

STATE ENERGY EFFICIENCY WORK GROUP REPORT AND RECOMMENDATIONS



Prepared in collaboration with:

**Board of Regents
Department of Administrative Services
Department of Development
Department of Mental Health
Department of Mental Retardation and Developmental Disabilities
Department of Natural Resources
Department of Rehabilitation and Correction
Department of Youth Services
Environmental Protection Agency
Public Utilities Commission
School Facilities Commission**

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STATE ENERGY EFFICIENCY WORK GROUP REPORT AND RECOMMENDATIONS

Statement of the Problem

General support. State government supports the concept of energy efficiency, and has been modestly successful in reducing energy costs in state buildings. Energy efficiency projects are currently saving state agencies about \$5 million per year, and efficient procurement saves another \$5 million, or about 10% of the state's \$100 million annual utility bill. These figures do not include costs for the state's educational institutions, which add several hundred million dollars to the total. The School Facilities Commission (SFC) has been successful in integrating energy efficiency into new schools through its design manual. The Board of Regents (BOR) is a partner in the Rebuild America Program, which includes energy efficiency in its goals.

Long term commitment. State government has not reduced its energy usage more significantly because of difficulty in sustaining the required long-term investment of personnel and money. Over the last ten years, capital funding for energy efficiency in state buildings has decreased from a high of \$2.5 million per biennium to zero in the current biennium. General revenue funding for energy efficiency has also been eliminated in the current operating budget. DAS currently has one employee assigned part-time to energy-related activities, down from five employees in the late 1990s. This commitment of resources is insufficient to make a significant impact on energy use in state buildings.

Higher costs. Energy costs, particularly natural gas costs, continue to outpace inflation. Escalating costs create a greater urgency to make state buildings more efficient.

Education. Energy efficiency expertise among building operators varies. There is no uniform standard of training for facility managers of state buildings. Certification programs are available but not required. As a result, some buildings are not operated in the most efficient manner.

Technology. This is not a barrier. Buildings can be highly efficient with commercial, off-the-shelf technology and good design practices. Suboptimal design is usually the result of cost tradeoffs during the design and construction process.

Legislative authority. Generally this is not a barrier. Higher education, the SFC, and DAS all have the authority to administer performance contracts and to integrate energy efficiency into their construction projects. DAS has the authority to set minimum energy efficiency standards for supplies and services. While in some cases the current authority in statute exceeds the funding available to carry out these duties, it may be desirable to create some new authority that may be exercised as funding allows.

Alternative energy. Most of the activity in the area of alternative and renewable energy has been on School Facilities Commission projects for demonstration and educational purposes. Because of the high initial cost for most projects of this type, state agencies have not been able to use alternative energy technology beyond the occasional pilot project.

Major Options and Recommended Solutions

The work group was fortunate to have experienced members who have been directly involved with implementing energy efficiency projects in an Ohio government setting.

The options and initiatives considered by the group have all been used successfully by Ohio, other states or the federal government. In weighing the various alternatives, the group considered the practical and financial implications. The goal was to gain maximum results through the careful use of limited state resources.

The table below summarizes the options, costs, savings, and brief comment for each option.

No.	Option	Avg. cost per sq ft (one time)	Savings per sq ft (annual)	Comments
1	Goals & reporting	\$1.00-3.00	\$0.20-0.50	Cost for each building affected. No mandated cost if voluntary.
2	New design standards	\$3.00-5.00 \$0.15-0.50	\$0.50 (included above)	Initial cost for each building affected. No mandated cost if voluntary. Review and enforcement cost of \$0.15-\$0.50/sf if mandatory.
3	Commissioning	\$0.35-1.00	\$0.08-0.12	Cost for each building affected. Based upon SFC experience.
4	Education/certification	\$0.01 \$0.17	>\$0.01 \$0.04	\$0.01 training cost if done statewide; some immediate savings. Project cost of \$0.17/sf and savings of \$0.04/sf for each building implemented.
5	Capital funding	\$0.09	\$0.018	Calculated at \$3.6 million in capital funding, distributed over 40 million sf (state agencies only). Can be used to partially implement options #1 or #2.
6	Alternative financing	\$0.00 (paid out of savings)	varies	For performance contracts, cost = savings over life of project, with no initial cost. Can be used to partially implement option #1.
7	Advanced energy purchases	unknown	\$0.00	Minimal additional cost if used only when prices are comparable to standard rates.
8	Demonstration projects	unknown	unknown	Done when grant funding is available.
9	Efficient space planning	unknown	unknown	Recommendation not fully developed.

