State of California Economic Analysis of Sustainable Building: Phase I

Greg Kats, Capital E
Amanda Eichel, California State and Consumer Services Agency
Arnie Sowell, California State and Consumer Services Agency

ABSTRACT

The green building movement is gaining momentum as municipalities across the country adopt green building and clean energy ordinances and guidelines. Consistent with these initiatives, the Governor of California issued two Executive Orders to guide California's sustainable building efforts. Despite this growing support, cost remains a prohibitive factor in the mainstreaming of green building. The general consensus is that a "green premium," which drives up the first cost of construction, is associated with the incorporation of sustainable building practices into standard construction. In response to concerns over cost, the State of California is funding a comprehensive economic analysis of green building which reviews the life cycle costs and benefits associated with energy, water & material efficiency, improved indoor air quality and reduced air emissions. While final numbers are pending peer review, preliminary results of the analysis show that although a "green premium" may generally be assigned to green buildings, benefits across various environmental categories exceed initial construction costs and therefore greatly overshadow any additional upfront costs.

Introduction and Background

Buildings have enormous environmental, social and fiscal impacts. "Green" building practices balance short term costs with long-term human needs and environmental considerations. Resulting buildings are more efficient, healthier, and less costly to operate and maintain. Recognizing the tremendous opportunity for state government to provide leadership in the area of exemplary building design and construction, Governor Davis issued two Executive Orders that address the siting and building of state facilities.

Executive Order D-16-00 establishes the Governor's sustainable building goal: "to site, design, deconstruct, construct, renovate, operate, and maintain state buildings that are models of energy, water and materials efficiency; while providing healthy, productive and comfortable indoor environment and long-term benefits to Californians" (State of California, 2000). Executive Order D-46-01 provides guidance on the process the state should use to locate and lease space, including such considerations as proximity to public transit and affordable housing, preserving structures of historic, cultural, and architectural significance, opportunities for economic renewal; and sensitivity to neighborhood and community concerns (State of California, 2001).

Fundamental to the implementation of these Executive Orders is the overarching issue of defining "cost-effective." The Executive Orders require consideration of externalities, economic and environmental performance measures, life cycle costing, and a whole building integrated systems approach to sustainable building funding decisions. While there is consensus on the environmental and social benefits of green building, there has been a consistent concern over the lack of accurate and thorough economic information.

Specifically, there is a need to develop a life cycle costing methodology that reflects those elements that are easily quantifiable, such as savings due to energy, water, and materials efficiency, and those that are less easily quantified, such as the use of recycled content materials and improved indoor environmental quality.

In response to these and other issues addressed by the Executive Orders, the Secretary of the State and Consumer Services Agency convened a Sustainable Building Task Force comprised of over 40 state agencies. Recognizing cost as a prohibitive factor in the mainstreaming of green building, Task Force members, including Division of the State Architect (DSA), Integrated Waste Management Board (IWMB), Air Resources Board (ARB), Department of Water Resources (DWR), Department of General Services (DGS), Department of Finance (DOF), and Department of Transportation (CalTrans) are funding an Economic Analysis Project to determine the true costs and benefits of sustainable building.

The Economic Analysis is taking place in two phases. Phase I includes a broad literature search of green building cost-benefit research, followed by a gap analysis to identify targeted areas for additional research. These areas may include exploration of specific externalities, building systems, or materials, and will be the basis for the Phase II analysis. This study is the first of its kind in California state government, and will dramatically increase our collective understanding of what it really costs to build green. The analysis will ultimately provide the DOF and DGS with a defensible, informed rationale for making sustainable building funding decisions. This paper shares the preliminary results of this analysis; full results will be finalized and available in fall, 2003.

Defining Green Building

To address the economics of green building, it was necessary to develop a common definition of “green.” While there is no universally accepted way to compare the diverse range of green processes and technologies, one standard has been gaining widespread industry acceptance – LEED.

The United States Green Building Council (USGBC), a national non-profit entity, developed the Leadership in Energy and Environmental Design (LEED™) rating system. LEED is a sustainable building rating system for new and existing commercial, institutional and high-rise residential buildings that is rapidly gaining widespread acceptance throughout North America and internationally. LEED allows the project team to choose the most effective and appropriate sustainable building measures for a given location and/or project.

