initially estimated? Table 4.12 illustrates the sensitivity of the extra initial costs on the NPV of the CALGreen buildings.

Table 4.12: Construction Cost Sensitivity Analysis

Level of Building	My Results		Percentage Change in Construction Costs and Associated NPV			
	Extra initial costs	NPV	-10%	-5%	5%	10%
Mandatory	($61,910)	($40,754)	($34,563)	($37,658)	($43,849)	($46,945)
Tier 1	($304,357)	($189,795)	($161,614)	($175,704)	($203,885)	($217,976)
Tier 2	($1,336,934)	($1,046,528)	($922,738)	($984,633)	($1,108,423)	($1,170,318)

Conclusion

This chapter reports the results of my cost/benefit analysis on CALGreen. My analysis examines whether it is a good economic decision for a private developer to implement any of the three CALGreen levels for a proposed office building on Lot 36. My analysis of the extra initial costs and associated benefits resulted in negative results of NPV, IRR, and DPP for all three green building levels of CALGreen. A potential solution for the Landlord would be to increase the Tenant's base rent even higher, if possible, to offset the extra initial costs associated with each level of CALGreen. Finally, I addressed the sensitivity of two important assumptions, discount rate and construction costs. I found similar negative results for all three CALGreen buildings with changes in my assumptions.

The final section of this thesis will include a discussion of how my findings could affect green building regulations in the future. In addition, I will summarize the first four chapters,

recommend a few topics for future research on CALGreen and green building regulations, and provide some concluding remarks about my analysis.

Chapter 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Introduction

My thesis attempts to answer whether it is economically feasible to implement CALGreen for a proposed office building on 10799 International Drive. My goal is to provide readers with findings from a case study about CALGreen because in my recent professional discussions I found that many people in the real estate industry have not heard about it, researched it, or knew any of its requirements. I begin the concluding chapter with a summary of the previous chapters, including how each chapter helped me to answer my research question. In the remainder of the chapter, I cover my suggestions for future research and concluding remarks on CALGreen and green building.

Summary of Previous Chapters

Chapter 1 helped me identify my thesis question. I found that from the public's perspective there are clear environmental problems with conventional development. In conventional developments, its suppliers and consumers benefit, but everyone in the society experiences the costs of conventional developments. Typical conventional developments consist of energy inefficient buildings in outlying suburbs. The people who live, work, and visit these types of developments mostly rely on automobiles. Conventional development results in negative externalities through environmental consequences such as greater greenhouse gas emissions and natural resources depletion.

Because of these negative externalities, many local, state, and federal governments view conventional development as a problem that requires government intervention. For example,

for decades the State of California has been an environmental leader by implementing progressive building regulations that aim to limit the negative externalities of conventional development. California was the first to implement building regulations such as AB 32, SB 375, and CALGreen. For instance, until CALGreen, green building was voluntary and left up to the private sector to determine whether it was economically feasible. As of January 1, 2011, CALGreen requires all new buildings (i.e., public and private) in California to follow a minimum set of green building measures.

Chapter 2 helped me to gain perspective on my thesis question with previous research on the costs and benefits of building regulations. My goal was to find what other researchers found important and use their findings to shape my cost/benefit analysis of CALGreen. The research suggests that building regulations affect construction costs and the supply of new construction. However, the research also suggests these additional costs of building regulations have both private and public benefits. The private benefits are energy savings and higher property values, whereas the public benefits are a cleaner environment and safer buildings. From my research, I learned that additional construction costs, utility savings, and higher property values were variables that I could use in my cost/benefit analysis.

Chapter 3 helped me present the process I went through to test my thesis question. I decided to analyze a case study because every building is different and it would be difficult to generalize the costs and benefits of multiple buildings across different uses (e.g., residential and commercial buildings). First, I calculated the extra initial costs of CALGreen. I listed the mandatory and voluntary CALGreen requirements and compared them to the building specifications in the architectural plans and construction estimate provided in 2008. Brown Construction provided me with revised construction estimates based on the green building

measures not included in their original construction estimate. I also received soft construction estimates from PWC Architects and the City of Rancho Cordova. Second, I calculated the benefits of utility savings by gathering the actual utility bills from a similar, existing office building (Lot 37) adjacent to the project site. I also used the utility savings to determine additional rent the property owner could charge the tenant and the increased property values if the property sold in Year 10. Finally, I analyzed the extra initial costs and associated benefits of CALGreen by finding the net present value (NPV), internal rate of return (IRR), and discounted payback period (DPP) for all three green building levels of CALGreen.

Chapter 4 helped me present the findings used to answer my thesis question. The extra initial costs for the mandatory CALGreen building is $61,910 (1.088 percent higher), the voluntary CALGreen Tier 1 building is $304,357 (5.292 percent higher), and the voluntary CALGreen Tier 2 building is $1,336,934 (22.304 percent higher) above the baseline building. For the Landlord's perspective, the measurable benefits of CALGreen came from utility savings. First, the Landlord's annual utility savings from the base year expenses are $1,214 for the mandatory CALGreen building, $12,420 for the Tier 1 building, and $23,322 for the Tier 2 building. In addition, the utility savings would increase the property's value (assuming the property sold in Year 10) by $7,240 for the mandatory CALGreen building, $67,484 for the Tier 1 building, and $141,950 for the Tier 2 building. Finally, the utility savings would allow the Landlord to charge the Tenant, over the term (i.e. 10 years) of the lease, additional rent of $1,777 for the mandatory CALGreen building, $18,181 for the Tier 1 building, and $34,140 for the Tier 2 building. However, the cost/benefit analysis of the extra initial costs and associated benefits resulted in negative values for NPV, IRR, and DPP for all three levels of CALGreen buildings. A potential solution for the Landlord would be to increase the Tenant's base rent

even higher, if possible, to offset the full amount of the extra initial costs for each CALGreen building. I also addressed the sensitivity of two important assumptions, discount rate and construction costs, and found similar negative values for NPV, IRR, and DPP for all three green building levels of CALGreen when my assumptions changed.

Future Research

I believe that I have laid the groundwork for future research on a variety of different topics about CALGreen and green building practices. First, researchers could follow the life cycle of one or a sample of CALGreen buildings from start (i.e., pre-construction) to finish (i.e., sale of the property). The analysis could reveal the actual costs and benefits of a building constructed under the CALGreen code. In addition, a researcher able to quantify the sales premium of a CALGreen building could help to justify the additional CALGreen costs for private developers.

The lease for a green building is another important topic for future research. For example, above I discussed why the Landlord could increase the Tenant's rent because the Tenant would receive utility savings after the first year. This additional rent provision and its specifics would need to be in the lease. A green lease is between a Landlord and Tenant of a commercial building and provides mutual obligations to minimize the environmental impact in areas such as energy, water, and waste. However, green leases are relevantly new, difficult to draft and administer, and create unique problems that traditional leases do not adequately address. Academic research on green leasing would be beneficial because there does not seem to be consensus for best practices in the real estate industry.

Another beneficial analysis for green building would be to compare the costs and benefits of private versus public administered green rating systems. For example, a researcher

could do a case study comparison of a developer's option to LEED certify or comply with a voluntary CALGreen tier program for a new project. Research could also focus on the public sector side of administering CALGreen. A study could analyze a jurisdiction's implementation of a voluntary CALGreen Tier program. In addition, that study could show how the additional green building measures affect the supply of new construction within the jurisdiction, which I found to be a cost of building regulations in my research.