Following are the pros and cons, discussion, and recommendations for each option considered.

1. Overall savings goals and standardized reporting.

A percentage reduction goal over a baseline period, i.e. 20% reduction in annual energy use per square foot compared to 2003 levels. Standardized reporting across all agencies.

Pros:

- Gets the entire organization working toward a common goal.
- Popular with many states (ex: NY, CA, AZ, NH).
- Required for participation in Energy Star and other programs.

Cons:

- Requires agencies to know baseline measurements or have metering installed in order to create baselines.
- High initial cost; without necessary funding this becomes an unfunded mandate.
- Considerable effort in tracking and monitoring progress toward goals.

Discussion:

This initiative has a broader reach than a new design standard, since an energy renovation can happen at any time, not just when a building is newly constructed or renovated.

Over the last ten years, state agencies have committed to spend approximately \$30 million on energy efficiency projects, which generate \$5 million (or about 5%) in annual savings. For those buildings affected, this translates into an expense of approximately \$3 per square foot to save about \$0.50/sf/yr. In order to save another 15%, state agencies would have to invest another \$90 million or so over the next several biennia. An annual capital investment of nearly \$10 million every year for ten years is unrealistic to expect, given the historical level of financial support for energy efficiency in state agency buildings. If including higher education facilities in this initiative, the \$90 million cost would at least double.

There is a need to standardize energy reporting across agencies, even on a voluntary basis, in order to report meaningful statewide data on energy initiatives.

Recommendation:

- Create uniform energy reporting standards.
- Create voluntary savings goals.
- Report voluntarily through data collection agent: BOR for higher education, SFC for K-12, DAS for state agencies.
- Implement through policy.

2. New construction design standards.

A design standard that exceeds current code, i.e., 20% above current American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.1 (2004).

Pros:

- More cost effective in achieving major energy efficiency gains than renovation or retrofit projects.
- Awareness creates a higher standard in the design community that benefits non-state projects.
- Higher initial costs do not add directly to project budget, but instead require state to spend less elsewhere on the construction project.

Cons:

- Significant effort to create and update; less effort if using existing design standard.
- Significant effort to implement, review projects, and enforce.
- “Hidden” and potentially unfunded mandate.

Discussion:

Ohio could create its own standard, or model one of several existing national programs, including U.S. EPA’s Energy Star or the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED). The American Institute of Architects (AIA) also has its own guidelines on sustainable rating systems.¹ In discussion, the group recommended adopting one of the existing standards, which would require less effort to create and update. The BOR expressed a preference for Energy Star, although it also has experience with LEED at the University of Cincinnati.

The average premium for “green” buildings is about 2%, or about \$3-5 per square foot.² For projects with fixed budgets, a new design standard may not add cost but instead may require tradeoffs in other areas of the construction project.

Monitoring the new standard would be the responsibility of the construction administrator, whether that person was a state employee or a contracted design professional. Additional construction plan review and enforcement could add 0.1%-0.2%, or \$0.15-\$0.50 per square foot, to the state’s administration cost.

On \$1 billion in capital funding, this translates into another \$20 million in construction cost, plus \$1-2 million per year in administration cost. At an average energy savings of 25%, monetary savings is about \$0.50/sf/yr.

Recommendation:

- Permit DAS and BOR, at their discretion, to establish a design standard for projects under their authority (note: SFC already has this authority for their projects).
- Implement through enabling legislation.
- When sufficient funding is available, adopt a new design standard through rules.
- Report through data collection agent: BOR for higher education, SFC for K-12, DAS for state agencies.

3. Commissioning.

A concentrated effort from initial design through construction completion by an independent third party to optimize building performance for maximum efficiency.

Pros:

- Ensures that building performance is optimized regardless of design.
- Awareness creates a higher standard in the design community that benefits non-state projects.
- Returns \$0.08-0.12/sf/yr in energy savings.

Cons:

- Adds approximately \$0.35-\$1.00 per square foot to the project cost.