LEED utilizes a list of 64 potential performance based “credits” worth up to 69 points, as well as the 7 prerequisite criteria, divided into six categories: Sustainable Sites; Materials and Resources; Water Efficiency; Indoor Environmental Quality; Energy and Atmosphere; and Innovation & Design Process. Four levels of LEED certification are possible, depending on the number of criteria met, and indicate increasingly sustainable building practices (USGBC, 2003a):

LEED Certified	26-32 points
LEED Silver	33-38 points
LEED Gold	39-51 points
LEED Platinum	52+ points

Within California 110 projects are registered for LEED certification (USGBC, 2003d).

Membership in the USGBC has increased dramatically since its establishment, to over 2800 members as of April 2003 (USGBC, 2003b). Nearly 20% of these member organizations (more than any other state) are located in California (USGBC, 2003c). However, support of the USGBC and the LEED rating system is not limited to council membership. A number of local governments and academic institutions have adopted LEED as a guideline for all future new construction and major renovation projects. Within California, the City of San Jose (City of San Jose, 2001), San Francisco city and county (City and County of San Francisco, 1999), the City of San Diego (City of San Diego, 2002), Los Angeles Community Colleges (LACCD, 2002), Los Angeles City and County (City of Los Angeles, 2001) and the University of California Merced (Notini, 2003) have all made a commitment to LEED. A number of other local governments, including the City of Oakland (City of Oakland, 2001), Alameda County (ACWMA, 2001) and Santa Monica (City of Santa Monica, 1997) have developed their own, LEED-based Green Building Guidelines.

With participation now extending internationally (there are LEED registered projects in India, China, and Canada and one certified project in Sri Lanka), LEED is truly the international industry standard for green building. Therefore the economic analysis used LEED as a means of benchmarking greenness and assigned a cost to each level of LEED.

Methodology

This study followed the general life cycle approach in evaluating a broad spectrum of costs and benefits, accounting for all upstream and downstream costs of a particular activity and integrating them through a consistent application of financial discounting. The value of buildings and systems is therefore calculated on a net present value (NPV) basis. NPV is defined as the value of all current and future benefits and costs in today's dollars. To arrive at this NPV estimate, projected future costs and benefits were discounted at 5% (real), with an additional 2% assumed rate of inflation. Finally, while green buildings are assumed to enjoy a longer life than most market buildings (40-60 years for silver LEED buildings) (Packard Foundation, 2002), most equipment is upgraded every 8-15 years (depending on technology and operations budgets). This analysis therefore assumes an average life of 20 years for those benefits associated with more efficient/sustainable energy, water, and waste systems and technologies. Data for this analysis was compiled from numerous state agencies and experts as well as studies conducted throughout the country.

Preliminary findings presented in this report are divided into two sections. The first portion of the analysis compiled data from existing LEED registered projects and projected costs that could be directly attributed to greening (or to various levels of LEED). These results are presented as an estimated upfront cost (or green premium) and the associated return on investment over the life of the building. The second portion of the analysis looked at the benefits associated with individual building components and/or systems, including energy, water, waste, and emissions, as well as benefits associated with building commissioning, improvements in indoor environmental quality, and reduced heat island effect, and compared these to the estimated green premium.

Cost Analysis of Current LEED Projects

Cost data was collected on 36 LEED registered projects (28 office buildings and 8 school buildings) with actual or projected dates of completion between 1995 and 2004. Information was collected primarily through interviews with architects and senior building personnel. In cases where these buildings have not yet been certified by the USGBC, the LEED level indicated is an assessment by the architect, design team and/or client. Figure 1 shows that, on average, the premium for green buildings is about 2% (A full list of projects, LEED levels, and cost premiums is included in the final report). These numbers should not be utilized to determine the cost differential between subsequent levels of LEED, but represent the cost premium attributable to a particular level of LEED on a specific project.