Conclusions

Most people would agree that green building is a good idea. The green building concept is simple; build structures that have less impact on the environment and human health and that increase the efficiency with which buildings and their sites use energy, water, and materials. Green building is not a new concept and goes back to the nineteenth century when structures such like London's Crystal Place and Milan's Galleria Vittorio Emanuele II used passive efficiency systems to maintain indoor temperatures (Building Design & Construction, 2003). Recently, green building has become more popular. In the early 1990s, President Clinton implemented green building measures in the White House and after seeing positive results, issued several executive orders to encourage similar measures for other federal buildings. Shortly afterwards, the U.S. Green Building Council (USGBC) emerged and since become an industry leader in rating a building's sustainability using its Leadership in Energy and Environmental Design (LEED) process.

Many private and public buildings have become LEED certified through the USGBC, including many buildings under the direction of Governor Schwarzenegger's Executive Order S-20-04. Typically, including under the terms of Executive Order S-20-04, green building is voluntary and it is the property owner's decision to implement green building improvements.

The additional costs for green building remain the main reason why project developers decide against it. From a property owner's perspective, it is the owner's best interest to implement green building improvements that provide greater economic benefit than cost.

However, CALGreen takes away that decision from property owners. CALGreen requires property owners, both private and public, to implement a minimum set of green building measures for every new building in California regardless of the economics. There are also additional green building measures in the CALGreen Tier 1 and Tier 2 programs that are voluntary, unless a jurisdiction mandates them. Used as an example, my case study of a proposed office building found that implementing the mandatory and voluntary CALGreen green building measures was a bad economic decision for the property owner. The extra initial costs outweighed the associated benefits and resulted in a loss for the property owner.

However, the property owner could lower the extra initial costs of CALGreen with rebates, subsidies, and/or tax breaks. In my analysis, I did not cover financing the extra initial costs of CALGreen; however, a property owner should research possible sources of financial assistance for green building improvements. For example, Pacific Gas and Electric (PG&E) has a program called Savings by Design that provides technical and financial incentives to encourage property owners to build new high-performance commercial buildings. For instance, PG&E's program will reimburse the property owner 10 percent of cost of building commissioning (Pacific Gas and Electric, 2010, January 1). However, there still seems to be more rebates and incentives for replacing inefficient products in existing buildings. I strongly believe the public sector needs to do more to assist property owners of new buildings, now that they have mandated green building for all new construction.

In my analysis, I showed how the Landlord could benefit by slightly increasing the Tenant's rent because the Tenant would have utility savings from an efficient building. For example, a Tenant occupying a mandatory CALGreen building will benefit from lower operating expenses, because of the utility savings, compared to the baseline building. In a typical full service gross lease, the Landlord is responsible for the expenses in the base year (i.e. first year) and the Tenant is responsible for their pro-rata share of the expenses over the base year expenses after the first year. In the CALGreen example, the Landlord benefits from lower expenses in the base year and the Tenant benefits from lower expenses in Years 2 through 10. Therefore, the Landlord could ask for additional compensation, equal to the Tenant's utility savings each year that the Tenant would not receive in a non-CALGreen building. Nevertheless, I found that the slightly higher rents did not offset the full amount of the extra initial costs of CALGreen.

The Landlord could increase the Tenant's base rent even higher to make up for full amount of the extra initial costs of CALGreen; however, doing so is not practical in the current weak office market. The combination of a weak market and a scenario where a property owner cannot recoup the extra initial costs with higher rents is unfavorable for any new construction projects. Currently, it is a tenant's market with high levels of vacancy throughout region. A tenant in today's market will most likely be able to negotiate the best lease deal with a property owner of an existing building with vacancies or with an existing tenant, who vacated a leased space and looking for a sub-tenant. In contrast, a new building, particularly one constructed under CALGreen, will demand higher rents and thus will not be able to compete with non-green existing buildings for tenants in this market. In today's market, any new building constructed under CALGreen will most likely be a build-to-suit project, which involves constructing a new

building from the ground up for a tenant's specifications and leasing that building to them on a long-term basis. In a build-to-suit project, a tenant who wants a new building built to their specification will be required to pay the additional rent to offset the developer's extra initial costs of CALGreen.

My analysis did not account for any of the possible public benefits from implementing CALGreen. I believe the most significant public benefit of a CALGreen building would be the use of less electricity compared to the baseline building. The mandatory CALGreen building standards do not require builders to implement electricity savings; however, the CALGreen Tier 1 and Tier 2 buildings must exceed the California Energy Code requirement by 15 percent and 30 percent, respectively. The electricity savings (in kWh) from the CALGreen Tier 1 and Tier 2 buildings result in less GHG emissions in the air, which benefits everyone. For example, the annual electricity savings from the CALGreen Tier 1 building is 78,084 kWh, which would result in 47,631 pounds less carbon dioxide in the air each year (based on an office building in California) (EIA, 2002, April). These types of carbon dioxide savings from new building construction could help California meet its AB 32's target of reducing GHG emissions to 1990 levels by 2020.

I believe that CALGreen is a positive step forward for California because it will help us meet our future environment goals and allow us to be more efficient with our limited natural resources. Many people may argue that it is not a good time to implement CALGreen during a weak real estate market, but I believe it is the best time to implement CALGreen because the building industry will have time to get used to its requirements and come up with creative ways to make it economically feasible in the marketplace. My case study analysis shows that

CALGreen does not currently make private economic sense; however, a green building on Lot 36 could be successful in the future with more CALGreen experience and innovation.

I also believe that the State of California will not continue to encourage LEED certification for its owned or leased property, but instead will strive for either CALGreen Tier 1 or Tier 2 compliance. California may not want to continue to be contractual obligated to a green rating system administered by a costly private nonprofit organization on the East Coast. Maybe other state governments may follow California's lead, as they have done in the past with other progressive building regulations, and require green building measures in their state's buildings codes. Many of these states may be waiting to see the outcome of CALGreen.

After completing my case study on CALGreeen, I have a few suggestions for the next revision to CALGreen. First, I suggest that the California Building Standards Commission or another State agency market CALGreen in order to encourage even higher property values for CALGreen buildings. The USGBC has been successful marketing the benefits of LEED certification and recently, tenants and real estate investors see LEED certification as a prestigious award and one they are willing to pay extra for. I do not see why CALGreen cannot be the same. With successful marketing, CALGreen could justify its extra initial costs to developers by increasing property values similar to buildings with the prestigious LEED certification.

More importantly, I suggest that the next revision to CALGreen include more green building measures that provide private benefits. In its current form, CALGreen has too many measures that only provide public benefits, which do not help property owners maximize economic profit. Utility savings provided the only private measurable benefits for CALGreen, but they could not offset the full amount of the extra initial costs of CALGreen. Without such

consideration in the next revision, CALGreen could remain just another costly building regulation with little private benefit. I hope that is not the case and CALGreen proves to be another success story for California.

APPENDIX

Table A1: Assumptions for CALGreen Analysis

General Assumptions		
Actual In Place / Start Date	1/1/2012	
Rentable Square Footage	56,700	
Occupany Level	100.00%	
Tenant	Single Tenant User	
Discount Rate for Mandatory CALGreen Bldg.	0.00%	
Discount Rate for Tier 1 and Tier 2 Bldgs.	8.00%	
Expense Assumption Summary		
Operating Expense Source	Lot 37's 2010 Actuals	
Operating Expense Reimbursement	100.00%	
Operating Expense Growth Rate (Annual)	3.00%	
Property Tax Growth Rate	2.00%	
Management Fee	3.00%	
Expense Reimbursement Method	Full Service Gross	
Market Leasing Assumptions		
Building Lease Rate w/out Increase	$1.75	PSF / month
Building Lease Rate w/ Increases		
Baseline Building Lease Rate	$1.75	PSF / month
Mandatory CALGreen Building Lease Rate	$1.76	PSF / month
CALGreen Tier 1 Building Lease Rate	$1.80	PSF / month
CALGreen Tier 2 Building Lease Rate	$1.96	PSF / month
Lease Rate Bumps	2.00%	every 24 months
Lease Term	10+ years	
Residual Sale		
Capitalization Rate	8.00%	

Table A2: Actual 2010 Water Bills

Baseline Building				
Month	Period		Usage (in CCFs)	Bill Amounts [1]
	Starts	Ends		
1	1/14/2010	2/17/2010	61	$106.42
2	2/17/2010	3/16/2010	658	$528.97
3	3/16/2010	4/20/2010	356	$320.31
4	4/20/2010	5/18/2010	324	$307.67
5	5/18/2010	6/17/2010	458	$445.96
6	6/17/2010	7/20/2010	1,201	$1,021.68
7	7/20/2010	8/20/2010	756	$663.86
8	8/20/2010	9/21/2010	1,334	$1,128.62
9	9/21/2010	10/18/2010	360	$353.16
10	10/18/2010	11/22/2010	209	$237.74
11	11/22/2010	12/21/2010	419	$405.43
12	12/21/2010	1/21/2011	132	$206.44
			TOTAL	$5,726.26

Notes:

(1) Amount based on: CCFs are charged on a rate and there is a flat service charge per month = $55.15

(2) Source: CNCP the tenant at 10811 International Dr.

