CHAPTER FOUR

Screening LBE Activities and Measures

This chapter addresses the second important step in developing a LBE program: screening an initial set of potential LBE activities and measures (as described in Chapter 2) to identify a subset for inclusion in the state's LBE portfolio.

To assist in this process, several "rules of thumb" are presented that can be used to establish a high-level estimate of the benefits and costs of LBE activities and measures. For states seeking a tailored analysis, a series of well-regarded and interactive "preliminary assessment tools" are also provided. This chapter also describes options for those interested in working with a consultant, efficiency program administrator, or energy services company (ESCO) for detailed technical assistance on activity and measure selection. Information is also presented on methods for refining these initial screening results over time as state priorities are clarified and additional resources become available.

This chapter is organized around the following four key steps in screening LBE activities and measures:

- Selecting an initial set of LBE activities and measures for assessment.
- Developing criteria to use in assessing the prospective LBE activities and measures.

DOCUMENT MAP

CHAPTER FOUR CONTENTS

Related appendices:

Appendix B, State and Local Clean Energy LBE Programs: Examples, Tools, and Information Resources. This appendix presents examples of state and local LBE activities, as well as resources for each of the activities described in this chapter.

Appendix H, State LBE Tracking Tools and Resources. This appendix presents both simple and complex tools that states can use to estimate energy consumption reductions from LBE activities and the environmental and economic benefits associated with these reductions.

- Estimating the costs and benefits of each LBE activity and measure using simple assessment tools and rules of thumb.

- Selecting the LBE activities and measures to include the state LBE program, using the selection criteria to assess the relative costs and benefits of each potential activity or measure.

4.1 SELECT LBE ACTIVITIES AND MEASURES FOR SCREENING

The first step in LBE screening is to identify the broad set of prospective activities and measures for consideration. This set of options can include all or some of those identified in Chapter 2, *Lead by Example Activities and Measures.* The decision on which activities and measures to include is based on how likely each is to assist states in meeting their overall LBE goals, as identified when establishing the LBE program framework (see Chapter 3, *Establish the LBE Program Framework*).

4.2 DEVELOP ASSESSMENT CRITERIA

After identifying a broad set of activities and measures for consideration, states can develop criteria for determining which to include in their LBE program. Developing criteria involves balancing priorities and requirements specific to state needs and circumstances. Criteria may include:

- *Energy Savings.* States can compare anticipated energy savings across LBE activities or establish a minimum threshold, such as a specific percentage contribution toward an LBE goal.

  EXAMPLE: *One criterion used by the Connecticut Working Group on energy efficiency opportunities at state facilities is potential energy savings (Department of Public Utility Control, 2005).*

- *Financial Criteria.* Common criteria are payback periods and life-cycle costs. Funding availability for candidate LBE activities can also be an important financial criterion, since states might want to save money and reduce administrative effort by prioritizing activities for which funding is readily available or easily obtained. Some funding mechanisms are available only for specific activities (e.g., loans for energy efficiency investments typically cannot be used to fund green power purchases). (See Section 5.2, *Funding the LBE Program*, for more information on funding mechanisms.)

  EXAMPLE: *The Colorado Greening Government Planning and Implementation Guide directs state agencies to prioritize actions that take into account life cycle costs and to select the ones with the shortest payback periods (Colorado, 2006).*

- *Environmental Benefits.* Criteria can address key environmental concerns, such as requiring LBE activities to contribute a certain percentage to state government GHG emission reduction goals.

  EXAMPLES: *In Pennsylvania, the Governor's Green Government Council was directed to facilitate government practices that would reduce state government's emissions to zero (Pennsylvania, 1998).*

  A Colorado executive order requires the state Greening Government Coordinating Council to implement activities that prevent pollution and conserve natural resources, in addition to saving energy (Colorado, 2005).

- *Economic Development.* States can look for activities that encourage local economic development and job growth in the state.

  EXAMPLE: *For example, an executive order directs the Oregon Sustainability Board to encourage state LBE activities that support in-state bio-energy markets (Oregon, 2006).*

- *Visibility.* Criteria can focus on LBE activities that are highly visible or are likely to have spillover effects into the private sector. This can include giving priority to LBE activities in state facilities (e.g., schools) where the public has the most contact, or to energy-efficiency product procurement activities that can stimulate the local economy and encourage the development of energy efficiency service markets.

- *Feasibility.* Criteria can be based on likelihood of success or ease of implementation. Feasibility criteria can be informed by LBE activities in other states and may include political feasibility, such as timing (e.g., activities that can be implemented within the current election term) and addressing the clean energy needs of key stakeholders.

  EXAMPLES: *In addition to considering energy savings, the Connecticut Working Group on energy efficiency* *opportunities at state facilities identified activities based on their ability to be implemented immediately (Department of Public Utility Control, 2005).*

The governor of Pennsylvania directed the Interagency Task Force on Energy to facilitate activities that foster strong working relationships with stakeholders (Pennsylvania, 2002).

When developing feasibility criteria, it is helpful to identify barriers to the state's ability to implement LBE activities and measures. States can select options for which barriers are minimal or for which there are clear strategies for overcoming them. A variety of barriers are applicable across *all* LBE activities and measures, including lack of management commitment, limited information and knowledge, limited time and staff availability, lack of comprehensive measurement tools and methodologies, financial barriers, policy and political disincentives and issues, and length of time required for decision-making (NAPEE, 2008).

In addition, states encounter barriers that affect *specific types* of LBE activities. Assessing these barriers can provide states with valuable information when determining the most appropriate activities to include in their LBE program. Table 4.2.1 presents a summary of barriers by type of LBE activity and options for overcoming them. Additional information on developing strategies for lowering both activity-specific and general LBE barriers is provided in Chapter 5, *Develop LBE Program.*

4.3 ESTIMATE BENEFITS AND COSTS OF LBE ACTIVITIES

The next step in screening LBE activities and measures is conducting an initial estimate of the potential benefits and costs based on the criteria identified above. The simple screening tools described in this section can help quantify the energy savings, costs, emission reductions, and other effects of prospective LBE options at a level of rigor that is sufficient for initial purposes.

Prior to using these tools, it is important to gather baseline information on the energy consumption and size (e.g., building square footage, number of vehicles) of state facilities, operations, and fleets, and associated expenditures. As noted in Section 3.4.1, *Establish LBE Goals,* this information may have already been collected for the purpose of setting LBE goals. For more information on developing a baseline, see Section 6.3, *Conduct Energy and Emissions Tracking and Benchmarking.*

Section 4.3.1 presents rules of thumb for obtaining an initial impression of the quantitative costs and benefits of prospective LBE activities and measures, and Section 4.3.2 summarizes tools to help make further assessments of the effects of LBE activities.

MICHIGAN - FINANCIAL CRITERIA FOR DEVELOPING AN ENERGY REDUCTION STRATEGY

The Michigan Department of Management and Budget (DMB) is developing an energy reduction strategy to reduce utility expenditures by 10% for DMB-managed and owned buildings by the end of 2008 based on utility expenditures in 2002. Criteria for determining the overall strategy include:

- Ensure "low-hanging fruit" has been picked.
- Focus on improvements that offer 20%-40% rate of return.
- Strive for a payback of five years of less.