Figure 1. Level of Green Standard and Average Green Cost Premium

Level of Green Standard	Average Green Cost Premium
Level 1- Certified	0.71%
Level 2- Silver	2.15%
Level 3 – Gold	0.50%
Level 4 – Platinum	6.50%
Weighted Average	**1.63%**

The data also indicate that building green is getting less expensive over time. Figure 2 shows that for 20 LEED Silver buildings, the average price premium has dropped from 3.25% in 1995-1996 to 2.01% in 2003-2004. This trend is expected to continue.

Figure 2. Average Green Cost Premiums for Buildings with Silver Certification

Year of Completion	Average Green Cost Premium
1995-1996	3.25%
1997-1998	2.25%
1999-2000	2.38%
2001-2002	1.63%
2003-2004	2.01%
Weighted Average	**2.15%**

This decrease over time has been experienced in Pennsylvania as well as the cities of Portland and Seattle. Portland's three LEED Silver buildings were completed in 1995, 1997 and 2000. They incurred cost premiums of 2%, 1% and 0% respectively. In Seattle the premium for LEED silver buildings has dropped from 3-4% several years ago to 1-2% today.

Analysis of these 36 buildings therefore indicates that while green buildings do cost more than conventional buildings, the "green premium" is much lower than is generally perceived and is decreasing over time.

The Benefits of Green Building

The remainder of the analysis addresses whether green buildings provide quantifiable financial benefits, and if so, compares the size of these financial benefits with the costs of designing and constructing green buildings. There are four areas where costs and benefits of green building could be reasonably quantified with available data: energy, emissions, water, and waste. In addition, the study includes some preliminary analysis of the more qualitative benefits of improved worker productivity associated with increased levels of indoor environmental quality.

Energy

The average annual cost of energy in state buildings is approximately $1.47/ft^2, of which over 97% is for electricity. Green buildings, on average, use 30% less energy than conventional buildings – resulting in a savings of $0.44/ft^2/yr, with a 20-year NPV of $6.71/ft^2 (for a 100,000 ft^2 state office building, energy savings amount to $44,000 per year, with a 20-year NPV of expected energy savings worth over $650,000). In addition to the value of lower energy consumption, green buildings also provide a reduction of peak electricity demand, particularly through reduced air conditioning load. Evaluation of 15 LEED rated buildings, including four in California, shows an average reduction in energy use of 30%, but an average peak reduction of about 40%. Assuming a peak demand reduction of 10%, a value of peak power at $1200/kW, and average state building energy usage, a 10% reduction in peak demand would amount to 200 kW or a savings of approximately $24,000 per year ($0.024/ft^2/yr, with a 20-year NPV of $0.38/ft^2). The total 20-year NPV energy benefit from green buildings is therefore $7.09.ft^2. Therefore, on the basis of energy savings alone, investing in green buildings appears to be cost effective.

Emissions

The costs of air pollution can be valued in several ways, and include:

- The direct effects of pollution on property, health and the environment
- The cost of avoiding or reducing these pollutants
- The value of pollutants within an established emissions trading/offset market.

Figure 3 shows the emissions factors for all power used (including out-of-state generation) in California. Emissions reductions are time and source dependent and will vary vastly from coal powered plants to renewable energy sources. This report relies on market values for traded emissions as the least imperfect option for determining emissions values. Prices reflect actual marginal cost of emissions reductions in relatively liquid and well-established trading markets. The California Air Resources Board compiles and publishes annual data on emissions offset transactions from 35 districts (see Figure 4).

Figure 3. California Power Emissions Factors from the Tellus Institute

Pollutant	1999	2010	2020
Carbon Dioxide	308	308	308
Sulfur Dioxide	0.32	0.281	0.244
Nitrogen Dioxide	0.404	0.448	0.399
PM-10	0.235	0.2	0.186

Source: Tellus, 2002

Because no market currently exists for CO_2 and there is no mechanism within California to account for CO_2 consistently, it was more difficult to estimate the value of CO_2 emissions reductions. A recent Intergovernmental Panel on Climate Change (IPCC) report cites a range in values between $5 and $125 per ton of CO_2 (IPCC, 2002). This analysis recommends a conservative range of $5 to $10 per ton when valuing CO_2 emissions.