Discussion:

SFC, BOR and DAS are beginning to include commissioning in their projects. SFC experience has shown that commissioning will pay for itself out of energy savings in three to five years. In existing buildings, commissioning has been used to produce energy savings of up to 15%.³ Additionally, the positive impact stays long after the building is commissioned. A recent study found that 80% of the energy savings persist for at least three years after the commissioning process is completed.⁴

Not all commissioning activities are equivalent in scope. Some owners may opt for detailed commissioning of just the electrical or mechanical systems, while others may involve sampling of systems across the total building. A combination of approaches is possible, with costs depending upon the level of detail required. At a recent project for the state's multi-agency consolidated laboratory complex, for example, detailed commissioning was specified for life/safety and specific lab-related systems, while sampling was specified for the more standard building systems.

Commissioning is generally recommended if the project budget allows. Costs are proportionally lower for larger buildings. For modular buildings, or for repeated applications of a prototype design, commissioning may be unnecessary. However, for most other projects it is a wise investment. The appropriate scope of commissioning depends upon the building's uniqueness and complexity.

It is possible to include commissioning as either a mandate or a voluntary goal. If a mandate, there is always the risk of it being unfunded.

Recommendation:

- Create voluntary commissioning goals.
- Include commissioning in uniform reporting standards.
- Report voluntarily through data collection agent: BOR for higher education, SFC for K-12, DAS for state agencies.
- Implement through policy.

4. Educational/Certification Requirements.

A minimum educational requirement for state building operators that ensures proficiency in energy efficiency.

Pros:

- Has been shown to generate energy and maintenance savings without a large investment.
- Raises the expertise and professionalism of state building operators beyond just energy efficiency.
- Existing programs available through DOD's Office of Energy Efficiency.
- Programs eligible for funding through DAS Workforce Development or the Exempt Professionals Development Program fund.

Cons:

- Requires a commitment of release time and training dollars from the organization.
- Requires ongoing education for periodic updates and new employees.

Discussion:

If funding is available through state sources, this option is an attractive one for state agencies. The DOD Office of Energy Efficiency participates in a multi-state Building Operator Training and Certification (BOC) Program that would be suitable for Ohio. The training costs of the BOC program would be about \$1,000 per student, which equates to about \$0.01/sf if one building operator is trained per 100,000 sf. According to a recent performance evaluation, BOC enrollees spent an additional \$0.17/sf in retrofit and maintenance costs in order to save their employers about \$0.04/sf/yr, for a payback of less than five years.⁵ Some maintenance items had an immediate payback.

Requirement could be created through legislation (legal requirement for all); executive order (cabinet agencies only), or through policy (each entity creates its own requirement). Unless existing state funds are a certainty, the training cost could still be an unfunded mandate.

Recommendation:

- Create voluntary training goals.
- Include training in uniform reporting standards.
- Report voluntarily through data collection agent: BOR for higher education, SFC for K-12, DAS for state agencies.
- Implement through policy.

5. Continuing capital funding.

Reactivate the energy conservation capital fund so that agencies can pay for higher initial cost equipment that is energy efficient.

Pros:

- Proven method of achieving energy efficiency in state buildings. Average payback is less than five years.
- Centralized fund allows projects to compete for capital funding, and only the best investments are funded.

Cons:

- Requires continuing commitment of funding and personnel each biennium.
- Competes against other priorities in the capital bill.

Discussion:

Many state agencies have benefited from the DAS energy conservation fund. Even with its small size, it has been effective in reducing utility costs in state buildings. Every \$1.00/sf invested has returned at least \$0.20/sf/yr in energy savings. The average payback on these projects has been less than five years. Any amount of funding in this area would be a wise investment of capital dollars. On a limited scale, this would be the partial funding mechanism for initiatives #1 (overall savings goals) and #2 (new construction design standards).

Recommendation:

It is recommended that energy conservation funding be included in the next capital budget.

6. Alternative project financing.

Pay for energy projects out of cost savings using Ohio Air Quality Development Authority (OAQDA) bonds, private sector funding, and/or other non-state funding mechanisms.

Pros:

- Performance contracting is a proven method of achieving energy efficiency in state buildings. Projects pay for themselves out of savings within ten years for state agencies and higher education, fifteen years for School Facilities Commission projects.
- No capital funding required.
- No increase in operating funding required.

Cons:

- Performance contracting is most suitable for larger projects (250,000 square feet or more) because of high fixed costs and contract complexity.
- Requires lots of documentation and annual monitoring to verify savings guarantee.
- In some cases, bonding agencies consider performance contracts as debt, thereby reducing appropriation available for other purposes.
- Other financing mechanisms may require seed money.