LBE activities selected on the basis of these criteria include:

- Energy conservation and use reduction measures.
- Green power renewable energy (purchasing methane landfill gas).
- Improved maintenance and upkeep.
- Procurement and billing management.
- Renegotiation of energy contracts.

Sources: Michigan, 2005 and 2007.

MASSACHUSETTS STATE SUSTAINABILITY PROGRAM: SELECTION CRITERIA

The Massachusetts *Agency Sustainability Planning and Implementation Guide* outlines a wide range of LBE activities and measures related to:

- GHG emission reduction strategies.
- Sustainable design and construction (new and existing facilities).
- Environmentally preferable purchasing.

It directs state agencies to prioritize and select LBE measures based on:

- Overall cost.
- Potential environmental impact.
- Payback period.
- Ease of implementation.

Source: Massachusetts, 2004.

TABLE 4.2.1. BARRIERS TO INDIVIDUAL LBE ACTIVITIES

LBE Activity	Barrier	Possible Response
Energy Efficiency Measures in Existing Buildings	▪ Leasing, rather than owning, state facilities can be a barrier to retrofit programs because the building owner, rather than the state, is responsible for the building infrastructure. Thus, states have limited influence on whether energy efficiency measures are implemented.	▪ Make the case to the building owner and manager that energy cost savings result from energy efficiency measures. ▪ Incorporate ENERGY STAR criteria into lease agreements when they are renegotiated for renewal ▪ Establish executive orders or legislation to direct state agencies to give preference to ENERGY STAR and LEED-certified spaces when pursuing building spaces for lease.
Energy Efficiency Measures in New Buildings / Green Buildings	▪ High capital costs present a financial hurdle. ▪ Actual energy and cost savings are sometimes less than anticipated. ▪ Architects and designers may be unwilling to commit the additional effort needed to make the integrated design process fully effective.	▪ In some cases it may make sense to incorporate green principles in a retrofitted building rather than design a new structure, since it is easier to access the O&M budget and to make the case using life-cycle cost analysis. ▪ When making the case for green buildings, use realistic estimates of benefits. ▪ States can choose to offer designers and architects energy performance bonuses to be distributed only if the building meets an agreed-upon efficiency target. ▪ Consider innovative funding mechanisms, such as performance contracting.
Energy-Efficient Product Procurement	▪ Some states require government purchasing agents to make purchase decisions based on products with the lowest upfront costs. However, energy savings from energy-efficient products are not realized until the products are employed. ▪ Purchasing authority is sometimes dispersed across agencies.	▪ When mandatory low-bid requirements are in place, legislative authority may be required to modify procurement regulations to require life-cycle costing. ▪ Investigate the possibility of aggregating purchasing contracts among state agencies.
Green Power Purchasing	▪ The market can fail to value the benefits of renewable energy. ▪ Green power is more expensive than conventional generation. ▪ Externalities are not included in the price of conventional electricity.	▪ Set targets to ensure green power usage. ▪ Provide recognition for green power users. ▪ Offer exemptions from utility fuel clause adjustment and future environmental control costs.
Clean Energy Generation	▪ New technologies must compete with mature power generation technologies. ▪ Regulatory disincentives, such as non-uniform interconnection standards and environmental permitting, can present barriers to implementing new clean energy technologies.	▪ Build on knowledge from private sector through communications outreach. ▪ Establish interagency partnerships to create leverage on industry. ▪ Establish tax credits and subsidies. ▪ Standardize interconnection standards (i.e., at the federal level).

ADVANTAGES OF USING SIMPLE SCREENING TOOLS

Benefit and cost calculations based on rules of thumb and/or simple screening tools require relatively little analytical work, are usually transparent, and are easily adapted to an initial screening of LBE activities, which may be repeatedly revised and redefined over the course of the program development and implementation.

4.3.1 RULES OF THUMB

Rules of thumb can be used to provide rough estimates of the benefits and costs of prospective LBE programs and help determine the specific activities and measures to pursue. These rules of thumb are typically simple calculations that produce first-order approximations suitable for an initial screening. While these calculations require relatively little analytical work and are less data-intensive than other approaches, they necessarily provide only approximate, "ballpark" estimates. Cost and benefit estimates derived from rules of thumb can vary greatly based, for example, on region, weather conditions, and other factors. As a result, they are not typically the sole basis for making final decisions about which LBE activities to include in a state program and are rarely, if ever, used to make energy savings claims in a regulatory setting.

Table 4.3.1 provides rules of thumb for the following LBE activities:

- Energy Efficiency in Buildings
- Green Buildings
- Energy-Efficient Product Procurement
- Green Power Purchases
- Clean Energy Generation

4.3.2 PRELIMINARY CLEAN ENERGY ANALYSIS TOOLS

The rules of thumb described above provide rough estimates for the purpose of screening LBE activities. Numerous tools and resources exist for going beyond these rough numbers to develop more rigorous calculations of the benefits and costs of LBE activities and measures. Eleven easy-to-use clean energy analysis tools, categorized by type of tool, are summarized in Table 4.3.2. States can use these tools to: 1) help assess the energy performance of energy efficiency approaches being considered in new and existing buildings, 2) estimate GHG and air pollutant emission reductions, 3) estimate energy savings at the community level, and 4) investigate the financial impacts of efficiency investments. If states require a higher degree of accuracy or precision in their results than what is offered by rules of thumb or preliminary assessment tools, they can follow the suggestions in the text box below (See "Further Quantitative Analysis").

Estimating the benefits of LBE activities and measures can be conducted *prospectively* or *retrospectively* with respect to program implementation. The tools and resources describe in this chapter are prospective in nature. However, once states have implemented a suite of activities it is important to look backward and conduct a retrospective assessment of program effectiveness. This topic and the related post-implementation step of tracking the progress of LBE activities and measures are addressed in detail in Chapter 6. A In addition, Appendix H, *State LBE Tracking Tools and Resources*, contains an annotated inventory of a wide range of tools for tracking energy savings, environmental emissions, economic benefits and other clean energy impacts and evaluating LBE programs and activities

FURTHER QUANTITATIVE ANALYSIS

Ultimately, more extensive analysis may be needed beyond the rules of thumb and preliminary assessment tools that provide an initial sense of the costs and benefits of LBE activities. Because the development of LBE activities is typically an ongoing, iterative process, further analysis is useful over time to make revisions to LBE program activities, design, and implementation, based on program experience and retrospective evaluations. A detailed analysis requires assembling extensive data on baseline energy consumption by state facilities and clean energy generation, including:

- Making plausible and transparent assumptions about future trends for energy consumption.
- Considering hiring outside expertise to help conduct the energy analysis, and using more sophisticated quantitative assessment tools.
- Assessing the amount of time and effort to invest in analysis – often, there are diminishing returns. The initial investment provides a large amount of helpful information about the measures, but reaching the next level of precision may require considerably more expense and analytical expertise.
- Ensuring that the state has its own expertise even if outside experts conduct the analysis. It is important to understand the underlying assumptions of the model, assess whether those assumptions are appropriate to the state, and communicate results to key stakeholders.