Figure 4. 2001 Prices Paid in Dollars Per Ton for California-Based Offsets

	NOx	PM10	Sox
Average (mean)	$ 27,074	$ 46,148	$12,809
Median	$ 22,000	$ 25,000	$ 7,500
High	$104,000	$126,000	$82,192
Low	$ 774	$ 400	$ 15

Source: ARB, 2002

Energy conservation, from the previous section, is assumed to be 30% for green buildings. In addition, for 21 green buildings on which the USGBC has collected data, 6% of electricity purchased was "green" power (or energy coming from clean, renewable sources such as wind or sun). Two factors should be considered in determining the net impact that green power purchases have on emissions. First, a small and growing portion – slightly less than ½% of the general population – already buys green power. This suggests that adoption of LEED provides a 5.5% net increase in green power purchases compared with conventional buildings. Secondly, LEED was recently modified to include the purchase of green certificates under the green power purchase credit. With this change, 100% of LEED buildings now have the ability to get LEED credit for buying green power, leading to the assumption that future green buildings will purchase an average of 8.5% of electricity from green sources. However, because a green building uses only 70% of the electricity that a conventional building does, the emissions reduction value of green power purchases will be reduced to approximately 6% and the resulting total emissions reduction (including that associated with energy efficiency) is therefore 36%.

Assuming average energy use of $10kWh/ft^2$ for state buildings, converting to GWh, multiplying by the emissions factors for 2010 (Figure 3), and multiplying again by average prices per ton (Figure 4) yields yearly emissions costs per square foot (Figure 5). Figure 6 shows the 20-year NPV of a 36% reduction in emissions of the four pollutants discussed.

Figure 5. Estimated Annual Cost of Emissions ($/ft^2$)

Pollutant	Emission Factors (short tons/ GWh)	Dollars/ton	Annual Cost Emissions/10 kWh
CO2	308	$5 - $10	$0.015 - $0.031
SOx	0.281	$12,809	$0.036
NOx	0.448	$27,074	$0.121
PM-10	0.2	$46,148	$0.092

Figure 6. 20-Year NPV of 36% Reduction for California Buildings (/ft^2)

Pollutant	Value
NOx	$0.66
PM10	$0.51
SOx	$0.20
CO2	$0.11-$0.22
TOTAL	**$ 1.48 (assume lower CO2 value)**

Water

Green building water conservation strategies commonly fall into four categories:

- Efficiency of potable water use through better design/technology.
- Gray water capture and use.
- Recycled/reclaimed water use.
- On-site storm water capture for use or groundwater recharge.

These four strategies combined can result in indoor water conservation of over 30% and cut outdoor water use by at least 50% (USGBC, 2001). Current studies likewise break the marginal costs of water conservation into several different categories:

- Supply: present value of the marginal price a utility would have to pay to obtain an additional acre foot of water each year
- Wastewater: present value of the average cost savings from the delay of new wastewater facilities construction over a year.
- Wastewater O&M: present value of average avoided cost to treat new supplies.

These cost values must be weighted to account for anticipated population growth for each region of the state. In addition, because reclaimed water projects provide an increasingly larger share of the "new" water supply, to accurately value water conservation, the value of reclaimed water use must be estimated. Figure 7 includes adaptations of existing estimates to establish a per square foot 20-year NPV for water conservation.

There are also costs that do not specifically fall into the category of water use efficiency. This study assumed a cost of urban water conservation programs of $500-$740/af of conserved water. These costs as well as the modified California Urban Water Agencies findings were applied to a hypothetical new state building project to determine potential savings. This provides a 20-year NPV of $0.51/ft^2 from green buildings. These costs are considered conservative and therefore this benefit is likely much higher in practice.

