Energy Savings Report

State of Minnesota: State Government, University of Minnesota, and Minnesota State Colleges and Universities

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EXECUTIVE SUMMARY

The 2007 Minnesota Legislature and the Governor commissioned the Minnesota Department of Commerce to work with the University of Minnesota, Minnesota State Colleges and Universities (MnSCU), and state agencies to identify barriers, describe the costs and benefits of actions that would lead to an annual 1.5 percent energy savings energy used in buildings, and develop policy recommendations that could lead to those actions.

The Commissioner of the Department of Commerce (DOC) contracted with the Center for Science, Technology and Public Policy (CSTPP) at the University of Minnesota to conduct the research work on its behalf. The University of Minnesota, MnSCU and the state agencies participated in the research through the completion of a survey and interviews, as well as by submitting data directly to the researchers. In addition, information was provided to the research team by representatives from these State Entities and outside energy experts who attended a meeting held to obtain ideas and input which, in part, formed the basis of this report.

The report provides background on energy savings in government buildings and addresses the questions asked by the state law. It also found that state government-owned buildings are a significant potential source of energy savings. The government is in a unique position to think about the long-term implications of present day decisions. Through leading by example, the government can serve as a platform for the development and implementation of energy savings programs, policies and technologies. That said, there are information, organization, and resource barriers to achieving energy savings in Minnesota government buildings.

A common problem noted by energy experts was the fact that many campuses and departments have considered energy efficiency measures but have been unable to act upon them. There were six key barriers identified for facilities managers to overcome in order to complete energy savings measures in their state buildings in Minnesota:

1. the size and quality of energy use and source data is inadequate;
2. the difficulty in sustaining energy savings policies long-term;
3. the potential and capacity for energy savings varies greatly among campuses and agencies;
4. resources for energy savings measures are scarce, despite acknowledged long term or life cycle benefits;
5. more communication, research and a common knowledge base about energy savings is needed to overcome the above barriers; and
6. the difficulty in changing rapidly enough to accomplish adequate energy savings.

While using these six barriers as a basis for the report, the research team also looked at policy options that might be able to achieve more energy savings in government-owned buildings. There are a wide range of policy options available.

First, facilities managers repeatedly asked that the energy savings goal be clarified. Among the questions asked were:

- What *units* of energy use (BTU, kWh) should be used to record the energy consumption and savings amount?
- Which *method* should be used for calculating annual targets?
- Which *baseline* should be used for energy usage?
- Which *entities* must comply with the legislation?

To answer these questions, the following policy recommendations emerged:

Measuring and Units

- Require standardized reporting of natural gas and other fuel use in BTUs and electricity use in kWh.

Annual Energy Savings Targets

- Choose a method to determine annual energy savings targets with periodic verification.

Baseline

- Find the energy use baseline for each building using common assumptions (site energy) and then sum for agency or campus totals.
- Determine the energy use baseline for a recent year such as 2007 without waiting to obtain better individual building data.

Applicable Entities

- Clearly identify each entity responsible for achieving energy savings and include all State Entities unless there is a compelling reason for exemption.

The second type of policies identified were those that would enable agencies and campuses to reach the energy savings goal. Specific questions that came up included:

- How should the amount of energy savings be *measured?*
- How should any energy savings measures be *financed?*
- Is there a centralized "hub" for energy savings information and assistance?
- Do we have the internal capacity, or funds to utilize external capacity, to take on these goals?

To answer these questions, the following policy recommendations emerged:

Measurements

- Install electric and fuel use meters on all existing and new state-run buildings.

Funding Options

- Expand the use of existing funding sources for energy savings projects and consider appropriating additional funding.

Outreach and Training

- Establish a one-stop shop for energy savings.
- Require energy savings training for building operators and users.

The third type of policies identified were those that would enable agencies and campuses to reach the energy savings goal. Specific questions that came up included:

- What are some ways to help agencies and campuses reach this goal?
- How can measurements be verified?
- How can energy savings be integrated into everyday practices?

To answer these questions, the following policy recommendations emerged:

Methods to Encourage Energy Savings

- Integrate the decision process for construction, operations and programming budgets.
- Make existing rebates easier to access and encourage utilities to develop and offer more.
- Provide recognition for energy savings champions.
- Allow flexibility to reach the energy savings goal – within and / or between agencies and campuses.
- Translate the energy savings into greenhouse gas (GHG) emissions as well as dollars and energy metrics (e.g. MMBTUs, kWhs).

Discussions with energy experts identified financial costs as the main cost to be examined. However, other costs are also important, such as the time needed to train building operators and building users on energy efficiency and conservation issues, and to integrate energy savings considerations into general organizational practices – from building operations, construction and renovation, to procurement policies.

Many informants (e.g., 70% of MnSCU campuses) felt the most viable place for energy savings measures to be undertaken is when buildings are being constructed or renovated. Generally speaking, it is more costly to do energy efficiency retrofitting measures than to design and construct a new building efficiently. On the other hand, when looking at energy savings within a building fleet, opportunities for energy savings among existing buildings – even if the measures are more expensive to retrofit than if they had been there in the first place – are often still cheaper to do versus build a new building.

Methods to Ensure the Occurrence of Energy Savings

- Establish a group charged with goal enforcement.
- Institutionalize policies and measures to reach the energy savings goal.
- Conduct further studies to achieve this energy savings goal.

This study revealed a number of benefits that could accrue to state government by undertaking energy savings efforts. First of all, state government can reap financial rewards from these savings by reducing operating and utility costs, which benefits the tax payer by "freeing up" more funds for programming initiatives. Moreover, environmental benefits at the local level

(e.g., reduced air pollution) and the global level (e.g., reduced GHG emissions) can accrue through implementing these measures.

State government is in a unique position to think long term. For this reason, state government can help to develop markets for relevant technologies and services. In addition, through conducting pilot projects and using these technologies, the private sector can also be encouraged to adopt these practices and products. Finally, regular measurement and reporting as well as planning and undertaking these energy savings efforts raises awareness and encourages an energy savings 'culture' among building users.

1.0 Background: State Government-Owned Buildings Are a Significant Potential Source of Energy Savings

1.1 Introduction

The State of Minnesota, through its state agencies, the University of Minnesota and the Minnesota State Colleges and Universities system (MnSCU) (collectively, the State Entities) own, lease or operate an enormous number and variety of buildings in the state -- at least 2014 buildings that are 5,000 square feet (SF) or above in size. These buildings and smaller ones account for at least 80 million SF of space. For instance, the Minnesota Department of Natural Resources alone manages 193 sites and 2800 buildings in the state. The 2007 Minnesota Legislature and the Governor commissioned the Minnesota Department of Commerce to work with the State Entities (which excludes local units of government and school districts) to develop policy recommendations, identify barriers and describe the costs and benefits of actions that would lead to an annual savings of 1.5% in energy use in those buildings. This report provides background on energy savings in government buildings and addresses the questions asked by the state law.

1.2 Study Objectives

To restate briefly the legislative mandate, the goals of the study were to identify:

- the most effective ***policy options*** to achieve 1.5% savings in annual energy use
- the principal ***barriers*** to achieving 1.5% savings in annual energy use
- the ***economic costs*** and ***benefits*** for state government operations associated with undertaking energy saving measures to reach a 1.5% annual energy savings goal

Government action on energy savings provides an excellent opportunity for the state to take on a leading role in this pivotal area. The government is in a unique position to think about the long-term implications of present day decisions. Through leading by example, the government can serve as a platform for the development and implementation of energy savings programs, policies and technologies. The state can encourage the development of markets for adoption of these practices and products by undertaking pilot projects, using energy savings technologies, serving as a source of expertise, and through collaborating with other sectors on energy savings – all potential components of what some have called the 'green economy.'

1.3 Study Rationale

The research project on which this report is based was mandated by the State of Minnesota in Session Laws 2007, Article 2, section 7 codified at section 216C.03, and titled "State Government Energy Savings Plan." It requires that:

> The commissioner of commerce, in coordination with the commissioners of the agencies listed in 15.01, the chancellor of the Minnesota State Colleges and Universities, and the president of the University of Minnesota, shall identify policy options, barriers, and economic benefits and costs for state government operations to

> achieve the energy savings goals in section 216B.2401 and the resulting carbon emission reductions. The commissioner of commerce must issue a report to the legislature by February 1, 2008.

The cross-referenced section states:

> 216B.2401 ENERGY CONSERVATION POLICY GOAL.
> It is the energy policy of the state of Minnesota to achieve annual energy savings equal to 1.5 percent of annual retail energy sales of electricity and natural gas directly through energy conservation improvement programs and rate design, and indirectly through energy codes and appliance standards, programs designed to transform the market or change consumer behavior, energy savings resulting from efficiency improvements to the utility infrastructure and system, and other efforts to promote energy efficiency and energy conservation.