TABLE 4.3.1 RULES OF THUMB

ENERGY EFFICIENCY IN BUILDINGS					
	Benefits				
Cost Premiums	Energy Savings	Cost Savings	Increased Productivity	Economic Development	Other Benefits
Standard lighting retrofits: $0.90-$1.20 per square foot.[a]	*Existing buildings:* overall consumption reductions of 20% to 30%, with reductions as high as 35%-40%, depending on aggressiveness.[f]	*Existing buildings:* reducing consumption by 20% to 30% can produce savings from 6%-9% of *total annual costs*.[l]	*Existing buildings:* improved comfort and better air quality can increase productivity.	*Existing buildings*: For every $1 spent in local economy, energy efficiency generates 57¢- 84¢ more economic activity than does payment of energy bills.[p]	*Existing Buildings:* energy efficiency investments can increase asset value by $2.00-$3.00 for each $1.00 spent.[q]
High-efficiency packaged and split system A/C equipment: $100-$180 per ton more than standard efficiency models.[b]	*Retro-commissioned commercial building:* average savings of 1.7 kWh/ft2 and average overall energy savings of 15%.[j]	*Converting constant volume HVAC systems to variable air volume systems:* can save between $0.10/ft2 to $0.20/ft2 or 10%-21% of HVAC energy costs.[m]	*Retrofitted buildings:* Increased savings from enhanced productivity can equal up to 10 times the energy cost savings.[n]		*Existing buildings:* a lighting power reduction of 40% increases an ENERGY STAR rating by 10 points.[g]
Premium Efficiency Motors (incremental costs vs. standard replacements): about $16 per horse power (HP) for 1 HP-10 HP motors; $8/HP for 11 HP to 100 HP.[c]	*Lighting retrofits:* save 10%-20% of *total* electric consumption in gas-heated buildings.[h]	*Installing premium efficiency motors and VFDs: Potential energy cost savings are 50-85%.*[d]	*Existing buildings:* 1% productivity improvements can offset entire annual utility costs.[o]		*Retro-commissioned buildings:* annual non-energy savings, such as extended equipment life and improved air quality, are approximately $0.26/ft2.[j]
Variable frequency drives (VFDs): $150-$200, installed.[d]	*High efficiency packaged and split-system cooling equipment:* 25% less *cooling* energy than standard equipment and 10%-15% less than ASHRAE standard.[i]	*Peak energy-reducing measures:* produce proportionally greater cost savings than those that have mostly off-peak savings.			
Commissioning new buildings: $0.50-$3.00 per square foot.[e]	*Building Operator training*: 0.35-1.2 kWh/ft2 per year.[k]	*Commissioning new buildings:* average savings of $0.05/ft2.[j]			
Retro-commissioning buildings: $0.05 and $0.40 per square foot.[e]		*Retro-commissioning existing buildings:* save around $0.27/ft2, resulting in 15% energy savings and a payback period of 0.7 years.[j]			

see next page for footnote information

ENERGY EFFICIENCY IN BUILDINGS FOOTNOTES

[a] The estimate assumes basic 1-for-1 lamp replacement and 1 electronic ballast per fixture to achieve the same illumination. Lamp and ballast costs total $20 for T8 – 800 series equipment, ½ hour of labor at $45/hour and 6-foot by 8-foot fixture spacing. Architectural design assistance and use of Super-T8 lighting can increase costs, but may result in fewer lamps and fixtures, better quality lighting design and greater energy savings (CEE, 2004).

[b] California DEER, 2005.

[c] Arizona Public Service. Premium motor replacement program. Based on analysis of proprietary data conducted by Summit Blue.

[d] U.S. EPA. Undated(a);

[e] According to the Federal Energy Management Program (FEMP) Operations and Maintenance Best Practices Guide, retro-commissioning for an existing building generally costs between $0.05 and $0.40 per square foot (FEMP, 2004). Median retro-commissioning costs are $0.27 per square foot (Mills et al., 2004) with a typical range of $0.13 - $0.45 per square foot.

[f] U.S. EPA., Undated(a); U.S. EPA. 2004; U.S. EPA, 2006h.

[g] For a typical building, a lighting power reduction of 40% increases the building's ENERGY STAR rating by about 10 points (U.S. EPA. 2006j).

[h] Lighting energy comprises 34% of non-space heat energy in commercial buildings. Retrofitting T12 lighting with standard T8 systems saves about 32% of lighting power while delivering the same or improved illumination (Advance Transformer 2005 catalog Energy-Savings T12 magnetic ballast and T8 low-output electronic ballast–different lamp configurations). Total electric savings is 34% x 32% = 11%. Older T12 ballasts are less efficient than new magnetic ballasts; therefore, retrofitting older systems will save more than 11% of building electricity. Lighting retrofits reduce cooling loads and increase electricity savings, but can increase heating loads slightly. New lighting designs can employ delamping, Super-T8 or T5 systems to increase savings (U.S. DOE, 2006d).

[I] Estimate assumes baseline efficiency of 9.2 energy efficiency ratio (EER) (ASHRAE Standard 90.1-2004 minimum requirements for air-cooled equipment efficiency) and 12.5 EER for High-efficiency equipment (ASHRAE 90.1, section that permits omission of economizers due to high efficiency cooling equipment).

[j] A comprehensive study of 106 buildings conducted by the Lawrence Berkeley National Laboratory (LBNL) estimates that retro-commissioning existing buildings can produce annual energy savings of 15% and annual energy cost savings of roughly $0.26 per square foot, depending on the aggressiveness of the retrofit. The study also estimates a median retro-commissioning cost of $0.27 per square foot, 15% energy savings, and a payback period of approximately 0.7 years, depending on the aggressiveness of the retrofit (Mills et al., 2004).

[k] Summit Blue Consulting, 2006.

[l] A report by BOMA International and Kingsley Associates estimates that energy expenses account for approximately 30% of a building's total costs. If a building reduced energy consumption by 20% to 30%, a reasonable target in many existing buildings, a building's total annual costs could be reduced by 6% to 9% (BOMA International and Kingsley Associates, 2006).

[m] U.S. EPA. 2006i.

[n] EPA estimates that increases in employee comfort related to improvements in energy performance can increase productivity in upgraded buildings. Revenue generated from this increase in productivity can equal as much as 10 times the energy cost savings received from performing upgrades (U.S. EPA. 2004).

[o] In a typical office building, the 30-year life-cycle costs are overwhelmingly comprised of personnel costs, with a comparatively small portion due to initial building capital or O&M costs. In dollar terms, annual costs per square foot come to ~$200 for personnel, ~$20 for lease/mortgage costs, ~$2 for utilities, and ~$2 for maintenance. Thus, very small improvements in staff productivity can more than compensate for major changes in the initial capital cost or building O&M. A 1% improvement in staff productivity equals the entire utility cost of a typical building (Smith, 2002).