Figure 7. 20-Year NPV of Avoided Costs to Water Agencies in 2003

	Supply (/af)	Wastewater (/af)	Wastewater O&M	Total (/af)
Bay Area	$8,392	$952	$201	$9,546
Central Coast	$4,423	$953	$201	$5,576
Sacramento	$629	$953	$201	$1,783
San Joaquin	$1,944	$953	$201	$3,098
South Coast	$7,920	$953	$201	$9,074
S. Lahontan	$3,683	$953	$201	$4,837
Tulare	$2,046	$953	$201	$3,200
Average	$5,075	$953	$201	
		Weighted Average	**Value:**	**$6,299**

Source: Fisk et al., 2001

Waste

Green building waste reduction strategies occur at the time of construction and may continue throughout the life of the building. Construction waste reduction options include:

- Diversion of construction and demolition debris from landfills
- Source reduction: 1) use of more durable materials that are easier to repair and maintain, 2) design to generate less scrap through dimensional planning, 3) increased recycled content, and 4) use of reclaimed building materials.
- Reuse of existing building structure and shell

Lifetime waste reduction strategies include:

- Development of indoor recycling program
- Use of movable walls and raised floors
- Increased reliance on open office space (fewer closed offices).

These strategies can have a dramatic affect on the reduction of landfill waste disposal. Recent efforts at Block 225 of the Capitol Area East End Complex, the state's first Gold LEED project, resulted in an over 90% diversion rate. Green buildings generally achieve between 50-75% C&D waste diversion. Current regulations in California support these efforts and required a 50% waste diversion rate from state projects by 2004. In addition, the State Agency Buy Recycled Campaign, or SABRC, requires agencies and their contractors to meet recycled content goals for products in each of 11 categories (CIWMB, 2003).

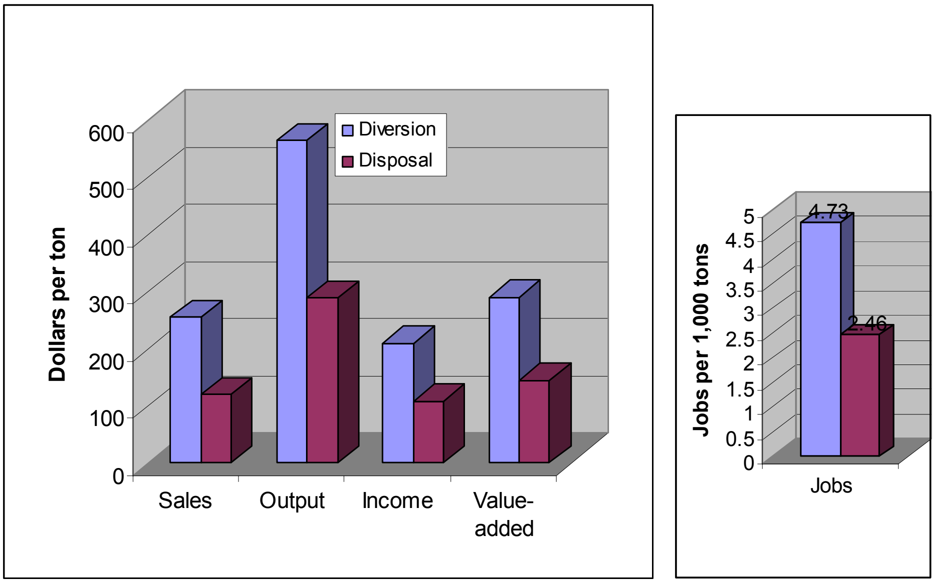
The costs of waste disposal include retail collection and removal fees, estimated to range from $90-$150/ton for disposal, with the average tipping fee at $34/ton (Goldman and Ogishi, 2001). The costs to recycle materials range from $120-$200/ton. However, these are only the costs associated with the collection and removal of waste and do not account for the true costs and benefits of landfill diversion. A recent study conducted by UC Berkeley calculated the "total sales" generated from waste and four multiplier effects:

- *Total Output:* how the disposal/diversion sector influences economic activity including direct, indirect, and induced impacts (but not environmental costs).
- *Total Income:* total income earned by all persons attributed to disposal/diversion

- *Total Value Added:* the increase in the value of goods sold by all sectors of the economy, minus the costs of inputs.
- *Number of Jobs:* the number of jobs created by disposal/diversion activities.