Table A3: Actual 2010 Electricity Bills

Baseline Building				
Month	Period		Usage (in kWhs)	Bill Amounts [1]
	Starts	Ends		
1	12/6/2009	1/7/2010	35,040	$4,364.15
2	1/8/2010	2/5/2010	33,840	$4,278.28
3	2/6/2010	3/9/2010	37,440	$4,500.78
4	3/10/2010	4/7/2010	35,280	$4,647.17
5	4/8/2010	5/6/2010	37,440	$4,906.62
6	5/7/2010	6/8/2010	42,480	$5,620.80
7	6/9/2010	7/7/2010	48,000	$6,167.67
8	7/8/2010	8/6/2010	50,160	$6,381.67
9	8/7/2010	9/3/2010	48,000	$6,317.63
10	9/4/2010	10/5/2010	59,040	$7,411.38
11	10/6/2010	11/4/2010	49,920	$6,460.95
12	11/5/2010	12/7/2010	43,920	$5,601.41
			TOTALS	$66,658.51

Notes:

(1) Amount based on: kWhs are charged on a rate and there are various fees state and local fees, took the original bill less the percent reduction.

(2) Source: CNCP the tenant at 10811 International Dr.

Table A4: Annual Water Savings in the Base Year

Baseline Building			Mandatory	Tier 1	Tier 2
Month	Actual Bill Amount [1]	Revised Bill Amount [2]	Annual Bill under 20% Reduction	Annual Bill under 30% Reduction	Annual Bill under 35% Reduction
1	$106.42	$112.81			
2	$528.97	$560.71			
3	$320.31	$339.53			
4	$307.67	$326.13			
5	$445.96	$472.72			
6	$1,021.68	$1,082.98			
7	$663.86	$703.69			
8	$1,128.62	$1,196.34			
9	$353.16	$374.35			
10	$237.74	$252.00			
11	$405.43	$429.76			
12	$206.44	$218.83			
TOTALS	$5,726.26	$6,069.84	$4,855.87	$4,248.88	$3,945.39
ANNUAL WATER SAVINGS			$1,213.97	$1,820.95	$2,124.44

Notes:

(1) Amount based on: CCFs are charged on a rate and there is a flat service charge per month = $55.15

(2) Assumed 3% increase in rate for CCF in January 2011 and 2012.

(3) Assumed tenant occupancy in January 2012.

(4) Source: CNCP the tenant at 10811 International Dr.

Table A5: Annual Electricity Savings in the Base Year

Baseline Building			Mandatory	Tier 1	Tier 2
Month	Actual Bill Amount [1]	Revised Bill Amount [2]	Annual Bill with no Reduction	Annual Bill under 15% Reduction	Annual Bill under 30% Reduction
1	$4,364.15	$4,626.00			
2	$4,278.28	$4,534.98			
3	$4,500.78	$4,770.83			
4	$4,647.17	$4,926.00			
5	$4,906.62	$5,201.02			
6	$5,620.80	$5,958.05			
7	$6,167.67	$6,537.73			
8	$6,381.67	$6,764.57			
9	$6,317.63	$6,696.69			
10	$7,411.38	$7,856.06			
11	$6,460.95	$6,848.61			
12	$5,601.41	$5,937.49			
TOTALS	$66,658.51	$70,658.02	$70,658.02	$60,059.32	$49,460.61
ANNUAL ENERGY SAVINGS			$0.00	$10,598.70	$21,197.41

Notes:

(1) Amount based on: kWhs are charged on a rate and there are various fees state and local fees, took the original bill less the percent reduction.

(2) Assumed 3% increase in rate for CCF in January 2011 and 2012.

(3) Assumed tenant occupancy in January 2012.

(4) Source: CNCP the tenant at 10811 International Dr.

Table A6: Baseline Building NOI (PV) from Building Operations

YEAR	Actual 2010	1 1/12-12/12	2 1/13-12/13	3 1/14-12/14	4 1/15-12/15	5 1/16-12/16
INCOME						
Contract Rent PSF	$21.00	$21.00	$21.00	$21.42	$21.42	$21.85
CPI and Other Increases	$0	$0	$0	$0	$0	$0
Expense Reimb.	$0	$0	$8,572	$18,115	$27,163	$37,210
Other Revenue	$0	$0	$0	$0	$0	$0
Potential Gross Rent	$1,190,700	$1,190,700	$1,199,272	$1,232,629	$1,241,677	$1,276,014
Less: Vacancy	$0	$0	$0	$0	$0	$0
Effective Gross Income	$1,190,700	$1,190,700	$1,199,272	$1,232,629	$1,241,677	$1,276,014
EXPENSES						
Management Fee	$35,721	$35,721	$35,978	$36,979	$37,250	$38,280
Operating Expenses	$190,971	$196,700	$202,601	$208,679	$214,940	$221,388
Real Estate Tax	$108,260	$110,425	$112,633	$114,886	$117,184	$119,527
Insurance	$6,653	$6,853	$7,058	$7,270	$7,488	$7,713
Total Expenses	$341,605	$349,699	$358,271	$367,814	$376,862	$386,908
Expenses PSF	$6.02	$6.17	$6.32	$6.49	$6.65	$6.82
NOI	$849,095	$841,001	$841,001	$864,815	$864,815	$889,106
PV FACTORS		0.9259	0.8573	0.7938	0.7350	0.6806
PV OF NOI		$778,683	$720,990	$686,490	$635,639	$605,125

(Continued) Table A6: Baseline Building NOI (PV) from Building Operations

YEAR	6 1/18-12/17	7 1/18-12/18	8 1/19-12/19	9 1/20-12/20	10 1/21-12/21
INCOME					
Contract Rent PSF	$21.85	$22.29	$22.29	$22.73	$22.73
CPI and Other Increases	$0	$0	$0	$0	$0
Expense Reimb.	$46,760	$57,338	$67,419	$78,559	$90,535
Other Revenue	$0	$0	$0	$0	$0
Potential Gross Rent	$1,285,564	$1,320,918	$1,330,999	$1,367,411	$1,379,387
Less: Vacancy	$0	$0	$0	$0	$0
Effective Gross Income	$1,285,564	$1,320,918	$1,330,999	$1,367,411	$1,379,387
EXPENSES					
Management Fee	$38,567	$39,628	$39,930	$41,022	$41,382
Operating Expenses	$228,029	$234,870	$241,916	$249,174	$256,649
Real Estate Tax	$121,918	$124,356	$126,843	$129,380	$133,262
Insurance	$7,944	$8,182	$8,428	$8,681	$8,941
Total Expenses	$396,458	$407,037	$417,118	$428,257	$440,234
Expenses PSF	$6.99	$7.18	$7.36	$7.55	$7.76
NOI	$889,106	$913,882	$913,882	$939,153	$939,153
PV FACTORS	0.6302	0.5835	0.5403	0.5002	0.4632
PV of NOI	$560,314	$533,250	$493,770	$469,764	$435,016