[p] When money goes toward paying energy bills, much of it often leaves the state, whereas when money is spent on other goods and services (whether it is a clean energy investment in energy efficiency and local green energy, or non-energy consumption), much more remains locally, creating economic growth and jobs within the state. The U.S. Department of Energy (DOE) estimates that for every dollar spent in local economies, energy efficiency generates 57¢ to 84¢ more economic activity than does the payment of energy bills (Hatcher and Dietsche, 2001). The measure of how much economic activity can be generated in a community by different combinations of purchasing and investment is called the economic multiplier. Depending on regional characteristics, energy-efficient LBE activities can have a high economic multiplier. The California Sustainable Building Task Force report estimates an economic multiplier of 2.23:1 for energy efficiency, meaning that for every dollar spent on energy efficiency in California, $2.23 is generated (U.S. DOE, 1996; Kats et al., 2003).

[q] Simple steps to improve energy efficiency can have substantial returns. Over a long time period, reductions from even small energy efficiency improvements can more than offset the implementation costs. EPA estimates that investments in energy-efficient equipment and buildings can increase the asset value by $2.00 to $3.00 for each $1.00 spent (U.S. EPA. 2004).

TABLE 4.3.1 RULES OF THUMB *(cont.)*

GREEN BUILDINGS					
	Benefits				
Cost Premiums	Energy Savings	Cost Savings	Increased Productivity	Average Period Payback (years)	Other Benefits
Green buildings: cost premiums average \$3/ft²-\$5/ft², or less than 2% of initial costs. *New high-performance green buildings*: cost premium range from 2%-7%, depending on the specific design features integrated. *LEED green buildings:* additional cost of certified projects: 0%-2.5%, Silver 0%-3.5%, Gold 0.5%-5%, Platinum 4.5%+ .[b]	*New green buildings:* mean savings is 27%; mean value for actual consumption is 1% lower than modeled.[d] *New green buildings:* 50% reduced consumption compared to conventional new buildings.[e]	*New green buildings:* energy cost savings compared to conventional design as high as \$0.47/ft².[f] *Commissioning new buildings:* average savings of \$0.05/ft².[j]	*Installing high-performance lighting:* productivity improvements of 0.7%-26% with a median of 3.2%. [h] *Incorporating daylighting:* productivity improvements of 0.45% -40%, mean of 5.5%. [h] *Increasing natural ventilation:* productivity improvements of 3%- 18%, mean of 8.5%.[h]	*High-performance buildings:* simple payback period can be as short as 2.0 years for offices, 2.1 years for libraries, and 2.6 years for schools.[i]	*GHG emissions reductions:* as high as 36%.[k] *Reduced indoor and outdoor water consumption:* 30% and 50%, respectively. [k] *Reduced waste consumption:* 50%-75%.[k] *Value of non-energy benefits:* 25%-50% of the value of annual electricity cost savings.[j]

[a] *Based on 2002 Green Building Roundtable and Prepared for the U.S. Senate. The report outlines trends, benefits, and barriers to green building practices (USGBC, 2003; Kats, 2003).*

[b] *The premiums for LEED certified green buildings are average ranges (Syphers, 2003).*

[c] *Kats et al., 2003.*

[d] *A joint study by LBNL, USGBC, U.S. EPA, and U.S. DOE reviewed the modeled and actual energy performance of 21 LEED certified buildings across the country. Although the mean value for actual consumption was 1% lower than the modeled value, there was a wide variation around the mean. (Diamond, 2006).*

[e] *Consumption can be reduced by as much as 50% in energy-efficient green compared to conventional buildings (U.S. DOE, 2006b). New York City defines High Performance as 40% more efficient (New York City, 1999). Pennsylvania Cambria Building consumes 50% as much energy as a conventional new office building (Deru and Hancock, 2003; Ziegler, 2003).*

[f] *A study of 33 LEED certified buildings assessed the financial value of the benefits of green building design. The combined financial benefits were found to be more than 10 times the average initial investment required to design and construct a green building. Energy cost savings alone were estimated at \$0.47/ft² per year (\$5.79/ft² net present value over 20 years), exceeding the average incremental cost associated with green buildings. (Kats et al., 2003).*

[g] *Mills et al., 2004.*

[h] *Loftness, 2005. A 1.5% increase in productivity (or a little over 7 minutes each workday) is equal to \$998 per year, or \$4.44/ft² per year, assuming an average employee salary of \$66,469 and an average space per employee of 225 ft² (Kats et al, 2003).*

[i] *A Minnesota study quantified the benefits of 41 high performance commercial buildings in the state. The study compared their high performance design to the same (hypothetical) buildings designed to meet minimum requirements of the MN Energy Code (MOEA, 2005).*

[j] *From research completed for NYSERDA (Barkett, 2006).*

TABLE 4.3.1 RULES OF THUMB *(cont.)*

ENERGY-EFFICIENT PRODUCT PROCUREMENT – ALL PRODUCTS				
	Benefits			
Cost Premiums	Energy Savings	Energy Cost Savings	Average Payback Period (years)	Emission Reductions
Energy-efficient as opposed to conventional products: cost premium varies with each product, but most often the difference is slight.	*Energy-efficient product procurement*: savings of 3%-12% of total building energy consumption.[a]	*Energy-efficient product procurement:* energy cost savings of 4%-17% relative to total commercial energy costs.[a]		*1 MWh of electricity saved: through energy-efficient product procurement equals emissions reductions of*: [e] ▪ 1,364 pounds of CO_2 ▪ 5.6 pounds of SO_2 ▪ 2.2 pounds NO_x

[a] *A comprehensive study of energy-efficient product procurement programs for federal, state, and local governments assessed major energy-use categories including HVAC, office equipment, washers, lighting, motors, and transformers. Basing its assessment on ENERGY STAR ratings and FEMP guidelines, the study found that diligent energy-efficient product procurement would yield roughly 3% to 12% energy savings by 2010, relative to total energy consumption. The study also found that energy-efficient product procurement would yield roughly 4% to 17% energy cost savings by 2010, relative to total energy costs. (Harris and Johnson, 2000).*

[b] *Columbia University, Undated.* [c] *U.S. EPA. Undated(b).* [d] *U.S. EPA. 2004.*

[e] *Energy Information Administration, 2005.*

ENERGY-EFFICIENT PRODUCT PROCUREMENT – BY TYPE OF PRODUCT			
Product Category	Effective Date of Current Specification[a]	Percent Savings Compared to Conventional Product	Cost-effectiveness (payback period)
Appliances			
Dehumidifiers	October 2006	15%	0 years (typically no retail cost premium)
Dishwashers	January 2007	40%	0 years (typically no retail cost premium)[b]
Refrigerators and freezers	April 2008	15%	4 years (refrigerators)[c] 6 years (freezers)[d]
Room air conditioners	November 2005	10%	Not available[e]
Room air cleaners	July 2004	45%	0 years (typically no retail cost premium)
Electronics			
Battery charging systems	January 2006	35%	0 years (typically no retail cost premium)
DVD products	January 2003	60%	0 years (typically no retail cost premium)
External power adapters	January 2005	35%	0 years (typically no retail cost premium)
Televisions	November 2008	25%	0 years (typically no retail cost premium)
Envelope			
Roof products	December 2007	Not available	< 4 years
Lighting			
Compact fluorescent lamps	January 2004	75%	< 1 year[f]
Office Equipment			
Computers	July 2007	25% - 50%	0 years (typically no retail cost premium)