These goals should be read in connection with other goals established in the same bill:

> 216C.05, Subdivision 2. Energy policy goals**.** It is the energy policy of the state of Minnesota that: (1) the per capita use of fossil fuel as an energy input be reduced by 15 percent by the year 2015, through increased reliance on energy efficiency and renewable energy alternatives; and (2) 25 percent of the total energy used in the state be derived from renewable energy resources by the year 2025.

This energy savings goal is applicable to MnSCU campuses and facilities statewide and the campuses of the University of Minnesota. The agencies listed in section 15.01 constitute every officially designated department of state government (see Table 1).

State Agencies	University of Minnesota
Department of Administration	Crookston
Department of Agriculture	Duluth
Department of Commerce	Morris
Department of Corrections	Rochester
Department of Education	Twin Cities
Department of Employment and Economic Development	Other Locations
Department of Finance	
Department of Health	
Department of Human Rights	MnSCU
Department of Labor and Industry	Statewide campuses and facilities
Department of Military Affairs	
Department of Natural Resources	
Department of Employee Relations	
Department of Public Safety	
Department of Human Services	
Department of Revenue	
Department of Transportation	
Department of Veterans Affairs	

The Commissioner of the Department of Commerce (DOC) contracted with the Center for Science, Technology and Public Policy (CSTPP) at the University of Minnesota to conduct the research work on its behalf. The University of Minnesota, MnSCU and the state agencies participated in the research through the completion of a survey and interviews, as well as by submitting data directly to the researchers. In addition, information was provided to the research team by representatives from these State Entities and outside energy experts who attended a meeting held to obtain ideas and input which would, in part, form the basis of this report.

1.4 Context

While discussions on energy efficiency and conservation are not new, recent re-examination of energy – production, transmission, distribution and us – has changed due to challenges involved with energy security, rising energy costs and the volatility of fossil fuel prices. In addition, environmental degradation from energy – from the local level: air, water and groundwater pollution, to the global level: climate change – equally warrants attention. For these reasons policy makers, academics and energy practitioners are looking to reduce energy use and greenhouse gas (GHG) emissions.

A number of studies focus on alternative sources of energy supply, including renewable energy sources, nuclear power and methods to reduce the environmental impact of conventional fossil fuels, such as combined heat and power (CHP) technology. Alternatively, demand side management includes energy savings through conservation and efficiency efforts. Energy conservation is defined here as those measures and/or actions that directly reduce energy demand through an individual's or an organization's behavior or action. Examples of conservation include turning down thermostats or turning off lights when a room is not occupied. Energy efficiency refers to those measures that reduce energy use through the application of a more efficient technology such as replacing cathode ray tube (CRT) computer monitors with liquid crystal displays (LCD). This report refers to both energy conservation and energy efficiency interchangeably through the term "energy savings" measures.

Energy savings goals, while important, are but one consideration in the building design, construction and use policy and program package. Energy savings objectives must be balanced with other goals, including, among others, protecting the health and safety of building occupants and providing a work environment that encourages productivity.

Moreover, energy savings must be examined within the larger context of sustainability. A Life Cycle Assessment (LCA) accounting approach assesses the energy involved from the cradle to the grave of products and services. More energy may be used and/or GHG emissions emitted in the construction of a new building (e.g., the energy involved in extracting primary products and transforming them to finished products used to create building materials, such as concrete and steel) than the energy used in retrofitting an existing building – even if the resulting new building would be considered more "energy efficient."

Other issues involved with evaluating the energy and GHG emissions impacts of new building development require a balance of outcomes, such as increased transportation costs incurred by building a public project outside of an urban area, driven by less expensive land.

Energy Use in the United States

Focusing on energy savings helps to reduce energy demand and carbon emissions. For instance, 76% of all electricity generated by United States (US) power plants is used by the building sector (Architecture 2030, 2007). Using data from the US Energy Information Administration illustrates that buildings are responsible for almost half (48%) of all GHG emissions annually. In the most recent Commercial Buildings Energy Consumption Survey (CBECS) conducted in 2003, commercial buildings, or those buildings where more than 50 percent of their floor space is devoted to activities other than residential, industrial or agricultural, made up about 51% of building stock in the U.S. (CBECS, 2003).

Public Buildings and Energy

While the majority of commercial buildings in America are owned and operated by the private sector, public building use and ownership is significant. In the U.S., "state and local governments are responsible for more than 16 billion square feet (SF) of building space and spend over $11 billion annually on building energy costs, which can account for up to 10% of a typical government's annual operating budget" (EPA, 2007 (draft): 1-5).

National Energy Savings Goals

One way in which municipalities, states and countries have chosen to curb energy use is through the establishment of an overall energy savings goal. For instance, on January 24, 2007, President George Bush signed Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, which called for the head of each federal government agency to improve energy efficiency and reduce GHG emissions from 2003 levels by 3% annually, or by 30% by the end of the 2015 fiscal year (FY2015) (White House, 2007). On January 9, 2008, the Department of Energy developed regulations that require most new federal buildings to be 30% more energy efficient than existing building codes. "The standards aim to address energy efficiency by looking at a building's entire performance, instead of relying on prescriptive requirements for building components and systems" (DOE, 2008).

In Australia, the Energy Efficiency in Government Operations Policy has set a goal for an overall reduction in the government's energy intensity from 2006 to 2011. The goal includes a 25% reduction in energy intensity for tenant light and power in office buildings and a 20% reduction for energy used in building central services.

The European Union's Commission of the European Communities released an action plan in October 2006, outlining a framework for realizing a 20% savings in EU annual primary energy consumption by 2020.

Regional and State Energy Savings Goals

The Midwestern Governors Association (MGA) in November 2007 targeted energy efficiency to provide a 2% annual reduction of natural gas and electricity use by 2015 (Midwestern Governors Association, 2007). This target, one of many climate change and energy initiatives adopted by the MGA in November, attempts to raise the baseline by bringing all Midwestern states up to similar levels that Minnesota, Iowa and Wisconsin currently require.

Some other U.S. states have also adopted an energy savings goal. These actions are varied because they depend on each state's individual, current baseline of activity. Actions include:

California: Executive Order S-20-04 directs state agencies to cooperate in taking measures to reduce grid-based energy purchases for state buildings by 20% by 2015 from 2003 levels.

Colorado: Executive Order D 0011 07 directs agencies to:

- reduce energy consumption by 20% by 2012, based on 2006 levels;
- assess and implement the development of state renewable energy projects;
- reduce paper and water use by 2012 by 20% and 10%, respectively; and
- reduce petroleum consumption by state fleets by 25% by 2012, based on 2006 levels, while increasing fleet efficiency.

Colorado law CRS 24-82 also requires that all state buildings designed or rehabilitated after 1981 to:

- be designed or improved to achieve a 55 BTU/square foot/year energy performance goal for heating, cooling, lighting, and ventilation energy;
- make maximum use of passive solar concepts such as energy conservation, natural lighting, and orientation and incorporation of thermal-mass;
- make maximum use of economically feasible renewable energy systems; and
- pursue the feasibility of retrofit with renewable energy systems.
- State buildings, which are not office buildings, shall be designed for maximum use of passive solar concepts.

Connecticut: Energy efficiency is included in their Renewable Portfolio Standard (RPS), Class III, which must constitute 1% of the state's electricity supply in 2007, increasing to 4% in 2010 and remain at 4% in 2020.

New York: Executive Order 111, first signed in 2001, required "state agencies to be more energy efficient and environmentally aware." This executive order required state agencies to attempt to reach a 35% reduction in energy consumption by 2010 relative to 1990 levels. It also required new state buildings to be built to Leadership in Energy and Environment Design (LEED) standards. The Executive Order was continued on January 1, 2007 by newly elected Governor Spitzer.

Washington: Executive Order 05-01 requires state construction projects over 25,000 sq. ft. to be designed according to LEED-Silver standards. The Order requires a reduction in agency energy use by 10% by September 1, 2009 using a FY 2003 baseline, using measures such as on-site renewable resources.

Energy Use and Savings in Minnesota

Energy use trends in Minnesota are similar to the rest of the country. For instance, commercial and industrial customers account for most of the energy consumption and conservation efforts in Minnesota (OLA, 2005: 11). In addition, like those studies examining energy use and GHG emissions in the US, previous studies in Minnesota indicate that conservation and efficiency efforts in commercial buildings must be key components of any energy and carbon management strategy. For example:

- For both electricity and natural gas, conservation projects for commercial and industrial customers accounted for 75-91% of the energy and capacity savings statewide. The commercial and industrial projects produced more energy savings per dollar of Conservation Improvement Program (CIP) spending than the residential projects (OLA, 2005: 14).