Notes:

(1) Management Fees based on Income and Operating Expense Reimbursement

(2) Source: Evergreen for Lot 37 Operating expenses (excluding management fees)

Table A7: Mandatory CALGreen Building NOI (PV) from Building Operations

YEAR	Actual 2010	1 1/12-12/12	2 1/13-12/13	3 1/14-12/14	4 1/15-12/15	5 1/16-12/16
INCOME						
Contract Rent PSF	$21.00	$21.00	$21.00	$21.42	$21.42	$21.85
CPI and Other Increases	$0	$0	$0	$0	$0	$0
Expense Reimb.	$0	$0	$8,534	$18,037	$27,044	$37,048
Other Revenue	$0	$0	$0	$0	$0	$0
Potential Gross Rent	$1,190,700	$1,190,700	$1,199,234	$1,232,551	$1,241,558	$1,275,852
Less: Vacancy	$0	$0	$0	$0	$0	$0
Effective Gross Income	$1,190,700	$1,190,700	$1,199,234	$1,232,551	$1,241,558	$1,275,852
EXPENSES						
Management Fee	$35,721	$35,721	$35,977	$36,977	$37,247	$38,276
Operating Expenses	$189,757	$195,450	$201,313	$207,353	$213,573	$219,981
Real Estate Tax	$108,260	$110,425	$112,633	$114,886	$117,184	$119,527
Insurance	$6,653	$6,853	$7,058	$7,270	$7,488	$7,713
Total Expenses	$340,391	$348,448	$356,982	$366,485	$375,492	$385,496
Expenses PSF	$6.00	$6.15	$6.30	$6.46	$6.62	$6.80
NOI	$850,309	$842,252	$842,252	$866,066	$866,066	$890,356
PV FACTORS		0.9259	0.8573	0.7938	0.7350	0.6806
PV OF NOI		$779,841	$722,062	$687,483	$636,558	$605,976

(Continued) Table A7: Mandatory CALGreen Building NOI (PV) from Building Operations

YEAR	6 1/18-12/17	7 1/18-12/18	8 1/19-12/19	9 1/20-12/20	10 1/21-12/21
INCOME					
Contract Rent PSF	$21.85	$22.29	$22.29	$22.73	$22.73
CPI and Other Increases	$0	$0	$0	$0	$0
Expense Reimb.	$46,554	$57,088	$67,123	$78,215	$90,142
Other Revenue	$0	$0	$0	$0	$0
Potential Gross Rent	$1,285,359	$1,320,668	$1,330,703	$1,367,067	$1,378,994
Less: Vacancy	$0	$0	$0	$0	$0
Effective Gross Income	$1,285,359	$1,320,668	$1,330,703	$1,367,067	$1,378,994
EXPENSES					
Management Fee	$38,561	$39,620	$39,921	$41,012	$41,370
Operating Expenses	$226,580	$233,377	$240,379	$247,590	$255,018
Real Estate Tax	$121,918	$124,356	$126,843	$129,380	$133,262
Insurance	$7,944	$8,182	$8,428	$8,681	$8,941
Total Expenses	$395,003	$405,536	$415,571	$426,663	$438,590
Expenses PSF	$6.97	$7.15	$7.33	$7.52	$7.74
NOI	$890,356	$915,132	$915,132	$940,404	$940,404
PV FACTORS	0.6302	0.5835	0.5403	0.5002	0.4632
PV OF NOI	$561,102	$533,980	$494,446	$470,390	$435,595

Notes:

(1) Management Fees based on Income and Operating Expense Reimbursement

(2) Source: Evergreen for Lot 37 Operating expenses (excluding management fees)

Table A8: CALGreen Tier 1 Building NOI (PV) from Building Operations

YEAR	Actual 2010	1 1/12-12/12	2 1/13-12/13	3 1/14-12/14	4 1/15-12/15	5 1/16-12/16
INCOME						
Contract Rent PSF	$21.00	$21.00	$21.00	$21.42	$21.42	$21.85
CPI and Other Increases	$0	$0	$0	$0	$0	$0
Expense Reimb.	$0	$0	$8,212	$17,384	$26,049	$35,702
Other Revenue	$0	$0	$0	$0	$0	$0
Potential Gross Rent	$1,190,700	$1,190,700	$1,198,912	$1,231,898	$1,240,563	$1,274,506
Less: Vacancy	$0	$0	$0	$0	$0	$0
Effective Gross Income	$1,190,700	$1,190,700	$1,198,912	$1,231,898	$1,240,563	$1,274,506
EXPENSES						
Management Fee	$35,721	$35,721	$35,967	$36,957	$37,217	$38,235
Operating Expenses	$179,655	$185,045	$190,596	$196,314	$202,204	$208,270
Real Estate Tax	$108,260	$110,425	$112,633	$114,886	$117,184	$119,527
Insurance	$6,653	$6,853	$7,058	$7,270	$7,488	$7,713
Total Expenses	$330,289	$338,043	$346,255	$355,427	$364,092	$373,745
Expenses PSF	$5.83	$5.96	$6.11	$6.27	$6.42	$6.59
NOI	$860,411	$852,657	$852,657	$876,471	$876,471	$900,761
PV FACTORS		0.9259	0.8573	0.7938	0.7350	0.6806
PV OF NOI		$789,475	$730,983	$695,742	$644,206	$613,058

(Continued) Table A8: CALGreen Tier 1 Building NOI (PV) from Building Operations

YEAR	6 1/18-12/17	7 1/18-12/18	8 1/19-12/19	9 1/20-12/20	10 1/21-12/21
INCOME					
Contract Rent PSF	$21.85	$22.29	$22.29	$22.73	$22.73
CPI and Other Increases	$0	$0	$0	$0	$0
Expense Reimb.	$44,846	$55,006	$64,657	$75,353	$86,873
Other Revenue	$0	$0	$0	$0	$0
Potential Gross Rent	$1,283,650	$1,318,587	$1,328,237	$1,364,205	$1,375,725
Less: Vacancy	$0	$0	$0	$0	$0
Effective Gross Income	$1,283,650	$1,318,587	$1,328,237	$1,364,205	$1,375,725
EXPENSES					
Management Fee	$38,510	$39,558	$39,847	$40,926	$41,272
Operating Expenses	$214,518	$220,953	$227,582	$234,409	$241,442
Real Estate Tax	$121,918	$124,356	$126,843	$129,380	$133,262
Insurance	$7,944	$8,182	$8,428	$8,681	$8,941
Total Expenses	$382,889	$393,050	$402,700	$413,396	$424,916
Expenses PSF	$6.75	$6.93	$7.10	$7.29	$7.49
NOI	$900,761	$925,537	$925,537	$950,809	$950,809
PV FACTORS	0.6302	0.5835	0.5403	0.5002	0.4632
PV OF NOI	$567,660	$540,051	$500,068	$475,594	$440,415

Notes:

(1) Management Fees based on Income and Operating Expense Reimbursement

(2) Source: Evergreen for Lot 37 Operating expenses (excluding management fees)