TABLE 4.3.1 RULES OF THUMB *(cont.)*

ENERGY-EFFICIENT PRODUCT PROCUREMENT – BY TYPE OF PRODUCT			
Product Category	Effective Date of Current Specification[a]	Percent Savings Compared to Conventional Product	Cost-effectiveness (payback period)
Copiers	April 2007	65%	0 years (typically no retail cost premium)
Monitors	July 2007	25%	0 years (typically no retail cost premium)
Multifunction Devices	April 2007	20%	0 years (typically no retail cost premium)
Printers, fax machines, and mailing machines	April 2007	15%	0 years (typically no retail cost premium)
Scanners	April 2007	50%	0 years (typically no retail cost premium)
Heating and Cooling			
Air source heat pumps	April 2006	5%	< 5 years
Boilers	April 2002	5%	< 1 year
Ceiling fans	September 2006	45%	0 years (typically no retail cost premium)
Furnaces	October 2006	15%	< 3 years
Geothermal heat pumps	April 2001	30%	< 5 years for new construction
Light commercial HVAC	January 2004	5%	< 1 year
Ventilating fans	October 2003	70%	0 years (typically no retail cost premium)
Commercial Food Service			
Commercial dishwashers	October 2007	30%	2 years
Commercial fryers	August 2003	15%	2 years (for typical unit)
Commercial ice makers	January 2008	25% - 30%	4 years (for typical unit)
Commercial solid door refrigerators and freezers	September 2001	35%	1 year
Other			
Water coolers	May 2004	45 %	0 years (typically no retail cost premium)
Vending machines	April 2004 August 2006 (rebuilt machines)	40 %	< 1 year

[a] *EPA and DOE develop performance-based specifications to identify efficient products in the market place that will be cost-effective to the consumer and will offer the expected functionality. These specifications, which are used as the basis for ENERGY STAR qualification, are developed using a systematic process that relies on market, engineering, and pollution savings research and input from industry stakeholders. Specifications are revised periodically to be more stringent, which has the effect of increasing overall market energy efficiency (U.S. EPA, 2007).*

[b] *U.S. EPA and U.S. DOE, 2007c.*

[c] *U.S. EPA and U.S. DOE, 2007b.*

[d] *U.S. EPA and U.S. DOE, 2007a.*

[e] *U.S. EPA and U.S. DOE, 2007d.*

[f] *U.S. EPA and U.S. DOE, 2008.*

TABLE 4.3.1 RULES OF THUMB *(cont.)*

GREEN POWER PURCHASES

Cost Premiums	Benefits: Energy Savings	Benefits: Energy Cost Savings	Benefits: Emission Reductions
Green power: about 2¢/kWh. Premiums vary by utility but range from 0.2¢/kWh-17.6¢/kWh[a] *Renewable energy certificates (RECs)*: 1¢/kWh (in ME) -about 5¢/kWh (in MA). Solar REC prices in NJ are the highest at 25¢/kWh[b] *RECs offered by a certificate marketer:* 0.5¢/kWh -7.5¢/kWh, with an average of 2.3¢/kWh. RECs are also available at \$5.50/ton CO_2 to \$12/ton CO_2, with an average of \$9.80/ton CO_2[c]	N/A	*Utility green power programs:* For some utility green power programs, the premium can be negative, thus reducing energy bills. These premiums have been as low as -0.13¢/kWh[a]	*Purchasing 1 MWh of green power is equivalent to:*[d] ▪ 0.14 passenger cars not driven for one year; ▪ 0.52 acres of pine or fir forests storing carbon for one year; ▪ 16 tree seedlings grown for 10 years; ▪ 0.21 tons of waste recycled instead of landfilled; and ▪ 71 gallons of gasoline.

[a] *Premiums vary by utility provider. Premiums for the Xcel Energy's WindSource program, the OG&E Electric Services' OG&E Wind Power program, and Austin Energy's GreenChoice program have all been negative at times (U.S. DOE, 2006c).*

[b] *LBNL compiled data from Evolution Markets for average monthly REC prices from August 2002 to December 2006 (Wiser, 2007).*

[c] *U.S. DOE, 2006c.*

[d] *The environmental impacts of green power purchasing can be better understood by translating emission reductions into tangible real-world concepts – for example, converting pounds of CO_2 avoided into an equivalent number of cars removed from the road or trees planted. The fossil fuel electricity generation emission factor used for CO_2 is 1,380 pounds per MWh. (U.S. Climate Technology Cooperation Gateway, 2006).*

CLEAN ENERGY SUPPLY

Total Costs	Benefits: Energy Savings or Energy Generated	Benefits: Cost Savings	Benefits: Emission Reductions
Small-scale CHP plant: installed cost of \$1.60/W for systems less than 500 kW, and about \$1/W for systems between 0.5 MW and 5 MW.[a] Installed costs for on-site CHP systems average around \$2.90/W in California.[b]	*CHP systems:* energy savings as high as 40%.[f]	*CHP systems:* as high as 40% of the cost of operating separate heat and power systems.[f]	*CHP systems:* equivalent to about 2.6 lbs NO_x/MWh, 5.8 lbs SO_x/MWh, and 1,200 lbs CO_2/MWh.[i]
Solar photovoltaics: average shipment price in 2004 was \$3.00/W; the average price in 2005 was \$3.20/W.[c] Total costs, including the inverter, installation, and balance of system range from \$6-\$9 per peak Watt.[d] Installed costs for PV modules average around \$8.70/W in California and \$7.90/W in New Jersey.[b]	*10 kW solar PV system:* generates 9,700 kWh/year to 16,800 kWh/year, depending on the location of the system.[g]	*10 kW solar PV system:* from about \$600-\$1,400 per year, depending on the geographic location of the system.[g]	*10 kW solar PV system*: from 12,000 lbs-20,000 lbs of CO_2, 10 lbs-90 lbs of SO_x, and 4 lbs- 90 lbs of NO_x per year.[j]
Small wind turbine: including installation, ranges from \$14,700-\$20,800 for a low-range model; \$28,100-\$59,600 for a mid-range model; and \$105,000 and \$115,000, respectively, for two elite models.[e] Installed costs for on-site wind generation average around \$3.60/W in California.[b]	*Wind turbine with 84-foot tower and 7-foot diameter (rated at 900 W)*: generates 96 kWh/month at an average wind speed of 10 mph and 155 kWh/month at 12 mph.[e] *Wind turbine with 140-foot tower and 50-foot diameter (rated at 65 kW):* generates 3,674 kWh/month at 10 mph and 5,992 kWh/month at 12 mph.[e]	*900W wind turbine*: cost savings range from \$9/mo.-\$14/mo per installed turbine.[h] *65 kW wind turbine:* range from \$330/mo -\$540/mo. Per installed turbine.[h]	*Single 10-meter wind turbine with 750 kW capacity with wind speeds ranging between 12.5 and 13.4 mph*: 2.36 million lbs of CO_2, 13,800 lbs of SO_x, and 8,600 lbs of NO_x in one year.[k]

see next page for footnote information

CLEAN ENERGY SUPPLY FOOTNOTES

[a] ACEEE, 1995. Costs escalated to 2007 assuming 2% annual inflation.