Discussion:

Performance contracting has been used extensively by the School Facilities Commission and DAS, but sparingly in higher education. If properly administered, these projects provide guaranteed savings without the need for state capital dollars. DRC reports that it has an annual savings of \$2,592,643 on its eight current performance contracts.

Performance contracts do not work well for small projects because of their relatively high fixed costs associated with the complexity of the contracts. Some higher education institutions have experienced additional financial barriers, as performance contract payments have been characterized as debt service. A few institutions have overcome this barrier, such as Kent State and Cuyahoga Community College.

It is possible to create an internal endowment fund or similar fund that could “loan” energy money and repay the fund out of savings. The state of Iowa has been successful in creating a non-profit facilities improvement corporation and an “energy bank” that uses both public and private funds to pay for energy projects.⁶ The workgroup has decided that more discussion on this topic is necessary before reaching a conclusion.

Recommendation:

- Continue to use performance contracts for larger state agency projects.
- Consider expanding the use of performance contracting in higher education, to the extent allowed by fiscal and debt policies.
- Convene a subset of this task force, including BOR, OAQDA, DOD, and DAS to make a final recommendation on other financing alternatives.

7. Advanced energy purchases.

Require a percentage of electricity that the state purchases to be generated from renewable sources such as wind, solar, biomass, geothermal, fuel cells and/or municipal solid waste projects in Ohio.

Pros:

- Popular in other states (i.e., CA, NY, RI, MD, NJ).
- Creates demand for renewable energy in Ohio, which could help establish a more robust renewable energy marketplace.
- Positive public relations for the state.
- Costs continue to fall as technology becomes more widely used.

Cons:

- Additional cost if required now.
- Without necessary funding this becomes an unfunded mandate.

Discussion:

Renewable energy portfolios have been popular in other states. Renewable energy generally commands a premium, so funding would have to be available in order to commit the state to a minimum percentage, if implemented today. The average price premium for green power was \$0.0262/kwh in 2003, and the premium has declined an average of 8% per year since 2000.⁷ It has been reported that the wind turbine project at Bowling Green, for example, currently generates electricity at \$0.014/ kwh above tariff rates.

Renewable energy technology is rapidly improving, and it is possible that renewables could soon be cost competitive with fossil fuel alternatives. Industry progress could allow the state at a later date to make a renewable energy commitment that would not be an unfunded mandate.

Recommendation:

- Enact enabling legislation that allows state to “ earmark” a percentage of its electricity purchases for renewable energy.
- Authority should allow the state to set either voluntary or mandatory goals, based upon competitiveness of renewables in comparison to tariff rates.
- Set no goal initially, but suggest that DOD monitor the state of the industry and report periodically.

8. Demonstration projects.

Use state land, facilities, personnel, waste streams, and federal or state grants to create advanced energy demonstration projects.

Pros:

- Creates demand for renewable energy in Ohio, which could help establish a more robust renewable energy marketplace.
- Positive public relations for the state.

Cons:

- State may have some additional cost because of grant matching requirements.
- Organizing projects of this type requires staff dedicated over a prolonged period.

Discussion:

State institutions have an abundance of land that could be used for solar, wind or geothermal projects. In addition, DRC has a readily available labor pool with Ohio Penal Industries, and some waste streams that potentially could be converted to useful energy. Grant funds may be available through the Ohio Biomass Energy Program or federal grant programs administered through DOD's Office of Energy Efficiency.

Recommendation:

It is recommended that the state identify potential grant opportunities, and compete for these grants when funding is available.

9. Efficient space planning.

Use only the minimum amount of square footage necessary for effective operation. Centralize operations where appropriate.

Pros:

- Easy to understand, common sense approach.
- If done properly during a planned move, should reduce both initial cost and operating cost.
- Can be used for both state-owned and state-leased space.

Cons:

- Requires diligence and fiscal restraint to maximize efficiency.
- Reducing space can be unpopular with those directly affected.

Discussion:

This has been accomplished in various ways. The Department of Mental Health has continued to reduce its space by consolidating some campuses into single central buildings. DMH reports that it has downsized by about three million square feet over the period 1988-2003, reducing about \$150 million in total centralized operating costs. MRDD has reduced space by closing entire developmental centers, and is continuing to downsize. DAS Real Estate Services monitors and attempts to reduce average square footage per state employee in commercial leased space.

Recommendation:

However it is accomplished, efficient space planning makes sense and should be used (details of recommendation to be developed).