Table A9: CALGreen Tier 2 Building NOI (PV) from Building Operations

YEAR	Actual 2010	1 1/12-12/12	2 1/13-12/13	3 1/14-12/14	4 1/15-12/15	5 1/16-12/16
INCOME						
Contract Rent PSF	$21.00	$21.00	$21.00	$21.42	$21.42	$21.85
CPI and Other Increases	$0	$0	$0	$0	$0	$0
Expense Reimb.	$0	$0	$7,814	$16,576	$24,819	$34,037
Other Revenue	$0	$0	$0	$0	$0	$0
Potential Gross Rent	$1,190,700	$1,190,700	$1,198,514	$1,231,090	$1,239,333	$1,272,842
Less: Vacancy	$0	$0	$0	$0	$0	$0
Effective Gross Income	$1,190,700	$1,190,700	$1,198,514	$1,231,090	$1,239,333	$1,272,842
EXPENSES						
Management Fee	$35,721	$35,721	$35,955	$36,933	$37,180	$38,185
Operating Expenses	$167,169	$172,184	$177,349	$182,670	$188,150	$193,794
Real Estate Tax	$108,260	$110,425	$112,633	$114,886	$117,184	$119,527
Insurance	$6,653	$6,853	$7,058	$7,270	$7,488	$7,713
Total Expenses	$317,802	$325,182	$332,996	$341,758	$350,002	$359,220
Expenses PSF	$5.60	$5.74	$5.87	$6.03	$6.17	$6.34
NOI	$872,898	$865,518	$865,518	$889,332	$889,332	$913,622
PV FACTORS		0.9259	0.8573	0.7938	0.7350	0.6806
PV OF NOI		$801,383	$742,008	$705,952	$653,659	$621,811

(Continued) Table A9: CALGreen Tier 2 Building NOI (PV) from Building Operations

YEAR	6 1/18-12/17	7 1/18-12/18	8 1/19-12/19	9 1/20-12/20	10 1/21-12/21
INCOME					
Contract Rent PSF	$21.85	$22.29	$22.29	$22.73	$22.73
CPI and Other Increases	$0	$0	$0	$0	$0
Expense Reimb.	$42,734	$52,433	$61,609	$71,816	$82,832
Other Revenue	$0	$0	$0	$0	$0
Potential Gross Rent	$1,281,538	$1,316,014	$1,325,189	$1,360,668	$1,371,684
Less: Vacancy	$0	$0	$0	$0	$0
Effective Gross Income	$1,281,538	$1,316,014	$1,325,189	$1,360,668	$1,371,684
EXPENSES					
Management Fee	$38,446	$39,480	$39,756	$40,820	$41,151
Operating Expenses	$199,608	$205,596	$211,764	$218,117	$224,661
Real Estate Tax	$121,918	$124,356	$126,843	$129,380	$133,262
Insurance	$7,944	$8,182	$8,428	$8,681	$8,941
Total Expenses	$367,916	$377,616	$386,791	$396,998	$408,014
Expenses PSF	$6.49	$6.66	$6.82	$7.00	$7.20
NOI	$913,622	$938,398	$938,398	$963,670	$963,670
PV FACTORS	0.6302	0.5835	0.5403	0.5002	0.4632
PV OF NOI	$575,765	$547,555	$507,017	$482,028	$446,372

Notes:

(1) Management Fees based on Income and Operating Expense Reimbursement

(2) Source: Evergreen for Lot 37 Operating expenses (excluding management fees)

Table A10: Increases in Property Value and NOI without Lease Rent Increase

Yr	Baseline		Mandatory		Tier 1		Tier 2	
	NOI (PV)	Value (PV)	NOI (PV)	Value (PV)	NOI (PV)	Value (PV)	NOI (PV)	Value (PV)
1	$778,683	$9,733,539	$779,841	$9,748,011	$789,475	$9,868,435	$801,383	$10,017,287
2	$720,990	$9,012,380	$722,062	$9,025,780	$730,983	$9,137,282	$742,008	$9,275,105
3	$686,490	$8,581,130	$687,483	$8,593,537	$695,742	$8,696,780	$705,952	$8,824,395
4	$635,639	$7,945,491	$636,558	$7,956,979	$644,206	$8,052,574	$653,659	$8,170,736
5	$605,125	$7,564,066	$605,976	$7,574,704	$613,058	$7,663,224	$621,811	$7,772,640
6	$560,314	$7,003,929	$561,102	$7,013,779	$567,660	$7,095,744	$575,765	$7,197,058
7	$533,250	$6,665,625	$533,980	$6,674,745	$540,051	$6,750,636	$547,555	$6,844,442
8	$493,770	$6,172,128	$494,446	$6,180,573	$500,068	$6,250,846	$507,017	$6,337,707
9	$469,764	$5,872,056	$470,390	$5,879,874	$475,594	$5,944,931	$482,028	$6,025,345
10	$435,016	$5,437,698	$435,595	$5,444,937	$440,415	$5,505,182	$446,372	$5,579,648
	$5,919,043		$5,927,433		$5,997,251		$6,083,549	
NOI difference from baseline			$8,390		$78,207		$164,505	
Value difference from baseline				$7,240		$67,484		$141,950

Table A11: Tenant's Annual Utility Expenses in the Baseline Building

Year	Annual Utility Expenses	
	Baseline Bldg. Utility Expenses	Tenant's Responsibility
1	$76,728	$0
2	$79,030	$2,302
3	$81,401	$4,673
4	$83,843	$7,115
5	$86,358	$9,630
6	$88,949	$12,221
7	$91,617	$14,889
8	$94,366	$17,638
9	$97,197	$20,469
10	$100,112	$23,385

Table A12: Tenant’s Annual Utility Expenses in the Mandatory CALGreen Building

Year	Annual Utility Expenses	
	Mandatory CALGreen Bldg. Utility Expenses	Tenant's Responsibility
1	$75,514	$0
2	$77,779	$2,265
3	$80,113	$4,599
4	$82,516	$7,002
5	$84,992	$9,478
6	$87,541	$12,027
7	$90,168	$14,654
8	$92,873	$17,359
9	$95,659	$20,145
10	$98,528	$23,015

Table A13: Tenant’s Annual Expenses in the CALGreen Tier 1 Building

Year	Annual Utility Expenses	
	CALGreen Tier 1 Bldg. Utility Expenses	Tenant's Responsibility
1	$64,308	$0
2	$66,237	$1,929
3	$68,225	$3,916
4	$70,271	$5,963
5	$72,379	$8,071
6	$74,551	$10,243
7	$76,787	$12,479
8	$79,091	$14,783
9	$81,464	$17,156
10	$83,908	$19,599

Table A14: Tenant’s Annual Utility Expenses in the CALGreen Tier 2 Building

Year	Annual Utility Expenses	
	CALGreen Tier 2 Bldg. Utility Expenses	Tenant's Responsibility
1	$53,406	$0
2	$55,008	$1,602
3	$56,658	$3,252
4	$58,358	$4,952
5	$60,109	$6,703
6	$61,912	$8,506
7	$63,770	$10,364
8	$65,683	$12,277
9	$67,653	$14,247
10	$69,683	$16,277

Table A15: Cost/Benefit Analysis for Mandatory CALGreen Building

Baseline				Mandatory CALGreen			Total Utility Savings
Year	Water	Electricity	Total	Water	Electricity	Total	
1	$6,070	$70,658	$76,728	$4,856	$70,658	$75,514	$1,214
2	$6,252	$72,778	$79,030	$5,002	$72,778	$77,779	$1,250
3	$6,439	$74,961	$81,401	$5,152	$74,961	$80,113	$1,288
4	$6,633	$77,210	$83,843	$5,306	$77,210	$82,516	$1,327
5	$6,832	$79,526	$86,358	$5,465	$79,526	$84,992	$1,366
6	$7,037	$81,912	$88,949	$5,629	$81,912	$87,541	$1,407
7	$7,248	$84,369	$91,617	$5,798	$84,369	$90,168	$1,450
8	$7,465	$86,900	$94,366	$5,972	$86,900	$92,873	$1,493
9	$7,689	$89,507	$97,197	$6,151	$89,507	$95,659	$1,538
10	$7,920	$92,193	$100,112	$6,336	$92,193	$98,528	$1,584