[b] Installed costs from a review of on-site generation programs in NJ and CA – the two states with the most installed solar in the U.S. From the public Statewide Self Generation Incentive Program Data (SGIP, 2007). Also used in the analysis completed for the Self Generation Incentive Program: Program Administrator Comparative Assessment (Cooney and Thompson, 2007). Information about the New Jersey Customer On-Site Renewable Energy Program is available at *http://www.njcep.com/*.

[c] EIA, 2006. In dollars per peak Watt.

[d] ASES, 2007.

[e] On-site wind electricity production reduces the amount of conventional fossil fuel used as an energy source. On-site generation capacity depends on the particular turbine model and the wind speed available at a particular site. The Wisconsin *Focus on Energy* initiative has compiled a table of 14 small wind turbine models ranked by electricity generation potential. The smallest of these models, which has an 84-foot tower and an area sweep of 36.9 ft^2, can produce 96 kWh/month at an average wind speed of 10 mph and 155 kWh/month at 12 mph. The largest model, which has a 140-foot tower and a sweep of 1,963 ft^2, can produce 3,674 kWh/month at 10 mph and 5,992 kWh/month at 12 mph. The cost of the 12 smaller systems, including installation, ranges from $14,700 to $20,800 for a low-range model; $28,100 to $59,600 for a mid-range model; and $105,000 and $115,000, respectively, for two elite models (Wisconsin Focus on Energy, 2005).

[f] CHP systems are typically 40% more efficient than separate heat and power generation systems, meaning CHP systems require 40% less source energy to achieve the same output that conventional separate systems achieve (U.S. EPA, 2006b).

[g] This estimate assumes a PV system with a DC rating of 10 kW, a DC to AC derate factor of 0.77, an array tilt equal to the latitude of Seattle and Albuquerque in degrees, an array azimuth of 180°, and cost of electricity ranging from 6¢/kWh to 9.0¢/kWh. Calculations were obtained using the National Renewable Energy Laboratory (NREL) PV Watts calculator (RReDC, 2006)]. Analysis was run for Seattle, WA and Albuquerque, NM for low and high exposure, respectively.

[h] Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, Year-to-Date through January 2007 and 2006. Average for 2006 for the commercial sector was about 9 cents/kWh (EIA, 2007).

[i] Combined heat and power systems provide substantial percentage reductions in total emissions amounts. Emissions factors from the EGrid annual average (U.S. EPA, 2006f).

[j] Emissions for solar PV systems estimated using the California Energy Commission Clean Power Estimator. Assumptions included a 10 kW ac system, 30 degree tilt, Southern orientation, and 20% PV output adjustment factor. Analysis was run in Seattle, WA and Albuquerque, NM for low and high exposure, respectively. (CEC, 2007b).

[k] The American Wind Energy Association estimates that operating a single 10-meter wind turbine with a 750 kW capacity for one year, with wind speeds ranging between 12.5 and 13.4 mph, can displace a total of 2.36 million pounds of CO_2, 13,800 pounds of SO_x, and 8,600 pounds of NO_x that would otherwise be emitted through the generation of conventional energy (Wisconsin Focus on Energy, 2005). Note that the emissions factors in the first bullet of the 'Emissions Reductions' column (EPA, 2006f) can be applied to other sizes of wind turbine, if energy output is available.

TABLE 4.3.2 CLEAN ENERGY ANALYSIS TOOLS

Tools/Organization	Type	Description	Inputs	Outputs	URL/Source
Tools for Assessing Building Performance					
Portfolio Manager (ENERGY STAR)	Web-based tool	▪ Enables states to rate their facilities' energy performance and identify priority opportunities. ▪ Assists states in applying for the ENERGY STAR label for facilities scoring 75 or higher.	▪ Facility space type. ▪ Meter information. ▪ Energy type. ▪ Energy use.	▪ ENERGY STAR energy performance rating (1–100). ▪ Portfolio profile, including information on status, progress, financials, performance, environment, and energy intensity.	*http://www.energystar.gov/index.cfm?c = evaluate_performance.bus_portfoliomanager*

TABLE 4.3.2 CLEAN ENERGY ANALYSIS TOOLS *(cont.)*

Tools/Organization	Type	Description	Inputs	Outputs	URL/Source
Target Finder (ENERGY STAR)	Web-based tool	▪ Allows states to assess the design of new buildings and compare simulations with existing buildings, based on data provided. ▪ Helps set energy performance goals and receive an energy rating for design projects.	▪ Facility location, type, size, occupancy, number of computers, and operating hours per week. ▪ Energy target rating or energy reduction target, energy source, estimated energy usage, and energy rate.	▪ Projected ENERGY STAR energy performance rating (1–100). ▪ Projected energy reduction (%) (from an average building). ▪ Projected energy use intensity. ▪ Projected annual source energy use. ▪ Projected site energy use. ▪ Projected energy costs.	*http://www.energystar.gov/index.cfm?c = new_bldg_design.bus_target_finder*
Small Business Calculator (ENERGY STAR)	Web-based calculator	▪ Estimates a facility's energy intensity and potential energy cost savings from upgrades.	▪ Facility size. ▪ Facility type. ▪ Previous 12 months energy bill figures.	▪ Energy intensity (energy used per square foot). ▪ Potential cost savings from energy efficiency upgrades.	*http://www.energystar.gov/index.cfm?c = small_business.sb_calculate*
Life-Cycle Cost Program (National Institute of Standards/ Technology)	Computer software	▪ Enables states to evaluate alternative designs that may have higher initial costs, using a life-cycle costing method.	▪ Initial and contract costs ▪ Base-year energy costs. ▪ Maintenance and repair costs. ▪ Time period. ▪ Emissions inputs.	▪ Costs and benefits of energy and water conservation and renewable energy projects. ▪ Economic analyses (net savings, savings-to-investment ratio, rate of return, payback period).	*http://www1.eere.energy.gov/femp/information/download_blcc.html*
Emission Inventory Tools					
Clean Air and Climate Protection Software (National Association of Clean Air Agencies)	Computer software	▪ Tracks emission reductions and forecasts emissions from proposed reduction measures. ▪ Develops government baseline inventory.	▪ Fuel and energy use by type of source (e.g., coal, solar, wind). ▪ Sector information. ▪ Emissions factors (default provided)	▪ Equivalent GHG emissions from fuel and electricity use, presented in reports outlined by sector, by location, by source, or by indicator.	*http://www.cacpsoftware.org/*
Greenhouse Gas Equivalencies Calculator (U.S. EPA)	Web-based calculator	▪ Translates GHG reductions into terms that are easier to conceptualize. States can also use the calculator "in reverse."	▪ Quantity of emission reductions (e.g., metric tons of CO_2 equivalent).	▪ Gallons of gasoline not consumed. ▪ kWh of electricity not consumed. ▪ Number of cars and light trucks not driven in one year.	*http://www.epa.gov/cleanenergy/energy-resources/calculator.html*