Program Implementation

1. Overall savings goals and standardized reporting.

Create voluntary goals with uniform reporting standards, and report voluntarily.

A. Cost

Incremental investment of time for each agency with facility responsibilities. Creating a reporting standard would require a one-time collaborative effort, and ongoing annual effort for each affected agency or institution. Any projects implemented could cost up to \$3/sf to save up to \$0.50/sf/yr.

B. Management responsibility

Collaborative effort to create and update reporting standards (DAS, BOR, SFC, DOD). Each participating agency would be responsible for setting its own goals. Three agencies would be responsible for report data collection: BOR for higher education, SFC for K-12, DAS for state agencies.

C. State legislation needed (if any)

Not needed.

D. Federal funding

Does not apply.

2. New construction design standards.

Enact legislation to authorize DAS and BOR to create design standards. Adopt and implement design standard through rulemaking when funding is available.

A. Cost

None initially. Once the standard is adopted and implemented, it would add about \$3-5/sf (about 2%) to the initial cost of construction. For projects with fixed budgets, would not add cost but instead would require tradeoffs in other areas of the construction project. Projected savings would be in the range of \$0.50/ft/yr.

B. Management responsibility

Collaborative effort to adopt and update standards (DAS, BOR, SFC, DOD). Three agencies would be responsible for report data collection: BOR for higher education, SFC for K-12, DAS for state agencies.

C. State legislation needed (if any)

Legislation to authorize DAS and BOR to create design standards for state agencies and higher education. The details of the standard could be finalized through rulemaking and policy.

D. Federal funding

Does not apply.

3. Commissioning.

Create voluntary commissioning goal with uniform reporting standards.

A. Cost

\$0.35-\$1.00/sf, with estimated savings of \$0.08-0.12/sf/yr.

B. Management responsibility

Collaborative effort to create and update commissioning standards (DAS, BOR, SFC, DOD). These same agencies would be responsible for enforcement of standards on their projects. State agencies and colleges/universities would be required to enforce the same standard for projects that they are authorized to administer locally.

C. State legislation needed (if any)

Not needed.

D. Federal funding

Does not apply.

4. Educational/certification requirements.

A voluntary, minimum educational requirement for state building operators that ensures proficiency in energy efficiency.

A. Cost

Approximately \$1,000 per employee x 500 employees = \$500,000 annually. Training cost is about \$0.01/sf if average enrollee is responsible for 100,000 sf. It is expected that at least part of this cost would be defrayed by existing DAS Workforce Development and Exempt Professional Development Program funds.

B. Management responsibility

DOD & DAS, if using DOD's Building Operator Certification (BOC) training program. Each agency would be responsible for identifying the appropriate employees for training, maintaining their certifications, and reporting annually.

C. State legislation needed (if any)

Not needed.

D. Federal funding

May not apply, but should be considered if state funds do not cover the entire cost.

5. Continuing capital funding.

Reactivate the energy conservation capital fund so that state agencies can pay for higher initial cost equipment that is energy efficient.

A. Cost

DAS will request \$3.6 million per biennium in its upcoming capital request.

B. Management responsibility

DAS. Each agency would be responsible for submitting projects that meet the established energy criteria.

C. State legislation needed (if any)

Funding and appropriation through the capital bill.

D. Federal funding

Not required.

6. Alternative project financing.

Pay for energy projects out of cost savings using Ohio Air Quality Development Authority (OAQDA) bonds, private sector funding, and/or other non-state funding mechanisms.

Continue to use performance contracts for larger state projects, and consider expanding the use of performance contracting in higher education, to the extent allowed by fiscal and debt policies. Investigate other financing mechanisms such as an internal endowment fund.

A. Cost

No additional cost for each project. Program administration costs are paid for out of savings. An endowment fund may require initial capitalization (amount unknown at this time).

B. Management responsibility

DAS, SFC, OAQDA, and each institution of higher education through its Board of Trustees.

C. State legislation needed (if any)

Not needed if using performance contracting. New authority may be needed depending upon alternative financing recommendations.

D. Federal funding

Not required.

7. Advanced energy purchases.

Enact enabling legislation that allows state to “earmark” a percentage of its electricity purchases for renewable energy. Authority should allow state to set either voluntary or mandatory goals, based upon competitiveness of renewables in comparison to tariff rates. Set no goal initially, but suggest that DOD monitor the state of the industry and report periodically.