- Studies conducted by Interstate Power and Light, Otter Tail Power and Xcel Energy indicate that between 10 and 20% of future electric load in Minnesota could be met through cost-effective conservation measures.

- According to the American Council for an Energy Efficient Economy (ACEEE), between 15-30% of future load for natural gas utilities in Minnesota could be met through cost-effective conservation.

- Another way to examine energy savings measures looks at what are considered "achievable savings." This approach integrates the potential impact of other factors, such as safety issues, on energy savings measures. When the ACEEE examined natural gas savings studies from other parts of the country that examined achievable savings, they were 23-53% lower than the estimates of cost-effective savings. The MN studies generally did not include achievable savings in their estimates (OLA, 2005: 41).

All Sectors

Even with these challenges, Minnesotans recognize that re-examining energy use and the move to a carbon constrained world represent important opportunities for the state to demonstrate its leadership and expertise in this area. To name some examples:

Integrated Resource Plans (IRPs)

State law requires electric utilities to prepare integrated resource plans (IRPs), which show the mix of electric generation and conservation that will achieve the least costly path for the utility to meet its customers' future electric needs (OLA, 2005: 5).

Conservation Improvement Program (CIP)

Since 1992, Minnesota's public electric and gas utilities have been required, through statute, to spend between 0.5% and 2.0% of their annual gross operating revenue on energy conservation improvement programs (CIP). CIP provides rebates, grants, energy audits, and education focused on energy saving improvements and technologies. (MidWest CHP Application Center, 2005; Office of the Legislature Auditor (OLA), Evaluation Report of CIP, 2005: 3). In the Next Generation Act passed last year, CIP now requires all utilities – investor-owned utilities as well as municipal and cooperative utilities – to reach a 1.5% annual energy savings goal (as outlined in the Introduction). DOC has regulatory oversight for CIP.

Utilities, through CIP, have designed and implemented some nationally award-winning programs. Two of those programs include:

- **Xcel's Energy Design Assistance Program**
  In this Xcel-funded program, operating since 1992, the Weidt Group, an energy consulting firm in Minnetonka, MN, conducts detailed analyses on new buildings through consultation, computer modeling and performance verification, to encourage buildings owners, architects and engineers to undertake a comprehensive package of energy efficiency measures (the Weidt Group, 2008). Because this is a program predominantly available only in Xcel's territory, DOC is working to make this option available statewide.

- **One-Stop Efficiency Shop**
  The non-profit organization, **Center for Energy and the Environment (CEE)**, manages the "One-Stop Efficiency Shop," which is an Xcel Energy CIP funded program available to small businesses in Minnesota with electric demand between 10 and 400 kW. Businesses receive a free, no obligation energy audit, and rebates to offset costs, should they undertake energy efficiency measures (to date, projects have received 15%-60% of the installed costs in rebates) (CEE, 2008).

- **Neighborhood Energy Connection (NEC)**
  This is a nonprofit organization located in St. Paul, MN that provides information, services and programs on energy efficiency for residents, businesses and communities across Minnesota (NEC 2008).

- **Sustain Winona**
  This initiative is a partnership between the largest public and private institutions in the City of Winona – including representatives from the local government, colleges, universities and schools in the city – who have come together to commit

to reducing GHG emissions through various initiatives such as energy savings measures, the use of more renewable energy and reducing waste (Sustain Winona, 2007).

- **Architecture 2030 (Sustainable Building 2030)**
  A number of organizations in Minnesota, such as the University of Minnesota's Center for Sustainable Building Research and several local firms, including LHB and the Architectural Alliance, are active players in the Architecture 2030 alliance, which is an initiative established by a Santa Fe, NM based non-profit architectural organization and adopted by the American Institute of Architects (AIA) and the U.S. Conference of Mayors. Guidelines and standards for new and existing buildings must require reductions consistent with the Architecture 2030 Challenge, which stipulates that they meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

  For new buildings, the fossil fuel reduction standard will be increased to 60% in 2010, 70% in 2015, to being carbon-neutral by 2030. For existing buildings, at a minimum, an equal amount of existing building area shall be renovated annually to meet the fossil fuel reduction standard of 50%.

  These goals have been adopted by a number of Minnesota architecture firms and non-governmental organizations, such as those noted above, as well as studio 2030, Perkins + Will, the Minnesota Center for Energy and the Environment (CEE), the Green Institute and the Indigenous Environmental Network (Architecture 2030, 2007).

  The Minnesota Climate Change Advisory Group recently adopted Minnesota 2030 as one of its options. Like Architecture 2030, this would require all new state buildings to achieve a carbon neutral design by 2030. Interim goals include meeting a fossil fuel reduction standard of 70% by 2015. The option also recommends that incentives be provided to encourage other public building owners as well as private sector owners to reach similar goals.

State Entities

For more than 30 years State Entities have also been implementing energy efficiency measures. Most recently these organizations have undertaken a number of measures for energy savings as manifested in the following examples:

- **Buildings, Benchmarks and Beyond (B3)**
  The Energy Security and Reliability Act of 2001 required the Departments of Administration and Commerce to work cooperatively to benchmark all Minnesota public buildings by maintaining an energy use database, and report energy conservation savings possibilities to the Legislature. The Act also required that all

new buildings receiving state bond funding after 2004 be consistent with sustainable building design guidelines developed by the Minnesota State Departments of Administration and Commerce.

The departments hired, after a substantial Request For Proposals (RFP) and interview process, a team consisting of individuals who had been involved with conservation in Minnesota for decades. The team consists of LHB Architects, as the overarching Project Manager; the Weidt Group, who handled the design and implementation of the benchmarking tool; and the University of Minnesota Center for Sustainable Building Research, who provided oversight on the sustainable design guidelines. This team still is working with the state agencies today, implementing both the benchmarking tool and the tracking the guidelines' pilot projects. In the 2007 Next Generation Act, continued funding for improvement and maintenance was provided through an annual assessment to the utilities.

- ***MN Benchmarking Tool***
  The benchmarking tool database contains nearly all public buildings owned by the State Entities , city and county governments and public schools over 5,000 SF. Although work is still underway to validate all the data and ensure that data for all public buildings are included, B3 Benchmarking will be an essential management tool to assist in tracking reduced operating costs and to assess the costs and benefits of renovation and retrofit projects designed to save energy (http://www.mnbenchmarking.com/). The Minnesota B3 Benchmarking tool provides a customized benchmark for each building site that is equivalent to the current version of the Minnesota energy code. The benchmark takes building size, type, operation, energy sources, and other variables into account when generating the baseline. The benchmark allows the state to identify those buildings that have the greatest opportunity for energy conservation investments.

- ***The Minnesota Sustainable Building Design Guidelines***
  The guidelines were developed by the B3 team with a new version issued in September 2006. The legislature required the guidelines to:

  - Exceed existing energy code by at least 30 percent
  - Achieve lowest possible lifetime costs for new buildings
  - Encourage continual energy conservation improvements in new buildings
  - Ensure good indoor air quality
  - Create and maintain a healthy environment
  - Facilitate productivity improvements
  - Specify ways to reduce material costs
  - Consider the long-term operating costs of the building including the use of renewable energy sources and distributed electric energy generation that uses a renewable source of natural gas or a fuel as clean or cleaner than natural gas (http://www.msbg.umn.edu/).

To date, 65 buildings are listed as using the guidelines. As these buildings are completed and used, their energy use will be maintained in the benchmarking tool, enabling building owners, as well as the guidelines developers, to understand how the guidelines are working so that they can be continually updated and maintained.

- ***Executive Order 05-16***
  This 2006 Order called for a reduction in energy consumption in state-owned buildings of 10% in 2006 and mandated heating temperature set points within 68-70 degrees and cooling temperature set points within 76-78 degrees (Fahrenheit). The Department of Administration and Department of Commerce began the ***Saving Energy Program,*** which focused on communications and operations to help achieve 05-16's goals. Components of it encompassed:

  - Communications activities, including energy fairs and seminars, and the creation of the Saving Energy website - www.savingenergy.state.mn.us;
  - Operations activities, including the development of a web-based energy consumption reporting system, among others (DOA and DOC, 2007: 3);
  - Program results, including the completion of two energy retrofitting programs in 2006, saving an estimated $122,289 in annual energy costs, and educating employees through five energy fairs held at state buildings (more than 500 state employees attended), and securing $147,000 in utility rebates for 21 energy efficiency improvement projects in 2006 (DOA and DOC, 2007: 3)

- ***Commissioning and Recommissioning***
  Commissioning is the process of ensuring that systems in a new building are designed, installed, functionally tested, and capable of being operated and maintained according to the owner's operational needs.