TABLE 4.3.1 RULES OF THUMB *(cont.)*

Tools/Organization	Type	Description	Inputs	Outputs	URL/Source
e-GRID (U.S. EPA)	Online database	▪ Allows states to obtain information on power plants. ▪ Develop emissions inventories for buildings.	▪ Year of data. ▪ Plant(s) or state(s) of interest.	▪ NO_x, SO_2, CO_2, and mercury, with emissions reported in tons, input and output rates. ▪ Generation resources mix, in MWh and percentage.	*http://www.epa.gov/cleanenergy/egrid/index.htm*
State Inventory Tool (U.S. EPA)	Interactive spread-sheet	▪ Enables states to develop GHG emissions inventories	▪ State-specific data (pre-loaded default data used otherwise)	▪ Comprehensive GHG emissions inventory covering multiple industry sources	*http://www.epa.gov/climatechange/wycd/stateandlocalgov/analyticaltools.html*
Emissions Forecasting Tool (U.S. EPA)	Interactive spread-sheet	▪ Enables states to forecast business-as-usual emissions through 2020	▪ State assumptions relating to future growth and consumption patterns	▪ Estimation of future emissions through linear extrapolation of State Inventory Tool output and federal forecasts	*http://www.epa.gov/climatechange/wycd/stateandlocalgov/analyticaltools.html*
Community-Level Energy Saving Tool					
Community Energy Opportunity Finder (Rocky Mountain Institute)	Web-based calculator	▪ Helps identify potential community benefits resulting from energy efficiency upgrades and renewable energy opportunities.	▪ Community and building characteristics. ▪ Building energy consumption. ▪ Energy costs. ▪ Emissions data.	▪ Energy savings. ▪ Dollar savings. ▪ Reductions in CO_2, NO_x, and SO_2 emissions. ▪ Job creation.	*http://www.energyfinder.org*
Financial and Economic Analysis Tool					
Cash Flow Opportunity Calculator (ENERGY STAR)	Web-based calculator	▪ Calculates the amount of equipment that can be purchased using anticipated savings. ▪ Compares costs of financing and waiting for cash.	▪ Facility size. ▪ Energy costs and savings target ▪ Financing rate and term. ▪ % savings to be committed to upgrades.	▪ Suggested spending on energy efficiency ($\$/ft^2$). ▪ Potential lost savings due to waiting one year to avoid financing. ▪ Potential cost of waiting for better interest rate.	*http://www.energystar.gov/ia/business/cfo_calculator.xls*

4.4 SELECT LBE ACTIVITIES AND MEASURES

Once states have assembled information on the objectives, assessment criteria, barriers, and estimated program impacts of each activity/measure, they can analyze these data to determine which LBE activities and measures to include in their initial LBE portfolio. Table 4.4.1 presents a sample spreadsheet that states can use to help make this recommendation. This approach is intended to illustrate just one approach for comparing and assessing alternative LBE activities. Individual jurisdictions may prefer to develop their own analytic tools to help with this purpose.

4.5 STATE EXAMPLES OF SCREENING LBE ACTIVITIES AND MEASURES

The activities and measures included in LBE programs across the country vary according to the state's specific goals, assessment criteria, and the screening methods used. The following examples illustrate a variety of approaches that states have used to identify the activities and measures in their LBE portfolios.

Utah—Energy Efficiency Policy Options: a Method for Screening Options

The Utah Governor announced a goal of increasing energy efficiency in the state by 20% in 2015. This goal covers all sectors and applies to all forms of energy use. The state commissioned an analysis of 23 potential policies, programs, and initiatives for consideration in meeting its goal, including the following three LBE initiatives:

- Adopt energy efficiency requirements for state agencies, including universities and colleges. Support energy efficiency for local government and K-12 Schools, including the expansion of Utah's Revolving Loan Fund.
- Implement energy efficiency education in K-12 schools.

Each option was screened according to the following criteria:

- Energy savings per year (measured against a business-as-usual baseline)
- Cost and cost effectiveness (measured by net economic benefit)
- Environmental and social benefits
- Political and other considerations

Based on this analysis, each option was assigned a priority level of high, medium, or low. The first option, adopting energy efficiency requirements for state agencies, received a "high priority" rating and was recommended for consideration by the governor and other key decision makers. The remaining options were rated as medium priority, and were not recommended for further consideration. (Geller et al., 2007.)

Web site: *http://energy.utah.gov/energy/utah_energy_efficiency_strategy.html*

Vermont—State Agency Energy Plan for State Government

The Vermont Department of Buildings and General Services created the Comprehensive Environmental and Resource Management Program in 2003 to ensure sustainable state government operations. This program was the impetus for legislative changes leading to a revised State Agency Energy Plan for State Government issued in 2005. The plan stresses the importance of selecting and implementing LBE actions that:

- Reduce state operating costs through energy savings
- Reduce environmental impacts
- Sustain existing and create new Vermont businesses that develop, produce, or market environmentally preferable products
- Demonstrate the economic benefits of clean energy activities to other states and to the private sector.

The plan focuses on the three programs listed below. State agencies are required to develop agency implementation plans that describe the actions they will take to comply with each of these programs, as appropriate to their operations.

- New and existing building infrastructure development, including O&M practices in existing infrastructure. The mid-term goal is to reduce energy consumption in existing and new state buildings and correctional facilities by 20%. State agencies are required to implement the following ten steps for each existing building: 1) benchmarking, 2) low cost/no cost use-habits, O&M improvements, 3) energy audits, 4) additional low cost/no cost use-habits and O&M measures, 5) technical energy analysis, 6) funding analysis and grants potential investigations and applications, 7) ranking and selection of energy savings measures (ESMs) that have associated costs, 8) schedule/streaming, 9) construction or implementation and commissioning, 10) monitoring and evaluation. In step 7, the plan recommends prioritizing ESMs according to the following criteria:
  - ESMs in buildings with sub-standard energy performance should receive the highest priority.
  - Best cost-benefit, life cycle cost
  - Lowest simple payback
  - Highest gross energy savings ranking
  - Renewable energy projects receive priority, when feasible

Table 4.4.1. SAMPLE ASSESSMENT APPROACH: Criteria Worksheet for Screening the Benefits, Costs, and Feasibility of LBE Activities

Goal: Reduce annual energy consumption by state-used buildings by 20% by 2015, using 2006 as a baseline.