A. Cost

Should be minimal cost increase if implemented only when renewable energy is competitive in the marketplace.

B. Management responsibility

DOD for monitoring the state of the industry.

C. State legislation needed (if any)

Enact enabling legislation that allows state to “earmark” a percentage of its electricity purchases for renewable energy. Authority should allow state to set either voluntary or mandatory goals, based upon competitiveness of renewables in comparison to tariff rates.

D. Federal funding

Not applicable.

8. Demonstration projects.

Use state land, facilities, personnel, waste streams, and federal or state grants to create advanced energy demonstration projects. Identify potential grant opportunities, and compete for these grants when funding is available.

A. Cost

Unknown, but should be minimal if grant funds are used.

B. Management responsibility

DOD, DAS, BOR, SFC and participating agencies.

C. State legislation needed (if any)

Not required. DOD currently administers federal grants, and DAS has the authority to accept grants from public and private sources for energy-related purposes.

D. Federal funding

Would require federal funding, likely awarded on a competitive basis through grant programs.

9. Efficient space planning.

Use only the minimum amount of square footage necessary for effective operation.
Centralize operations where appropriate.

A. Cost

No additional cost for SFC (already incorporated into design guidelines). For other entities, may require some additional design time per project, although amount would be difficult to quantify. Some additional personnel time would be required to create and maintain space planning guidelines or standards.

B. Management responsibility

Collaborative effort to create and update guidelines or standards (DAS, state agencies, BOR, individual colleges & universities). These same agencies could be responsible for enforcement of space planning standards on their projects. State agencies and colleges/universities would be required to enforce the same standard for projects that they are authorized to administer locally.

C. State legislation needed (if any)

Unknown at this time. Could be used to mandate space planning standards across all state agencies and educational agencies that have property management responsibilities. If accomplished through non-legislative means, could be more flexible but less likely to be enforced.

D. Federal funding

Not required.

Next Steps

1. Legislation

The workgroup recommends new legislative authority in these areas:

- New construction design standard authority for DAS and BOR.
- Energy conservation capital funding in the upcoming capital appropriation bill.
- Renewable energy “set-aside” or earmark authority for state government consumers.

2. Policy Tasks

- Convene alternative project financing subgroup to make recommendations.
- Collaborate on uniform reporting standards.
- Collaborate on other tasks listed in the recommendations.

The following table summarizes the next steps.

No.	Option	Legislation Recomm.?	Primary Responsibility	Comments
1	Goals Reporting standards	No No	Each agency DAS, BOR, SFC	Voluntary but encouraged Standards require multi-agency collaboration
2	New design standards	Yes	DAS, BOR, SFC, DOD	Legislation to create authority; exercised as funding is available
3	Commissioning	No	Each agency	Voluntary but encouraged
4	Education/certification	No	DAS, DOD	Voluntary but encouraged
5	Capital funding	Yes	DAS	Already submitted in DAS capital request
6	Alternative financing	No	DAS, BOR, SFC, OAQDA, DOD	Subgroup to convene for final recommendations
7	Advanced energy purchases	Yes	DOD, DAS	Legislation to create authority; exercised as funding is available
8	Demonstration projects	No	Each agency	As grant funding is available
9	Efficient space planning	Unknown	Unknown	Group has not detailed this recommendation yet

Endnotes

¹ The American Institute of Architects (2005). *Draft High Performance Building Position Statements*.

² Kats, G. H. (2003). *Green Building Costs and Financial Benefits*. Massachusetts Technology Collaborative.

³ Mills, E., et. al. (2004). *The Cost Effectiveness of Commercial Buildings Commissioning*. Lawrence Berkeley National Laboratories Report No. LBNL-56637.

⁴ Bourassa, N.J. (2004). *Evaluation of Retrocommissioning Persistence in Large Commercial Buildings*. Proceedings of 12th National Conference on Building Commissioning, Portland Energy Conservation, Inc.

⁵ RLW Analytics (2005). *Impact and Process Evaluation, Building Operator Training and Certification (BOC) Program, Final Report*. Middletown, CT.

⁶ United States Environmental Protection Agency (2005). *EPA Clean Energy-Environment Guide to Action*. Washington, D.C. Chapter 3.3, "Lead by Example," August 15, 2005 draft.

⁷ Bird, L. and Brown, E. (2005). *Trends in Utility Green Pricing Programs (2004)*. National Renewable Energy Laboratory (Technical Report NREL/TP-620-38800).