In general, total economic benefits from diversion are nearly twice as large as those associated with disposal: one additional ton of waste disposed in a landfill in California generates $289 of total output in the state economy while one additional ton of waste diverted as recyclables generates an average of $564. To date, no studies in California have attempted to value the economic benefit of diversion. Therefore, numbers generated from a Massachusetts study (Skumatz and Morris, 2000) are used in this analysis, with environmental benefits from recycling assumed to be approximately $63/ton. A rough calculation for Construction & Demolition Waste diversion is $0.15/ft^2, and accounts for all the multiplier effects of diversion.

Figure 8. Value of Diversion vs. Disposal in UCB Study



The Building Productivity Link

In order to assess the potential linkage between buildings and increased worker productivity, this study first had to determine total costs of building construction and operation, including employee costs. In general, employee costs average 80-90% of the total building cost (with construction, operations and maintenance (including energy) ranging between 10-20% of total – see Figure 9). Therefore, any improvements in productivity would have an impact on 80-90% of the costs associated with that building: even a minimal productivity improvement could have enormous impact. The difficulty is determining which building features can impact productivity and to what degree. This analysis reviewed published reports and testimonials to determine an average impact of various building components on worker productivity and estimates a conservative value for green buildings.

Figure 9. Costs in California State Employee-Occupied Office Buildings (DGS, 2002)

Cost Category	Percent Total
Electricity	1%
O&M	4%
Other Energy	0%
Rent	6%
Employee	89%

Building attributes which are generally assumed to promote healthier work environments (and therefore positively impact worker health and productivity), include:

1. Lower source emissions from better building siting and material source controls, including: less toxic materials; and indoor chemical and pollutant source control.
2. Significantly better lighting quality, including: daylighting, use of shading, greater occupancy control over light levels, and less glare.
3. Improved thermal comfort and better ventilation.
4. Commissioning, use of measurement and verification, and CO2 monitoring to ensure better performance of systems, including ventilation, heating and air conditioning.

Potentially the most definitive work developing values of benefits from improvements in indoor air quality has been completed by Bill Fisk of Lawrence Berkeley National Laboratory. Figure 10 includes the results of his analysis.

Assuming a low value of \$25 billion, a \$385 direct health improvement potential exists for each of the 65 million full time office workers and teachers in the US. If one third of these benefits can be achieved in a green building, this translates to about \$130 per year in health-related financial benefits. With 225ft^2 in average space per worker, the potential annual productivity gain is \$0.58/ft^2. The addition of other productivity benefits from improved indoor environmental quality are conservatively estimated to impact worker productivity by 1%. For state of California employees with average salary and benefits costs of \$65,141 per year, a 1% increase in productivity (5 minutes per working day) is equal to \$665 per employee per year (\$2.96/ft^2/year). Assuming no change in salaries, the 20-year NPV of productivity benefits is about \$44.94/ft^2.

Figure 10. Potential Productivity Gains from Improvements in Indoor Environments

Source of Productivity Gain	**Potential Annual Health Benefits**	**Potential US Annual Savings (2002 dollars)**
1) Reduced respiratory illness	16-37 million avoided cases of common cold or influenza	\$7-\$16 billion
2) Reduced allergies and asthma	8-25% decrease in symptoms for 53 million allergy sufferers and 16 million asthmatics	\$1-\$5 billion
3) Reduced sick building syndrome symptoms	20-50% reduction in SBS symptoms experienced at work by ~ 15 million workers	\$10 - \$35 billion
4) SUBTOTAL		**\$18-\$56 billion**
5) Improved worker performance from changes in thermal environment and lighting	N/A	\$25-\$180 billion
6) TOTAL		**\$43-\$235 billion**

Conclusions

The benefits estimated in this report are a measure of financial benefits to the state of California as a whole, rather than to specific building tenants or owners. The summary of benefits from a range of green building attributes assumed to be consistent with LEED certified and silver rating levels, is contained in Figure 12. Total financial benefits of green design are estimated to be over $70/ft^2 for certified and silver level green buildings. This is over ten times larger than the 2% cost premium ($5-6/ft^2 in California) for the 36 green buildings analyzed. These values are assumed to be very conservative.