Objective	Activity Description	Assessment Criteria				Quantitative Screening			
		Contribution Toward Goal: How will the described measure contribute to the overall goal of reducing energy consumption by state buildings by 20% by 2015, using 2006 as a baseline?	Visibility: How will the described measure spill over into the private sector?	Payback period: How will the described measure meet the payback period of five years or less?	Feasibility: What are the potential barriers and strategies to overcome them?	Annual Energy Savings ($)	Annual Energy Savings (BTU)	Annual GHG Reductions	Total Cost Premium
Reduce energy consumption in state government office buildings.	Implement energy-efficiency measures in all state government office buildings.	This measure will reduce total energy consumption by state-used buildings by 4% by 2015, based on projected energy savings.	This measure may have limited public visibility. Activities will be implemented primarily through changes in behavioral and maintenance practice by state employees.	Yes. The measure is anticipated to have a payback period of less than two years, based on the anticipated energy savings and the projected cost.	The state leases, rather than owns, some of the buildings its agencies occupy. It will be necessary to negotiate with the property owners to implement certain energy efficiency measures.	$3.5 million	200 billion Btu	66 million pounds of CO2 avoided	$6.25 million
		Baseline: Annual energy consumption in state government office buildings totals approximately 2 trillion Btu, costing nearly $35 million.							
	Activity 1.2								
	Activity 1.3								
Objective 2	Activity 2.1								
	Activity 2.2								
	Activity 2.3								
Objective 3	Activity 3.1								
	Activity 3.2								
	Activity 3.3								

Note: The figures used in this model are hypothetical, and should not be interpreted as realistic expectations of the costs and/or benefits of this, or any, hypothetical LBE policy option. Information on performing rough quantitative assessments of the benefits and costs of implementing LBE measures are presented in Section 4.3.1., *Rules of Thumb and Section 4.3.2, Preliminary Clean Energy Analysis Tools.*

- Availability of grant money
- Highest public visibility and educational benefits.

New construction and major renovations must be conducted according to the following five-step process: 1) planning and design, 2) construction and commissioning, 3) facility operation and maintenance, 4) training occupants about how the building functions and required usage protocols that optimize comfort and energy efficiency, and 5) monitoring energy usage and adjusting usage protocols.

- State purchasing and contract administration policies and practices. The plan establishes a general commodities purchasing policy to encourage the purchase of environmentally preferable products. This policy also encourages economically sound purchases by considering the total life cycle cost of these purchases.

- Transportation activities relating to fleet vehicles, personal vehicles, and employee commuter driving practices. Transportation policies cover the state fleet (passenger cars, light duty trucks, and heavy duty trucks) and employee commutes to and from work. The plan sets an initial target of 10% reduction in energy and anticipates that more aggressive targets may be set individually by agencies or departments. Energy reduction strategies include: minimizing personal vehicle reimbursed mileage opportunities, right-sizing vehicles, instituting vehicle maintenance procedures, ensuring that purchasing decisions require fleet vehicles to be among the most fuel-efficient and lowest emission vehicle models in each class, adopting strategies to reduce on-the-job miles, instituting no-idling campaigns and policies, and encouraging alternative reduced-emission fuels or fuels that reduce emissions of greenhouse gases. (Vermont, 2005.)

Web site: *http://www.bgs.vermont.gov/sites/bgs/files/pdfs/BGS-CERMP.pdf*

Wisconsin Energy Initiative—A Phased Approach to Implementing Energy Efficiency in State Buildings

Wisconsin instituted the Wisconsin Energy Initiative (WEI) in 1992 to comprehensively address energy savings opportunities, with a goal of reducing energy use in state buildings by 15%. The state Department of Administration (DOA) hired an ESCO to conduct audits of energy use in state facilities and to implement improvements in the following order:

- Installation of Energy-Efficient Lighting in State-owned Building Space. Lighting was replaced first, in part because it was easiest to implement and could be funded from the maintenance budget. Another reason for targeting lighting first is that it is important to upgrade the lighting system early in the building upgrade process to have a significant impact on how other building systems (especially heating and cooling systems) use energy.[1] To help gain buy-in and demonstrate that lighting quality is comparable to that of less efficient options, the first lighting replacement was completed without prior notice on the floor where state office engineers were located. Subsequently, aging electrical ballasts and lighting fixtures were replaced one building or campus at a time. More than 700,000 fluorescent T-8 lamps, 350,000 ballasts, and tens of thousands of exit signs and CFLs were installed, resulting in annual energy savings of over $5 million.

- Installation of Energy Efficient Lighting in Local Schools and Municipal Facilities. In this phase, the DOA worked with the Cooperative Educational School Agencies (CESAs) to leverage private funds to improve energy conservation in schools across the state.

- Upgrading Mechanical Equipment. The state entered into performance contracts to upgrade HVAC, other mechanical equipment, and water-saving devices in state buildings, campuses and other institutions. Improvements included lighting occupancy sensors, stream traps, air handling and distribution systems, and ultra-low flow toilets. More difficult and time-consuming than improving lighting, DOA estimated that this phase would save enough energy to heat 10,000 Wisconsin homes and reduce state expenditures by $6.8 million annually.

- Upgrading Specifications for New Buildings. DOA also upgraded its specifications for new buildings to include the most up-to-date energy-savings and green technologies, including daylighting, building automation systems, heat recovery systems, and co-generation. (Wisconsin 2002; Mapp et al., 2006; Mapp, 2007.)

Web site: *http://www.doa.state.wi.us/press_releases_detail.asp?prid=123&divid=4*

[1] *For more information on the staged approach to upgrading buildings for energy efficiency, see EPA's ENERGY STAR Building Upgrade Manual at http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual.*

Nevada—Energy Conservation Plan for State Government

In its State of Nevada Energy Conservation Plan for State Government, the state's Office of Energy outlined its plan for implementing measures to reduce both total energy usage and peak energy loads in state buildings. Measures were identified based on whether they could be implemented immediately, in the short term, or in the long term, as follows:

- Immediate Measures: measures that can be performed at the present time requiring no additional funding or legislative support. These include behavior modification measures such as:
    - Turn off lights when leaving a room
    - Turn down heaters for the night
    - Eliminate unnecessary appliances
    - Keep lighting fixtures, filters, and heating and cooling coils clean.
- Short-term Measures: measures that can be performed within the fiscal year requiring no funding in addition to current budgets and/or legislative support, including:
    - Replace incandescent bulbs with CFLs
    - Acquire photocells to automatically turn lights on and off
    - Clean and maintain filters, coils, and vents
- Long-term Measures: measures that cannot be accomplished within the fiscal year and/or require additional funding or legislative support, including:
    - Perform energy audits on all buildings
    - Incorporate energy efficiency guidelines for all new construction and building retrofits
    - Purchase only ENERGY STAR equipment (Nevada, 2001.)

Web site: ***http://energy.state.nv.us/conservation%20plan%20for%20state%20government.pdf***

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