  Recommissioning is the commissioning process applied to an existing building.

  The Department of Commerce partnered with MnSCU and the Department of Administration to recommission facilities at Mesabi Range Community and Technical College, Ridgewater College - Willmar campus, and the Ely Revenue building. In each of these projects thousands of dollars of operating costs were saved and comfort was dramatically improved with relatively inexpensive changes to the systems.

- ***Guaranteed Savings or "Performance Contracting"***
  Under performance contracting, major capital improvements are financed by the performance contractor or another financial institution. The public entity repays the loan out of the energy savings accrued by the project. After the loan is paid off, the public entity will continue to benefit from the ongoing reduced energy outlays.

The unique characteristic of a guaranteed savings contract is that all or a significant portion of the payment to the contractor depends on the measured energy savings resulting from the contractor's work. The Department of Administration and MnSCU have successfully begun this process with agreements whereby the payments to the contractor are based on pre-contract calculated energy savings expected from the contractor's work. The process in future contracts will evolve whereby payments to the contractor would be based on measured results.

The Department of Administration's ***Guaranteed Energy Savings Program*** was established in 2003 for state agencies and Minnesota State Colleges and Universities (Minnesota Statute 16C.144) (DOA and DOC Report, 2006: 10).

The Energy Services Coalition (ESC) is a national nonprofit organization composed of a network of experts from a wide range of organizations working together at the state and local levels to increase energy efficiency and building upgrades through energy savings performance contracting. Currently 22 states have ESC chapters. ESC, with funds from the U.S. Department of Energy, recently launched a new initiative to accelerate energy savings performance contracting through providing their proven set of tools (e.g., model contracts, procurement methods, analyses) as well as one-on-one expert assistance to states who wish to join the initiative (www.energyservicescoalition.org). DOC is currently working with the Department of Administration to see how ESC can assist Minnesota's public buildings by identifying model contracting documents and procedures for measurement and verification of savings that have been effectively employed in other states.

Wisconsin, has also realized energy savings through their energy performance contracting program entitled the Wisconsin Energy Initiative (WEI), which began in 1992. These projects were financed by state bonding and after that funding was exhausted performance contractors provided project financing. One example of a WEI project includes the installation of 2,000 premium-efficiency motors and more than 8,500 occupancy sensors at the University of Wisconsin-Madison (Mapp et al., 2006: 128).

- **The University of Minnesota's energy efficiency efforts include:**
  - Retrofitting inefficient lighting systems on campus with more efficient lighting systems;
  - Installing Direct Digital Controls (DDCs) to better control equipment;
  - Operational improvements that schedule equipment to turn off when a space is not in use;
  - Establishing a campus-wide energy conservation campaign, partnering with sustainability classes and student interest groups (U of M Fact Sheet, 2007).

- **MnSCU has multiple energy efficiency projects implemented throughout MnSCU's campuses, including:**
  - a $1.2 million energy retrofit for five campuses of Minnesota West Community and Technical College;
  - Minnesota State University, Mankato campus energy retrofit project between 1994 and 1997;
  - Winona State University, which has taken a number of steps for energy savings, including replacing their incandescent lighting with fluorescent and / or LED lighting, operating a Utility Plant at their campus, which allows them to maintain campus heating and cooling using less, but larger and more efficient, equipment, and by being an energy savings leader, working with partners in the Sustain Winona initiative;
  - a number of Guaranteed Energy Savings projects (e.g., lighting and temperature control systems), working with the Department of Administration, and
  - energy audits and/or projects targeting certain energy end use areas – primarily Heating Ventilating and Air Conditioning (HVAC) systems, lighting, roof insulation, and windows (Energy Savings Survey Results, January 2008; Sustain Winona, 2007).

Despite these efforts and recognition of the importance of energy savings in Minnesota and elsewhere, implementing efforts on energy savings is difficult.

Achieving these energy savings goals can appear especially difficult when looking at projected increases in energy demand and GHG emissions that are the product of population and economic growth. Without a doubt, energy plays a pivotal role in the economic and social development of regions, states and nations. It is estimated that by 2030, global demand for energy will have increased by 60% (Netherlands, 2004). Global GHG emissions are also increasing. For example, the Intergovernmental Panel on Climate Change (IPCC) in their Fourth Assessment Report (FAR), measuring gigatons of carbon dioxide equivalent per year (Gt CO_2-eq/yr), estimates that globally, GHG emissions have increased about 70% between 1970 and 2004 (IPCC 2007: 4). This trend is also similar in the United States. For instance, although GHG emissions in 2006 in the Unites States were 1.5% lower than 2005, this was "the first annual drop since 2001 and only the third [drop in GHG emissions] since 1990" (EIA, 2007).

Minnesotans are well aware of the enormous challenges faced by the state, and also know that energy savings must be examined as a part of an overall state context. According to the United States Census Bureau (2005), the state is projected to grow 28.2% in population between 2000-2030. In addition, according to the United States Department of Commerce, between 1997-2006, the state's Gross Domestic Product (GDP) has grown about 56.8% (2007).

Moreover there are a number of barriers – economic, political and organizational among others – that influence the adoption of energy efficiency measures. In 2007, the State Legislature established, for the state of Minnesota, a policy goal to achieve annual energy savings equal to 1.5% of annual retail energy sales of electricity and natural gas. As a first step in leading by

example, through this report, the Legislature solicited advice on how to realize this goal within state government operations by identifying policy options, barriers and economic benefits and costs.

1.5 Study Methods

The DOC adopted some clarifications of the scope of the study recommended by the research team. The legislative cross-reference refers only to retail sales of electricity and natural gas because CIP is the mechanism through which the savings will be realized and verified. The DOC interpreted the legislative mandate to include analyzing all energy use at building sites that are owned, operated or used by the State Entities. Many state buildings are heated by steam generated from a variety of fuels or by energy sources other than natural gas or electricity. If other energy sources had not been included, the results of the study would have been incomplete and/or misleading.

The study did not specifically address the energy use of state organizations not named in the legislation, including the Legislature, the constitutional officers, the Minnesota Zoological Garden and the Minnesota Historical Society. The Legislature and some constitutional officers, however, reside in buildings that are operated by the Department of Administration.

The Legislature did not define a time period for how long the State Entities should try to achieve 1.5% annual energy savings, most likely because the initial legislative mandate does not specify nor intend an end date for the utilities' requirement. The DOC and the research team also recognized that the State Entities ' savings program could actually be a component of the larger statewide CIP programs and ensuing savings so understanding how much energy might be saved by State Entities could be useful information for the larger program.

For purposes of analysis as to how much energy could be saved within a given time frame by the State Entities, the research team assumed a 20-year period.

Site versus Source Energy

In addition, it is important to distinguish between source energy and site energy. Source energy "represents the total amount of raw fuel that is required to operate the building…it incorporates all transmission, delivery, and production losses, thereby enabling a complete assessment of energy efficiency in a building" (EnergyStar, 2007). Site energy on the other hand, is the amount of energy a building consumes (electricity and other energy sources used to heat and cool buildings). As information on energy transmission, delivery and production losses was not available, the research team decided to focus on site energy for the purposes of this analysis.

Information for this report is from both primary and secondary sources. The three principal methods for collecting quantitative and qualitative information were through:

1) responses to an on-line survey;
2) interviews and informal discussions with energy experts and;
3) results based on discussions with about 40 facilities managers from the State Entities and outside experts (e.g., engineering and architecture firms, a non-governmental organization) at a meeting to generate ideas and inputs on the above objectives, hosted by the Center for Science, Technology and Public Policy, Humphrey Institute of Public Affairs, University of Minnesota, on January 9, 2008. The discussion centered on a "Menu of Options" document the study team developed, based on information from survey results, interviewees and other studies on energy savings (please see Appendix G for the Menu of Options document).

The on-line survey had two components. **Part I** was a series of questions answered electronically. The purpose of the **first section**, entitled **General Details**, and asking for information about number of employees, students (where applicable), etc., was to obtain some understanding of the magnitude of energy use and costs in comparison to the size and volume of activity of an agency or campus.

The aim of the **second section**, entitled **Facilities**, was to obtain detailed information on facilities in which these State Entities' operate and information on renovations and construction planned or already underway. It also asked for detailed information on energy cost and use for Fiscal Year 2007, which respondents provided separately in an Excel spreadsheet.