(Continued) Table A15: Cost/Benefit Analysis for Mandatory CALGreen Building

Year	Discounted LL Utility Savings	Increased Property Value	Tenant Utility Savings	Costs/Benefits ($61,910)	Payback
1	$1,214	$0	N/A	$1,214	-$60,696
2	$1,214	$0	$36	$1,250	-$59,446
3	$1,214	$0	$74	$1,288	-$58,158
4	$1,214	$0	$113	$1,327	-$56,831
5	$1,214	$0	$152	$1,366	-$55,465
6	$1,214	$0	$193	$1,407	-$54,058
7	$1,214	$0	$236	$1,450	-$52,608
8	$1,214	$0	$279	$1,493	-$51,115
9	$1,214	$0	$324	$1,538	-$49,577
10	$1,214	$7,240	$370	$8,824	-$40,754
Rate				0.00%	
NPV				($40,754)	
IRR				-12.88%	
Payback					None
Loss					($40,754)

Table A16: Cost/Benefit Analysis for CALGreen Tier 1 Building

Baseline				CALGreen Tier 1			Total Utility Savings
Year	Water	Electricity	Total	Water	Electricity	Total	
1	$6,070	$70,658	$76,728	$4,249	$60,059	$64,308	$12,420
2	$6,252	$72,778	$79,030	$4,376	$61,861	$66,237	$12,792
3	$6,439	$74,961	$81,401	$4,508	$63,717	$68,225	$13,176
4	$6,633	$77,210	$83,843	$4,643	$65,628	$70,271	$13,571
5	$6,832	$79,526	$86,358	$4,782	$67,597	$72,379	$13,978
6	$7,037	$81,912	$88,949	$4,926	$69,625	$74,551	$14,398
7	$7,248	$84,369	$91,617	$5,073	$71,714	$76,787	$14,830
8	$7,465	$86,900	$94,366	$5,226	$73,865	$79,091	$15,275
9	$7,689	$89,507	$97,197	$5,382	$76,081	$81,464	$15,733
10	$7,920	$92,193	$100,112	$5,544	$78,364	$83,908	$16,205

(Continued) Table A16: Cost/Benefit Analysis for CALGreen Tier 1 Building

Year	Discounted LL Utility Savings	Increased Property Value	Tenant Utility Savings	Costs/Benefits ($304,357)	Payback
1	$11,316	$0	N/A	$11,316	($293,041)
2	$10,478	$0	$373	$10,850	($282,191)
3	$9,702	$0	$756	$10,458	($271,733)
4	$8,983	$0	$1,152	$10,135	($261,598)
5	$8,317	$0	$1,559	$9,876	($251,722)
6	$7,701	$0	$1,978	$9,680	($242,043)
7	$7,131	$0	$2,410	$9,541	($232,502)
8	$6,603	$0	$2,855	$9,458	($223,044)
9	$6,114	$0	$3,313	$9,427	($213,617)
10	$5,661	$67,484	$3,785	$76,930	($136,687)
Rate				8.00%	
NPV				($189,795)	
IRR				-7.56%	
Payback					None
Loss					($136,687)

Table A17: Cost/Benefit Analysis for CALGreen Tier 2 Building

Baseline				CALGreen Tier 2			Total Utility Savings
Year	Water	Electricity	Total	Water	Electricity	Total	
1	$6,070	$70,658	$76,728	$3,945	$49,461	$53,406	$23,322
2	$6,252	$72,778	$79,030	$4,064	$50,944	$55,008	$24,022
3	$6,439	$74,961	$81,401	$4,186	$52,473	$56,658	$24,742
4	$6,633	$77,210	$83,843	$4,311	$54,047	$58,358	$25,484
5	$6,832	$79,526	$86,358	$4,441	$55,668	$60,109	$26,249
6	$7,037	$81,912	$88,949	$4,574	$57,338	$61,912	$27,036
7	$7,248	$84,369	$91,617	$4,711	$59,059	$63,770	$27,848
8	$7,465	$86,900	$94,366	$4,852	$60,830	$65,683	$28,683
9	$7,689	$89,507	$97,197	$4,998	$62,655	$67,653	$29,543
10	$7,920	$92,193	$100,112	$5,148	$64,535	$69,683	$30,430

(Continued) Table A17: Cost/Benefit Analysis for CALGreen Tier 2 Building

Year	Discounted LL Utility Savings	Increased Property Value	Tenant Utility Savings	Costs/Benefits ($1,336,934)	Payback
1	$23,802	$0	N/A	$23,802	($1,313,132)
2	$22,039	$0	$700	$22,739	($1,290,393)
3	$20,407	$0	$1,420	$21,827	($1,268,566)
4	$18,895	$0	$2,163	$21,058	($1,247,508)
5	$17,495	$0	$2,927	$20,423	($1,227,086)
6	$16,200	$0	$3,715	$19,914	($1,207,172)
7	$15,000	$0	$4,526	$19,525	($1,187,646)
8	$13,888	$0	$5,361	$19,250	($1,168,397)
9	$12,860	$0	$6,222	$19,081	($1,149,316)
10	$11,907	$141,950	$7,108	$160,965	($988,350)
Rate				8.00%	
NPV				($1,046,528)	
IRR				-15.54%	
Payback					None
Loss					($988,350)

Table A18: Mandatory CALGreen Requirements from Baseline Building

Section	Description of Green Building Measure	Baseline Building	Change to Baseline Building for Mandatory CALGreen Building	Extra Initial Costs	Associated Benefits
5.106.1	prepare a storm water-soil loss prevention plan for projects under one acre	Satisfies Measure: SWPPP is required because the site is greater than one acre	None	N/A	N/A
5.106.4	providing short- and long-term bicycle parking spaces based on the anticipated number of tenants, employees, and visitors	Doesn't Satisfy Measure: The plans have 10 Type I bicycle lockers and 3 Type II bicycle racks (for 6 bikes) included	Install an additional 3 Type II bicycle racks for short-term bicycle parking.	Yes	None
5.106.5.2	providing and marking a specific number of designated parking spaces for fuel-efficient and carpool vehicles based on number of total parking spaces	Doesn't Satisfy Measure: There are only compact parking stalls designated in the plans	Stencil 19 parking stalls CLEAN AIR VEHICLE (based on the measure requiring 8% of the 230 parking stalls)	None	None
5.106.8	installing exterior lights that contain shields and automatic controllers	Satisfies Measure: There are shield for all exterior lights in the building plans and an automatic irrigation controller	None	N/A	N/A
5.106.10	designing the site's drainage system to move surface water away from the building	Satisfies Measure: The site's design includes sloping all concrete flat work to drain away from all doors and windows.	None	N/A	N/A
5.201.1	energy efficiency language that states that the California Energy Commission will continue to adopt mandatory building standards.	Not Applicable: There are no energy efficiency standards are required in this measure.	None	N/A	N/A

5.303.1	installing separate sub-meters for each individual tenant space within a building (greater than 50,000 square feet) that is projected to consume more than 100 gal/day	Not Applicable: The building is a speculative building with no tenants committed with a lease.	None	N/A	N/A
5.303.2	reducing the overall use of potable water within the building by 20 percent with more efficient plumbing fixtures	Doesn't Satisfy Measure: 8 sinks (@.5 gpm), 2 showerheads @ (2.5 gpm), 2 drinking fountains (na) and 1 service sink faucet (na)	Install 8 sinks (.4 gpm) and 2 showerheads (2 gpm)	Yes	Yes
5.303.4	reducing wastewater by 20 percent with more efficient toilets and/or using non-potable water systems	Doesn't Satisfy Measure: 11 water closets (@ 1.6 gallons/flush) and 3 urinals (@ 1.0 gallons/flush)	Install 11 water closets (@ 1.29 gallons/flush) and 3 urinals (@ .5 gallons/flush)	Yes	Yes
5.304.1	preparing a water budget that is consist with local water efficient landscape ordinances	Satisfies Measure: A water budget is in the architectural plans; however, it would need to be updated for the 2010 building codes.	None	None	None
5.304.2	installing a separate meter or submeter (for landscaped areas between 1,000 and 5,000 square feet) for indoor and outdoor potable water use	Not Applicable: The landscaping area is greater than 5,000 square feet (per landscaping plans = 14,801 SF).	None	N/A	N/A
5.304.3	installing weather- or soil moisture-based irrigation controllers for bldgs. with between 1,000-2,500 SF of landscaped area	Not Applicable: The landscaping area is greater than 2,500 square feet (per landscaping plans = 14,801 SF).	None	N/A	N/A