Figure 11. Summary of Findings (per ft^2)

Category	**20-Year NPV**
Energy Value	$7.09
Emissions Value	$1.48
Water Value	$0.58
Waste Value	$0.15
Commissioning O&M Value	$10.27
Productivity and Health Value (at 1%)	$44.94
TOTAL	**$70.59**

This report is a synthesis of the Phase I Analysis conducted by Capital E for the California Governor's Sustainable Building Task Force. The Capital E report identifies gaps in current knowledge about green building costs and benefits and recommends areas of future research and analysis. The complete report is available upon request.

References

ACWMA. 2001. Green Buildings Guidelines. Available at: www.stopwaste.org/nhguide.html

CARB. 2001. Emission Reduction Offset Transaction Cost Summary Report for 2001. Table 1. Available at: www.arb.ca.gov/erco.erc01web.pdf

CIWMB. 2003. State Agency Buy Recycled Campaign. Available at: www.ciwmb.ca.gov/BuyRecycled/StateAgency/Buying.htm

City and County of San Francisco. 1999. Resource Efficient City Buildings Ordinance. Available at: www.sfgov.org/sfenvironment/aboutus/policy/legislation/efficient.htm

City of Los Angeles. 2001. Sustainable Building Initiative. Available at: www.lacity.org/SAN/lasp/sbi-draft-nov2001-300.pdf

City of Oakland. 2001. Oakland Sustainable Design Guide. Available at: www.oaklandpw.com/greenbuilding/

City of San Diego. 2002. Policy No. 900-14: Available at: clerkdoc.sannet.gov/RightSite/getcontent/local.pdf?DMW_OBJECTID=09001451800850ad

City of San Jose. 2001. Green Building Policy. Available at: http://www.ci.san-jose.ca.us/esd/gb-policy.htm

City of Santa Monica. 1997. Green Building Guidelines. Available at: greenbuildings.santa-monica.org/introduction/introduction.html

David and Lucille Packard Foundation. 2002. Building For Sustainability Report: Available at: www.packard.org/pdf/2002Report.pdf

Department of Finance. 1999. Capital Outlay and Infrastructure Report. State of California. Available at: www.dof.ca.gov/HTML/capoutly/capout.pdf

DGS. 2002. Costs in California State Employee-Occupied Office Buildings.

Dorgan, C., et al., 2002. The Value of the Commissioning Process: Costs and Benefits. Presented at the 2002 US Green Building Council Conference, Austin, TX.

Fisk, et al. 2001. Urban Water Conservation Potential Final Report.

IPCC Working Group III. 2002. Summary for Policymakers: The Economic and Social Dimensions of Climate Change. Available at: www.ipcc.ch/pub/sarsum3.htm

LACCD. 2002. Proposition A. Available at: www.propositiona.org/PropAInfo/SustainableBuildingPrinciples.asp

Notini, R. 2003. UC Merced: Building and Operating a Sustainable Campus in the 21st Century. Presentation delivered at meeting of the Sierra Club, January, 2003.

Oppenheim Lewis, Inc. 2002. Life-Cycle Cost Analysis of Green Buildings Completing the Picture. Presentation by Kevin Hydes et al.

Skumatz, L. and Morris, J. 1998. Massachusetts Recycle 2000: Baseline Report.

State of California. 2000. Governor's Executive Order D-16-00. August 2000. Available at: www.governor.ca.gov/state/govsite/gov_homepage.jsp

State of California. 2001. Governor's Executive Order D-46-02. October 2001. Available at: www.governor.ca.gov/state/govsite/gov_homepage.jsp

USGBC. 2001. LEED Reference Package, Version 2.0, June 2001, pg. 65.

USGBC. 2003a. LEED. Available at: www.usgbc.org/LEED/LEED_main.asp

USGBC. 2003b. Update – 2/2003. Available at: www.usgbc.org/Docs/News/News230.pdf

USGBC. 2003c. Directory. Available at: www.usgbc.org/Members/members_directory.asp

USGBC. 2003d. Registered Projects. Available at: www.usgbc.org/LEED/Project/project_list_registered.asp