In the **third section**, entitled **Energy Efficiency (EE) Information**, questions were asked in order to determine how much energy efficiency was a part of the culture of the organization, as well as obtaining information on costs and benefits of implementing various energy efficiency actions.

The **final section**, entitled **Opinions,** was to provide respondents with an opportunity to determine where to focus efforts to address barriers and develop policy options.

Part II was an Excel spreadsheet asking for detailed information on energy cost and use from the 2007 Fiscal Year (FY 2007).

2.0 There Are Information, Organization and Resource Barriers to Achieving Energy Savings in Minnesota Government Buildings

2.1 Establishing a Baseline

It is difficult to judge the costs or benefits of the proposed 1.5% annual energy savings goal without identifying the current level of energy use by the State Entities. For this reason, the research team recommends establishing a baseline as an important first step. The study sought to quantify current use and energy savings as much as possible, using information from the B3 benchmarking tool and additional data from campuses and state agencies. In the course of conducting the study, the research team identified a number of limitations on the quality of the data used in the baseline. These qualifications should be kept in mind.

Limitations

- A number of agencies and campuses do not have basic information on energy used (e.g., the amount of kilowatt hours (kWhs), British Thermal Units (BTUs)) used on a yearly or monthly basis.

- The main source of information on energy use for some campuses and agencies is through utility bills.

- Metering of buildings is not employed at all sites. For example, some of the MnSCU campuses have only one or a few meters campus-wide (whether the campus has, for example, one or 50 buildings). On the other hand, other campuses or agencies, such as the Duluth campus of the University of Minnesota have full metering on some buildings, but none on others (Personal Communication, MnSCU Office of the Chancellor and Facilities Management Team, University of Minnesota, Duluth, December 2007 – January 2008). Analysis is then conducted on a "site" rather than "building" basis, limiting opportunities for quantifying specific energy efficiency improvements.

- This baseline provides a preliminary snapshot for energy use and cost using information from the B3 database (using energy cost and usage data from 2004-2007) as well as MnSCU campuses, U of M campuses and some state agencies (using energy cost and usage data from Fiscal Year 2007) solicited in our survey. It will be important to develop a more detailed and accurate baseline, that also examines other factors such as the carbon content of energy sources. In addition, when examining comparable data over period of years, it will be important to adjust the data for weather variations. The US Department of Energy's Federal Energy Management Program, the standard used in establishing baselines for federal buildings, provides comprehensive guidelines (DOE, 2006). The B3 Benchmarking Tool can also develop a customized baseline based on the building's historical energy consumption. The B3 Benchmarking tool is also coordinating with the ENERGY STAR ® building Portfolio Manager program to implement seamless provision of an ENERGY STAR rating

within B3 Benchmarking. This will allow for statistical comparison to similar buildings nationwide, taking numerous variables into account such as normalization for weather and square footage (DOE, 2008).

Methods

It is helpful to estimate the total amount of electricity and natural gas consumed by state agencies and organizations in Minnesota. This offers insight not only into the amount of money spent on energy, but also into the amount of carbon emissions created by state government. Information for this analysis was taken from detailed Fiscal Year 2007 energy cost and usage data submitted by state agencies and campuses while completing the survey for this study. For agencies that could not provide detailed information, data was taken from the B3 Benchmarking Report prepared for this study by the Weidt Group (Appendix C). Energy information for the University of Minnesota, MnSCU, and state buildings managed by the Department of Administration can be found in Appendices D and E.

Table 2.1. Energy Use Summary

	Electricity (MWh)	Natural Gas (MMBTU)	Cost ($ Million)	CO_2 Emissions (metric tons)
State Government	233,107	3,109,748	27.37	333,441
University of Minnesota	399,330	2,221,141	38.99	405,793
MnSCU	289,982	4,981,115	29.51	474,031
Total	922,419	10,312,004	95.87	1,213,265

Summary of Baseline for State Entities

Minnesota's public institutions consume at least 922,000 MWh of electricity and 10,312,000 MMBTU of natural gas each year. This amounts to a total of at least $95.87 million a year in energy costs and 1,213,265 metric tons of CO2 emissions.

University of Minnesota

The University of Minnesota consumes more than 399,330 MWh of electricity and 2,221,141 MMBTU of natural gas each year. This results in annual energy costs of at least $38.99 million each year. Carbon dioxide emissions for the University of Minnesota amount to at least 405,793 tons per year. The University of Minnesota Twin Cities campus is by far the largest user of energy in this study, possibly due to its large area and variety of operations.

Minnesota State Colleges and Universities

MnSCU operates 53 college campuses throughout the state of Minnesota, so its aggregate energy use is also quite large. Together, MnSCU sites consume at least 289,982 MWh of electricity and 4,981,115 MMBTU of natural gas each year. This results in annual energy costs greater than $29.51 million. Carbon dioxide emissions for MnSCU amount to greater than 474,000 tons per year.

State Government

Minnesota's state government buildings consume at least 233,107 MWh of electricity and 3,109,748 MMBTU of natural gas each year. This results in annual energy costs greater than $27.37 million each year. Carbon dioxide emissions for state government amount to at least 333,441 tons per year.

Table 2.2. Estimated Annual Energy Consumption and Emissions

	Electricity			Nat. Gas				
	MWh	Cost ($)	CO2 Emissions (metric tons)	MMBTU	Cost ($)	CO2 Emissions (metric tons)	Total Cost ($)	Total Emissions (metric tons)
Department of Administration	73,110	5,509,047	52,639	103,588	819,514	5,516	6,328,561	58,155
Department of Corrections	59,050	4,133,483	42,521	384,700	3,846,974	20,486	7,980,457	63,007
Department of Human Services	34,378	2,406,482	24,755	201,900	2,019,380	10,754	4,425,862	35,509
Department of Military Affairs	23,691	1,574,647	17,061	208,259	1,723,477	11,089	3,298,124	28,151
Department of Natural Resources	6,737	471,595	4,851	13,400	133,521	711	605,116	5,562
Department of Transportation	22,811	1,740,975	16,424	2,105,401	1,129,895	112,112	2,870,870	128,537
MnSCU	289,982	17,114,216	208,787	4,981,115	12,395,868	265,244	29,510,084	474,031
UMN - Duluth	35,949	1,892,584	25,883	294,647	2,288,881	15,689	4,181,465	41,573
UMN - Morris	9,629	597,318	6,933	87,837	771,162	4,677	1,368,480	11,610
UMN - Twin Cities	353,752	22,373,004	254,702	1,838,657	11,069,324	97,908	33,442,328	352,610
Veterans Home Board	13,324	932,664	9,594	92,500	924,820	4,925	1,857,484	14,519
Total	922,419,298	58,746,015.00	664,151	10,312,004	37,122,816	549,114	95,868,831	1,213,264

2.2 Barriers

Information provided by survey respondents, meeting attendees and people interviewed revealed a common problem: many campuses and departments have considered energy efficiency measures but have been unable to act upon them. Six key barriers were identified:

i) **Inadequacy of Data:** the amount and quality of energy use and (source) data is inadequate;

ii) **Ensuring Long Term Sustainability of Policy**: it is difficult to sustain energy savings policies in the long-term;

iii) **Diversity of Campuses, Agencies and Buildings**: building and energy use and savings potential varies greatly among campuses and agencies;

iv) **Resource Scarcity**: despite long-term and/or life cycle benefits, resources for energy savings are scarce;

v) **Communication and Information Challenges**: there is a need for more communication, research and a common knowledge base about energy savings;

vi) **Organizational Inertia**: Ingrained practices and policies do not allow State Entities to easily face challenges in changing rapidly to accomplish energy savings.

i) **Inadequacy of Data.**

Clear, accurate data to serve as a baseline and tracking system is a fundamental need for identifying and measuring energy conservation activities. The purpose of benchmarking tools such as B3 Benchmarking and the ENERGY STAR Portfolio Manager is to help organizations make sense of and track their data, even when units of measure differ across energy sources. Informants requested more clarity on what to measure and asked for clearly defined goals and achievement criteria (Personal Communications, the Weidt Group and Department of Commerce, December 2007; Interviews, DOA, DOT, DNR, January 2008; Summary of Energy Savings Survey Results, January 2008).

Many respondents indicated a need to seek outside expertise to undertake energy savings measures. For example, North Hennepin Community College noted that they need to hire an electrical consultant to conduct a feasibility study with specifics on payback time before planned energy efficiency measures were undertaken (Summary of Energy Savings Survey Results, January 2008). Others noted that even when outside expertise was obtained, internal capacity was still required to undertake further analysis of these studies – fine-tuning general results to better match actual performance or conditions (Personal Communication, University of Minnesota, Twin Cities, Facilities Management Team, January 2008).