5.407.1	providing a weather-resistant exterior wall and foundation envelope	Satisfies Measure: These items are weather-resistant and specs provided in the plans	None	None	None
5.407.2	designing and maintaining sprinklers to not spray on structures and constructing overhangs over exterior entries	Satisfies Measure: Irrigation sprinklers are designed to not spray on the building and the main entrances are designed with vestibules	None	None	None
5.408.2	preparing and adhering to a construction waste management plan for the diverted materials	Doesn't Satisfy Measure: The plans or bid provide no description of such a plan	Prepare a construction waste management plan that satisfies the green building measure	Yes	None
5.408.3	recycling and/or salvaging for reuse a minimum of 50% (calculated by weight or volume) of the non-hazardous construction and demolition debris	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Recycle and/or salvage for use a minimum of 50% of the non-hazardous construction and demolition debris.	Yes	Yes
5.408.4	reusing or recycling 100 % of trees, stumps, rocks and vegetation and soils resulting from land clearing	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure	Reusing or recycling 100% of trees, stumps, rocks and vegetation and soils resulting from land clearing	Yes	None
5.410.1	providing areas that are labeled for recycling non-hazardous materials including (at a minimum) paper, cardboard, glass, plastics and metals	Doesn't Satisfy Measure**:** The plans or bid provide no indication of satisfying this measure.	Provide a commingled recycling bin in the 1st floor lobby.	None	None
5.410.2	building commissioning process for buildings that are 10,000 square feet and over	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Satisfy the building commission requirements	Yes	Yes

5.410.4	testing and adjusting of systems for buildings less than 10,000 SF	Not Applicable: The building is greater than 10,000 SF and is required to doing building commissioning instead.	None	N/A	N/A
5.503	installing only a direct-vent sealed-combustion gas or sealed wood-burning fireplace, or a sealed woodstove or pellet stove	Not Applicable: The plans do not include a fireplace	None	N/A	N/A
5.504.3	covering all ducts and other air distribution openings with tape, plastic, or sheet metal during construction	Doesn't Satisfy Measure: The plans or bid provide no description of such a plan.	When stored or moved into rough frame, HVAC equipment openings and ducts need to be covered until final startup of the system	None	None
5.504.4	applying finish materials that meet specific local or regional air pollution control measures or air quality	Doesn't Satisfy Measure: The building plans provide some finish materials; however, not all the specifics.	Use finish materials that comply with VOC limits in Sections 5.504.4.1 through 5.504.4.3.	Yes	None
5.504.4	installing carpet and wood products that meet specific industry requirement standards	Doesn't Satisfy Measure: The building's core area would be a mixture of tile and carpet; however, the specific specs are not provided in the building plans.	Install carpet, cushion, and use adhesive in the common area that meet the requirements in Section 5.504.4.4.	Yes	None
5.504.5.3	installing HVAC filters that have a Minimum Efficiency Reporting Value (MERV) of at least 8	Doesn't Satisfy Measure: The filters spec'd for AC-1 and AC-2 are 4" thick stamped and labeled 30% efficient	Install HVAV filters that have a MERV of 8.	Yes	None

5.504.7	prohibiting smoking within 25 feet of building entries, outdoor air intake, and operable windows	Doesn't Satisfy Measure: The plans don't specify where smoking is prohibited	post signs that prohibits smoking within 25 FT of building entries, outdoor air intake, and operable windows	None	None
5.505.1	meet or exceed the provisions of California Building Code, CCR, Title 24, Part 2, Section 1203 (Ventilation) and Chapter 14 (Exterior Walls).	Satisfies Measure: The plans met the 2007 California Building Code, which this measure is requiring the building to meet	None	N/A	N/A
5.506.1	meeting the minimum requirement of Section 121 of the California Energy Code, CCR, Title 24, Part 6, or the applicable local code and Chapter 4 of CCR, Title 8	Satisfies Measure: The plans met the 2007 California Building Code, which this measure is requiring the building to meet	None	N/A	N/A
5.506.2	installing carbon dioxide (CO2) sensors and ventilation controls for building equipped with demand control ventilation	Doesn't Satisfy Measure: The plans don't show carbon dioxide sensors, but the AC units do have economizers (which provide ventilation controls).	Install carbon dioxide sensors.	Yes	None
5.507.4	constructing wall and roof-ceilings assemblies making up the building envelope with an STC of at least 50, and exterior windows with a minimum STC of 30 for buildings near freeways, busy airports, and other noisy uses	Unknown	Unknown	None	None

5.507.4.2	constructing wall and floor-ceilings between tenant spaces and tenant spaces and common area with material which a STC of at least 40	Unknown	Unknown	None	None
5.508.1	installing HVAC, refrigeration, and fire suppression equipment that does not contain Chlorofluorocarbons (CFCs) or Halons	Satisfies Measure: The HVAC units use R410A refrigerate and not CFCs or Halons	None	None	None

Table A19: CALGreen Tier 1 Requirements from Baseline Building

Section	Description of Green Building Measure	Baseline Building	Change to Baseline Building for Tier 1 Building	Extra Initial Costs	Associated Benefits
A5.106.5.1	providing and marking a minimum of 10% of parking capacity for a combination of low-emitting, fuel-efficient and carpool vehicles based on total parking spaces	Doesn't Satisfy Measure: There are only compact parking stalls designated in the architectural plans.	Stencil 23 parking stalls CLEAN AIR VEHICLE (based on 230 total parking stalls).	None	None
A5.106.11.2	installing a cool roof that meets specific thermal emittance, solar reflectance or SRI values (see codes' table A5.106.11.2.1)	Doesn't Satisfy Measure: The plans detail a Class "A" rated roof assembly 4-ply built-up roof (see A2.3) with mineral cap sheet over plywood deck.	The specific roofing material requirement for this building (@ 1/4" per foot slope, climate zone 12) is a minimum 3-year aged solar reference = .20, thermal emmittance = .75, and SRI = 16	Yes	Unknown
A5.106.4.3	Complying with one elective green building measure in the division (Planning and Design)				
	1) provide changing/ showering facilities based on the number of anticipated tenant-occupants	Satisfies Measure: The plans provide 1 shower stall per gender 14 lockers per gender	None	None	None
A5.203.1.1	Exceeding California Energy Code requirements, based on the 2008 Energy Efficiency Standards, by 15 percent and meet the requirements of Division A45.6	Doesn't Satisfy Measure: Building plans comply with 2005 California Energy Code (designed in 2008).	HVAC upgrade or more efficient lighting (?) that results in 15% more energy efficiency than 2008 Energy Efficiency Standards.	Yes	Yes
A5.303.2.3.1	reducing the overall use of potable water within the building by 30% with more efficient plumbing fixtures	Doesn't Satisfy Measure: 8 sinks (@.5 gpm), 2 showerheads @ (2.5 gpm), 11 water closets (@1.6 gallons/flush) and 3 urinals (@1.0 gallons/flush)	Install 8 sinks (.35 gpm), 2 showerheads (1.8 gpm), 11 water closets (@ 1.12 gallons/flush), and 3 urinals (@ .5 gallons/flush)	Yes	Yes