Moreover, the course of this study has revealed a lack of utility meters on sites with multiple buildings. As noted previously, a number of MnSCU campuses have only one or two meters for an entire campus that may contain a variety of facilities such as classroom buildings, offices and laboratories. In St. Paul, the Capitol Complex Loop reports only a single figure for no less than 12 buildings, across many departments, including the Capitol, Administration, State Office, and Transportation buildings. While submetering may occur at some physical locations throughout the Capitol Complex, energy data reporting and management at the administrative level for this area lacks detail and clarity. Adding meters will allow facilities managers to identify where savings opportunities exist. Such changes are necessary for legislation to have an appreciable effect on energy usage and savings. Without a separate meter on each building, it is difficult to develop an energy management system or a specific strategy for identifying and implementing energy efficiency improvements.

ii) **Ensuring Long-Term Sustainability of Policy.**
The second barrier noted by informants is ensuring the energy savings goal remains sustainable in the long-term, in the context of changing administrations, organizational leadership and priorities. Often, planning and programming is done short-term, requiring measurable results over a brief time frame in order to justify policy or programming continuity.

For example, while some important achievements on energy savings in state agencies were completed following Governor Pawlenty's Executive Order 05-16, this Order could be changed under a subsequent Governor. Specific goals and appropriate incentives will be needed to sustain a long-term policy. Therefore, it is important to include legislation to support goals established at the executive level to ensure sustainability on these issues over the long-term.

iii) **Diversity of Campuses, Agencies and Buildings.**
Major differences exist with respect to building type, size and use among and within state government departments, the University of Minnesota and MnSCU campuses. For instance, the Department of Natural Resources (DNR) operates large buildings, such as their head office in St. Paul, Minnesota, as well as many small buildings, such as fish hatcheries and public restrooms in state parks and highway rest areas. The University of Minnesota and MnSCU, in many instances, have energy use similar to industrial operations due to the nature of their activities (e.g., energy intense research laboratories, data centers, welding and automotive shops). The campuses also have dormitories, with energy consumption patterns similar to that of multi-family housing.

Variation also occurs – whether on a per building or per campus basis - with respect to:

- the data available
- building ownership –a number of state agencies lease their buildings, thus limiting the ability for facilities managers to implement energy efficiency measures.
- institutional culture – for some organizations, energy efficiency gets lost to other priorities. For example, one survey respondent indicated:
  - "Awareness programs [regarding energy savings] have been difficult in my organization as the facility population has other things on their mind. I am referring to the on-going Global War on Terrorism…[in this context] it is difficult to tell people to turn the lights off when they have other [concerns]."
- energy source – in many north and northeastern parts of Minnesota, buildings rely on electric heating, therefore increasing their electricity use substantially in the winter.

For these reasons, it is hard to describe a central solution considering the varying environments and activities of these organizations. This is important to keep in mind, as contributions for energy savings will also vary greatly depending on the building, agency, campus or organization. For example, one Department of Administration informant indicated that an important area to look at for energy savings is the baseline energy use in

"off" operating hours (e.g., 6 p.m. to 6 a.m. and weekends / holidays); he noted that in the Capital Complex Loop had a baseline in this time period "far too high."

iv) **Resource Scarcity.**

Another barrier identified was resource scarcity. Participants noted that this was a major hurdle. In essence, this barrier includes a lack of finances, staff, information, capacity, and time for energy savings issues. The most prevalent barrier identified was financial – either insufficient funds allocated to energy savings or competition with other priorities for funds. For example, MnSCU campuses indicated major discrepancies between what they requested and what they received for Higher Education Asset Preservation and Replacement (HEAPR) funds, which is one mechanism they use to undertake energy savings projects. The following table shows the difference between the amount of HEAPR funds requested in MnSCU's capital budget compared to the actual amount ultimately appropriated in the bonding bill.

Table 2.3 -- Higher Education Asset Preservation and Replacement (HEAPR) Funds Requested and Received by MnSCU Campuses 1998-2006

	1998	2000	2002/03	2004/05	2006
Requested	$91.0	$100.0	$100.0	$100.0	$110.0
Enacted	$43.0	$30.0	$60.0	$41.5	$40.0
Funding Received	48%	30%	60%	42%	36%

Personal Communication, MnSCU, Office of the Chancellor, January 2008

Energy savings efforts and investments are often not given priority over those projects yielding greater fiscal returns in the shorter term. In addition, if staff are interested in undertaking energy savings measures, these investments are often drawn from their operating budget. This hurdle is difficult to overcome because it involves a fundamental change in perception with respect to handling the fiscal aspects of an organization. Energy savings projects often require large, upfront investments in capital, although the benefits are widespread and are realized for a longer time period. This understanding leads to the need to maximize return on investment by choosing the right buildings – those with the most opportunity for energy savings. Ongoing financial incentives can also help correct the problem of longer payback periods for performance improvements.

Based on the information review process and discussions with various energy experts in Minnesota, the research team concluded that there is the potential to obtain energy savings of 20-30% through efficiency improvements to existing buildings. However, it is often difficult to implement many of the energy efficiency measures that would reap these benefits due to inadequate funds. Capturing these savings and putting them back into buildings is an important strategy to achieve the energy savings goal.

The State of Wisconsin, in a study on energy savings in public buildings, also noted a lack of finances and decreasing staff devoted to facilities management in public buildings as barriers to achieving energy savings goals (Mapp et al., 2006: 129).

A lack of finances in general, or finances competing with other areas is not unique to the public sector. For example, in an analysis of energy audits done for Small Medium Enterprises (SMEs) in Sweden, a key barrier for implementing energy efficient measures identified by respondents was competing priorities for capital investment (Thollander et al., 2007: 5779). This same study on energy audits for SMEs in Sweden, a key barrier for implementing energy efficient measures identified by respondents was a lack of time (Thollander et al. 2007: 5779). This barrier was also identified in a study evaluating the CIP program in Minnesota among cooperative and municipal utilities (Wilson et al. 2007: 2).

Facilities managers also spoke of the need for staff dedicated to energy savings and a lack of information and capacity in this area. A shortage of skilled staff was also identified in other studies in this area, such as Nadel's, assessing utility Demand-Side Management (DSM) programs (1992: 529).

This lack of resources is important because some existing expertise on energy savings outside of State Entities is not being used. For instance, survey results revealed that many are aware of outside resources but do not always draw from them because of insufficient time or resources, or the experts are unable to travel to their campus. Others indicated that they are leasing their buildings and so they are unable to control many energy efficiency decisions.

An inability to utilize expertise on energy savings due to a lack of resources is also a finding not exclusive to public buildings in Minnesota. Again in Sweden, regarding SMEs and energy efficiency measures, many face difficulties in obtaining strategic information on new and already existing equipment (Thollander et al., 2007: 5780).

Another Minnesota study also noted similar results. In this study, cooperative and municipal utilities also indicated that the Minnesota utilities CIP was difficult to implement, as they needed to acquire the necessary know-how to implement the program effectively (Wilson et al., 2007: 2). While true to date, there have been increased efforts among cooperatives and municipal utilities to work with Commerce to acquire those skills -- especially since legislation was passed following the Office of Legislature Auditor (OLA) evaluation on CIP in 2005 as well as the legislation passed in 2007, increasing the cooperatives and municipal utilities' responsibilities.

v) **Communication and Information Challenges.**

While the study found that there was often little or no communication between and within agencies and campuses on energy savings, almost all campuses and departments are looking for energy savings opportunities and many have done various energy savings measures in the last five years (2002-2007). Also encouraging is that there is increasing

communication between campuses and their leadership. For example, representatives from MnSCU campuses formally meet with their Office of the Chancellor twice per year to discuss various topics involved with facilities management including energy conservation aspects. This communication is also occurring within some state agencies. The Minnesota DNR has a departmental energy efficiency policy in place and an energy efficiency group that meets regularly with the Deputy Commissioner. Despite this, when speaking generally, energy experts repeatedly noted the lack of communication about this topic between agencies and campuses, and, in some cases, within the agency or campus.

Hand in hand with a lack of communications, some signaled the need for ongoing research on energy savings technologies and their actual performance. When looking at energy savings in new and existing buildings, there is a lack of feedback on what actually works in the field that could inform designers as well as establish the future research agenda. What is often the case is that designers have concepts of what might solve a problem but have limited tools to assess performance during design and no process to determine measurable outcomes once the building is completed.

In addition to this lack of research, many noted the need for one common place to turn to for information about energy savings in public buildings in Minnesota. People working on energy savings could obtain information on energy savings projects implemented in the region (including all stages of the project cycle – from planning to evaluation) and have one place to go to ensure they are using a standardized reporting format and common assumptions.

vi) **Organizational Inertia.**

The fifth barrier identified can be termed organizational inertia or the fact that these organizations already have ingrained practices and policies with respect to energy accounting, construction and renovation planning. This is particularly important when one examines the overall general goals of construction and operations. For construction contract awards, the bidder that receives the contract is often the one who proves they can meet the project objectives on time and at the lowest, initial cost, whereas operations focus on keeping budgets intact and allowing for growth. Neither approach is conducive to supporting energy savings initiatives.

While there is growing recognition about the environmental impacts involved in any organization's operations, initial cost remains the dominant driver for decision-making. This emphasis on cost also continues when considering which energy savings measures to implement.

Finally, and this was also noted in the third section on diversity, many facilities managers spoke about the difficulty involved in changing departmental or campus "culture." Both the U of M and MnSCU spoke about the challenge of trying to reduce energy use while at the same time meeting the needs of faculty members and staff. As an example, one MnSCU campus had many different classes going in different buildings in the summer. In this case, they decided to consolidate classes in one building for this time period.

However, another MnSCU campus noted that due to the specific needs of their students (e.g., ceramics, automotive technical capacity) this consolidation was not an option. The University of Minnesota-Twin Cities group also pointed out that Minnesota academic institutions are competing globally. In order to both be recognized as innovation hubs and be at the cutting edge of research to attract world-renowned experts would require large amounts of energy use in certain areas.

3.0 Minnesota Has a Wide-Range of Policy Options Available for Achieving Energy Savings in Government-Owned Buildings

This study revealed three types of policy options:

- Policies to *clarify the legislation*
- Policies to *enable organizations to reach the energy savings goal*
- Policies to *ensure the long-term sustainability* of the energy savings goal

3.1 The Legislature Should Clarify Energy Savings Goals and How They Are Measured

Energy Savings Goal

A goal for energy savings should be clarified and better-defined. In addition to the annual amount of energy savings that is desired for each agency to achieve, it is important to define how this amount should be measured and in what units it should be recorded. The method for annually calculating the incremental energy savings target needs to be clearly described, while the baseline for actual energy usage must be decided upon. Finally, so facilities staff and management can understand their role in achieving the energy savings goal, it is important to identify each State Entity to which the legislation applies.

One message that was repeated by facilities managers was the need to clarify the energy savings goal. If the legislature decides to proceed with applying a 1.5% annual energy savings goal, it is necessary to answer the following questions:

- What *units* of energy use (BTU, kWh) should be used to record energy and savings amount
- Which *baseline* should be used for energy usage
- Which *method* should be used for calculating annual targets

To answer these questions, the following policy recommendations emerged:

Policy Recommendation 1:
Require standardized reporting of natural gas and other fuels in BTUs, electricity in kWhs

Policy Recommendation 2:
Chose a method to determine annual energy savings targets with periodic verification

Policy Recommendation 3:
Find the energy use baseline using common assumptions for each building (site energy), then sum for a agency or campus

Policy Recommendation 4:

Determine the energy use baseline for a recent year such as 2007 with the best information available without waiting to obtain better individual building data

Policy Recommendation 5:

Clearly identify each State Entity responsible for achieving energy savings and include all State Entities unless there is a compelling reason for exemption. This does not preclude a portfolio approach in which those agencies or buildings, irrespective of agency, with the largest opportunity for cost effective savings would be the ones to first make improvements towards the goal. A flexible policy approach across agencies will help meet the goals most cost effectively.

Measuring and Units

Policy Recommendation 1:

Require standardized reporting of use from all energy sources and specify which measurement units to use for each source

The availability of consistent, verified and unambiguous data will be crucial to the success of the energy savings goals in both the short and long run. Energy management will require regular reporting of billing or metering information in a standardized format. A staff member at each department or site should be appointed to determine and record consistent monthly data. The staff member would record the data internally and make it available upon request for verification by an entity charged with sustaining the energy savings goals across state agencies, the University of Minnesota, and MnSCU facilities, and record data into B3.

Facilities and campuses have diverse methods of energy reporting and billing, determined primarily by the local electric utility. Some sites report natural gas using British Thermal Units (BTU, MMBTU), a very standard energy measurement unit, while others report using Therms or CCF (100 Cubic Feet) as a unit of measurement. These units are simply different methods of measuring the same type of energy.

Although it is possible to convert one energy unit to another, a clearly defined standard unit would facilitate the effective management of energy across multiple sites and entities. Electricity is most commonly reported in kilowatt-hours (kWh). Secondly, while it may be somewhat useful to roll up energy data across all fuel sources (e.g. natural gas, electricity and steam) into one figure, it is important to keep the data refined enough for future carbon emissions considerations. This becomes particularly important when examining carbon emissions through electricity in the state, region and country. This is because Minnesota is a state with a higher CO_2 production per kilowatt-hour, versus other states which use electricity generated from less carbon intensive sources, such as hydroelectricity and nuclear (Thomas, 2008: 45). Therefore, when accounting for energy usage, natural gas and other fuel sources should be reported using BTUs while electricity should be reported separately in kWh.

Annual Energy Savings Targets

Policy Recommendation 2:

Choose a method to determine annual energy savings targets with periodic verification.

In order to maintain comprehensible and achievable annual energy savings goals, it is important to define a method for calculating consumption and reduction levels over a certain time period. A period of 20 years will be used to examine the potential energy savings under this policy since it will span the various time frames already given for various energy goals.

As noted previously, the research team assumed an absolute target for energy savings of 1.5% annually. Three methods that have been identified for calculating annual energy targets are as follows:

- An absolute target of 1.5% energy usage reduction, using one initial baseline
- An absolute target of 1.5% energy usage reduction, using a rolling baseline (e.g. re-assessing the baseline every three or five years)
- An absolute target of 1.5% energy usage reduction based on the previous year's baseline (compounded annual reduction)

The 1.5% annual energy savings requirement is similar to the CIP program of Minnesota, as noted earlier, which stipulates that public electricity and natural gas utilities should achieve 1.5% annual energy savings (Minnesota Statute 216B.2401). This builds on previous legislation which required electric utilities to spend 1.5% (apart from Xcel Energy which is required to spend 2%) and natural gas utilities to spend 0.5% of their annual gross operating revenue on conservation programs. Changing from a spending requirement to a savings goal will require utilities to, overall, double the amount of energy savings that the spending currently provides. Furthermore, the Department of Commerce is required to report to the legislature in 2010 on whether spending requirements are still necessary to achieve the conservation goals or whether the move to the savings goal is providing the results the legislation required.

While similar, the approach being recommended here by the research team is different than the approach for utilities as the State Entities are direct consumers of energy and so have more control over their own energy consumption patterns than utilities have over their customers. The control over their own energy consumption patterns, will best manifest itself, however, if other recommendations are also taken by the Legislature, (e.g., appropriate meter installations).

The three methods of determining energy savings targets involve slightly different methods of mathematical computation. An annual reduction increment can be based on a compounded calculation, which adjusts to the previous year's level, or a linear

calculation, which holds a specific amount constant through a period of years. A compounded calculation results in a smaller target each year because it considers the reductions that are made annually. A linear calculation involves a repeating annual target that can be based on an initial baseline or on rolling baselines, which could be set every 3 to 5 years. An analysis of each method, found in Appendix B, is helpful in determining which would be the most appropriate for this legislation. Table 3.1, below, summarizes the pros and cons of each method.

Table 3.1. Pros and Cons

Method	Manageability	Efficacy	Transparency
Linear – Initial Baseline	Annual target held constant over time	Largest reduction and savings Simple calculation	Least complicated method
Compounded	May require more complex administrative analysis	Reflects reductions in previous years	More complex method
Linear – Rolling Baseline	Flexibility for periodic adjustments Minimal administrative requirements	Smallest savings and reduction achievement	Uses periodically updated baseline information

Projection of Energy Cost and Carbon Emissions

Annual and cumulative savings from reductions for energy usage and cost, as well as savings in the case of future CO2 emissions regulation, can be projected using the baseline estimates established in Section 2.1. After 20 years, there is a very clear economic and environmental benefit from annual reductions.

Table 2.1 indicates that Minnesota governmental operations spend at least $95.87 million per year on energy, resulting in at least 1,197,910 metric tons of CO2 emissions. Calculations for energy cost savings are determined using this estimate ($95.87 million) with the effective reductions for each method from Appendix B, Table V.