A5.304.4.1	reducing the use of potable water to a quantity that does not exceed 60 percent of ETo (Reference Evapotranspiration) times the landscape area	Unknown: This measure requires extra landscape architect analysis, which is beyond the scope of this thesis.	Unknown	Yes	None
A5.304.6	Complying with one elective green building measure in the division (Water Efficiency and Conservation)				
	1) restoring areas disturbed by construction	Doesn't Satisfy Measure: Building construction hasn't taken place yet, so no areas are disturbed.	Restore all landscape areas disturbed during construction by planting with local adaptive and/or noninvasive vegetation.	Yes	Yes
A5.405.4	using materials with postconsumer or pre-consumer recycled content value (RCV) for a minimum of 10% of the total value, based on estimated costs of materials on the project	Doesn't Satisfy Measure: The plans or bid don't specify using recycled material.	Purchase material with 10% recycled content (based on total estimated costs of project materials).	Yes	Yes
A5.408.3.1	recycling 65% of on-site construction and demolition debris	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Recycle and/or salvage for use a minimum of 50% of the non-hazardous construction and demolition debris.	Yes	Yes
A5.405.1	Complying with one elective green building measure in the division (Material Conservation and Resource Efficiency)				
	1) using 10% of regional materials	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Use 10% Regional materials, based on cost, of total materials value.	Yes	Yes

A5.504.4.7	installing specific resilient flooring material (complying specific VOC-emission limits) for 80 percent of floor area receiving resilient flooring	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	For 80% of floor area (requiring resilient flooring material), install resilient flooring material (e.g., tile) that complies with the VOC-emission limits.	Yes	None
A5.504.4.8	complying with thermal insulation meeting 2009 CHPS low-emitting materials list	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure. The plans have wall insulation = R-13 and roof installation = R-19; however, there is no product type detailed.	Install thermal insulation that complies with Chapters 12 – 13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code and with the VOC-emission limits	Yes	None
A5.504.2	Complying with one elective green building measure in the division (Environmental Quality)				
	1) IAQ post-construction: flushing out the building prior to occupancy	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure and this is not general practice.	After interior finishes, flush out building running all air handling units at their maximum outdoor air rate and all supply fans at their maximum position and rate for 14 days.	None	None
A5.504.5.3.1	Complying with one additional elective green building measure selected from any division				
	1) installing HVAC filters with a MERV of 11	Doesn't Satisfy Measure: The filter's spec'd for AC-1 and AC-2 are 4" thick stamped and labeled 30% efficient.	Install HVAV filters that have a MERV of 11.	Yes	None

Table A20: CALGreen Tier2 Requirements from Baseline Building

Section	Description of Green Building Measure	Baseline Building	Change to Baseline Building for Tier 2 Building	Extra Initial Costs	Associated Benefits
A5.106.5.1	providing and marking a minimum of 12% of parking capacity for a combination of low-emitting, fuel-efficient and carpool vehicles based on total parking spaces	Doesn't Satisfy Measure: There are only compact parking stalls designated in the architectural plans.	Stencil 28 parking stalls CLEAN AIR VEHICLE (based on 230 total parking stalls).	None	None
A5.106.11.2	installing a cool roof that meets specific thermal emittance, solar reflectance or SRI values (see codes' table A5.106.11.2.2)	Doesn't Satisfy Measure: Class "A" rated roof assembly 4-ply built-up roof (see A2.3) with mineral cap sheet over plywood deck	The specific roofing material requirement for this building (@ 1/4" per foot slope, climate zone 12) is a minimum 3-year aged solar reference =.23, thermal emmittance = .85, and SRI = 20	Yes	Yes
	Complying with three elective green building measure in the division (Planning and Design)				
A5.106.4.2	1) providing secured long-term bicycle parking for 5% of tenant-occupant motorized vehicle parking.	Satisfies Measure: The plans provide 10 Type I bicycle lockers (plans calculate 121 tenant-occupants)	None	None	None
A5.106.4.3	2) providing changing/ showering facilities based on the number of anticipated tenant-occupants.	Satisfies Measure: The plans provide 1 shower stall per gender 14 lockers per gender	None	None	None
A5.106.6	3) designing parking capacity to meet but not exceed minimum local zoning requirements.	Satisfies Measure: The plans provide exactly the parking requirement (230 stalls)	None	None	None

A5.203.1.2	Exceeding the California Energy Code requirements, based on the 2008 Energy Efficiency Standards, by 30%	Doesn't Satisfy Measure: Building plans comply with 2005 California Energy Code (designed in 2008).	HVAC upgrade or more efficient lighting (?) that results in 30% more energy efficiency than 2008 Energy Efficiency Standards.	Yes	Yes
A5.303.2.3.2	reducing the overall use of potable water within the building by 35% with more efficient plumbing fixtures	Doesn't Satisfy Measure: 8 sinks (@ .5 gpm), 2 showerheads @ (2.5 gpm), 11 water closets (@ 1.6 gallons/flush) and 3 urinals (@ 1.0 gallons/flush)	Install 8 sinks (.325 gpm), 2 showerheads (1.625 gpm), 11 water closets (@ 1.04 gallons/flush), and 3 urinals (@ .5 gallons/flush)	Yes	Yes
A5.304.4.2	reducing the use of potable water to a quantity that does not exceed 60 percent of ETo times the landscape area	Unknown: This measure requires extra landscape architect analysis, which is beyond the scope of this thesis.	Unknown	Yes	None
A5.304.6	Complying with three elective green building measure in the division (Water Efficiency and Conservation)				
	1) restorating areas disturbed by construction	Doesn't Satisfy Measure: Bldg. construction hasn't taken place yet, so no areas are disturbed.	Restore all landscape areas disturbed during construction by planting with local adaptive and/or noninvasive vegetation.	None	None
	2)				
	3)				
A5.405.4.1	using materials with post-consumer or pre-consumer recycled content value (RCV) for a minimum of 15%	Doesn't Satisfy Measure: The plans or bid don't specify using recycled material.	Purchase material with 15% recycled content (based on total estimated costs of project materials).	Yes	Yes

A5.408.3.1	recycling 80% of construction and demolition debris	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Recycle and/or salvage for use a minimum of 50% of the non-hazardous construction and demolition debris.	Yes	Yes
A5.405.1	Complying with three elective green building measure in the division (Material Conservation and Resource Efficiency)				
	1) use 10% of regional materials	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure.	Use 10% Regional materials, based on cost, of total materials value.	Yes	Yes
	2)				
	3)				
A5.504.4.7.1	installing specific resilient flooring material (complying specific VOC-emission limits) for 90% of floor area receiving resilient flooring	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure	For 90% of floor area, install resilient flooring material (e.g., tile) that complies with the VOC-emission limits	Yes	None
A5.504.4.8.1	complying with thermal insulation meeting 2009 CHPS low-emitting materials list and no added formaldehyde	Doesn't Satisfy Measure: The plans or bid provide no indication of satisfying this measure. The architecture plans have wall insulation = R-13 and roof installation = R-19; however, there is no product type detailed.	Install No-Added Formaldehyde thermal insulation in addition to meeting the 2009 CHPS criteria and listed on its Low-Emitting Materials List [BSC] (or Product Registry).	Yes	None

A5.504.2	Complying with three elective green building measure in the division (Environmental Quality)				
	1) IAQ post-construction: flushing out the building prior to occupancy	Doesn't Satisfy Measure: The architectural plans or construction bid provide no indication of satisfying this measure and this is not general practice.	After interior finishes, flush out building running all air handling units at their maximum outdoor air rate and all supply fans at their maximum position and rate for 14 days.	None	None
	2)				
	3)				
	Complying with three additional elective green building measure selected from any division				
	1)				
	2)				
	3)				

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