Emissions savings are determined by multiplying the amount of CO2 emissions (metric tons) by the estimated cost of emission ($/ton). In 2007, the Minnesota Public Utilities Commission estimated that CO2 regulation of electricity generation will cost between $4/ton and $30/ton for 2012 and thereafter (Minnesota Public Utilities Commission, 2007). Thus, Tables 3.2 and 3.3 report savings for a range determined by the low and high regulation estimate.

Table 3.2. Annual Savings After 20 Years

Method	Energy Cost Reduction ($ Million)	Emissions Reduction (metric tons)	Emissions Savings ($ Million)	Total Savings ($ Million)
Linear – Initial Baseline	28.76	363,980	1.46 to 10.92	30.22 to 39.68
Compounded	25.01	316,492	1.27 to 9.49	26.27 to 34.50
Linear – Rolling 3yr Baseline	22.61	286,088	1.14 to 8.58	23.75 to 31.19
Linear – Rolling 5yr Baseline	22.97	290,710	1.16 to 8.72	24.13 to 31.69

Compounded annual reduction will result in an annual savings of at least $25 million in energy costs. CO2 emissions will be reduced by at least 316,492 tons annually. With a regulatory cost of $4 – 9/ton, total annual savings would be at least $26 million to $34 million.

Similarly, linear reduction with an initial baseline will result in an annual savings of at least $28 million. CO2 emissions will be reduced by at least 363,980 tons annually. Total annual savings would be at least $30 million to $39 million.

Table 3.3. Cumulative Savings Over 20 Years

Method	Energy Cost Reduction ($ Million)	Emissions Reduction (metric tons)	Emissions Savings ($ Million)	Total Savings ($ Million)
Linear – Initial Baseline	301.99	3,821,785	15.29 to 114.65	317.28 to 416.64
Compounded	275.14	3,482,022	13.93 to 104.46	289.07 to 379.6
Linear – Rolling 3yr Baseline	258.17	3,267,238	13.07 to 98.02	271.24 to 356.19
Linear – Rolling 5yr Baseline	263.09	3,329,442	13.32 to 99.88	276.4 to 362.97

Over 20 years, compounded annual reduction will result in a cumulative savings of at least $275 million in energy costs. A total of at least 3,482,000 tons of CO2 emissions will be prevented. This may result in a cumulative savings of $289 million to $379 million due to savings from CO2 regulation costs.

Similarly, linear reduction with an initial baseline will result in a cumulative savings of at least $301 million. A total of at least 3,821,785 tons of CO2 emissions will be prevented. This may result in a cumulative savings of $317 million to $417 million.

Implementing an annual energy usage reduction will result in annual savings of at least $22 million and a cumulative 20 year savings of at least $258 million. With a high likelihood for regulatory CO2 emissions costs, potential savings could be even

greater. After 20 years, annual reductions will also prevent at least 3,267,238 tons of CO2 from being released into the atmosphere. These projections present an unmistakable benefit in both economic and environmental terms.

Method Analysis and Recommendation

It is necessary, however, to maintain a balance between effective reduction targets and achievable goals. Additionally, establishing goals with the most efficient and least cumbersome administrative needs would be most conducive to successfully achieving annual targets. An annual linear reduction from an initial baseline would yield the largest effective reduction and cumulative savings after 20 years. However, the perpetual use of an initial reduction amount may be challenging as organizations continue to reduce their annual consumption by taking energy savings actions.

Another option is to use rolling baselines with a linear annual reduction. This would allow flexibility for periodic adjustments while maintaining minimal administrative requirements. This method includes an automatic adjustment of reduction targets to more reasonable levels in light of an organization's annual energy saving achievements, as well as a periodic opportunity to intervene or revise targets based on an organization's efforts.

A third choice is to a use compounded annual reduction, which would make annual adjustments to the reduction target based on the reduced consumption level of the previous year and would recognize progress made in reducing energy use. The actual performance of an organization could then be compared with the ideal performance of a compounded annual reduction (Appendix B, Table IV). While yielding greater reduction and savings than a rolling baseline method, compounded annual reduction requires annual review of targets and may require complex or burdensome administrative analyses. One way to counteract the drawback would be to require an official account through verification of energy savings only every three years while retaining the compounded annual reduction goal.

The legislation should consider the secondary administrative demands that any annual targets would require so that any benefits gained from energy savings are not offset by costly management tasks. However, the policy must set an aggressive goal so that State Entities can do as much as they can to work towards the larger aims of increased energy efficiency, reducing greenhouse gas emission and protecting the environment.

Baseline

Policy Recommendation 3:

Find the energy use baseline using common assumptions for each building (site energy), then sum for agency or campus.

Policy Recommendation 4:

Determine the energy use baseline for a recent year such as 2007 without waiting to obtain better individual building data.

In the interest of maintaining clear policy goals, a baseline for setting annual targets must be defined. Again, because much of the energy savings efforts will be concentrated on building design, renovation, and recommissioning, a baseline for every single building should be determined. It is also important to note that in the case of future involvement in carbon trading exchanges, a climate exchange association will most likely demand thorough and verifiable baseline energy data. Energy usage should be defined as site energy, or energy that is coming into the building.

For the purposes of this legislation, it is more appropriate to consider only site energy and not source energy, which also considers power plants and other source analyses. Active onsite generation, such as photovoltaic panels or wind turbines, should be recorded but should not be considered as part of the baseline or energy savings. Onsite generation is often achieved through renewable or similar sources and should be calculated as a source of energy rather than an instance of energy savings.

An agency or campus should then create a combined total baseline for their entire agency or campus and work toward an 1.5% annual reduction of the total.

This provides a balance between entities that have extensive per building efforts, such as the University of Minnesota - Twin Cities, against other agencies that do not have as clearly outlined efforts to date.

As previously mentioned there are currently many issues with metering that need to be resolved to facilitate estimation of accurate baselines. Of specific importance is the Capitol Complex Loop, which provides one electricity figure for 12 buildings across multiple state agencies. It would be hard for the various agencies throughout the 12 buildings to have unique efforts when their individual contributions are not tracked or cannot be found in billing records. That said, it is desirable to begin energy savings efforts started immediately, using the best quality data currently available, in which case a baseline energy usage may be determined or estimated for years such as 2005 through 2007, recognizing the need for more accurate data in the future.

Applicable Entities

Policy Recommendation 5:

Clearly identify each State Entity responsible for achieving energy savings and include all State Entities unless there is a compelling reason for exemption.

The legislation needs to provide a clear and unmistakable list of agencies and entities that are covered under the energy savings plan. There should be no doubt whether an agency needs to abide by this policy or not (for a complete list of affected entities, please refer to Section 1.3 – Table 1.1, page 3 of this report).

The statute requiring this analysis did not include the *Minnesota Zoological Garden, Minnesota Historical Society, Iron Range Resources, the Legislature or the Constitutional Officers*. The inclusion of these entities should be considered because they contribute to state government energy use and there are no major barriers to energy savings efforts unique to these entities that can be identified. The Department of Administration, which manages the building space of the Legislature and Constitutional Officers, is an important resource for these staff to turn to when considering decisions affecting energy use (e.g. installing new computers which typically affect peak loads for electricity use). Coordination between these parties is essential, as these decisions can have major implications for energy use and savings.

Furthermore, the Legislature should consider the role of the Metropolitan Council in helping to achieve energy savings goals as a regional agency appointed by the Governor. The availability of information and resources for smaller entities such as city and county governments is also important to consider.

3.2 The Legislature Should Adopt Policies That Enable State Entities to Meet Energy Savings Goal

The second type of policies identified were those that would enable agencies and campuses to reach the energy savings goal. Specific questions that came up include:

- How to *measure* the amount of energy savings
- How to *finance* any energy savings measures
- Is there a centralized "hub" for energy savings information and assistance?
- Do we have the internal capacity or funds to utilize external capacity to take on these goals?

To answer these questions, the following policy recommendations emerged:

Policy Recommendation 6:
Install electric and fuel use meters on all existing and new state-run buildings.

Policy Recommendation 7:
Expand the use of existing funding sources for energy savings projects and consider appropriating additional funding.

Policy Recommendation 8:
Establish a one-stop shop for energy savings

Policy Recommendation 9:
Require energy savings training for building operators and users.

Measurements

Policy Recommendation 6:
Install electric and fuel use meters on all existing and new state-run buildings.

This area provides great potential for legislation to be swiftly effective through simple policy implementation. Mandatory metering at every single building on an agency facility or campus would not only make possible the effective reporting and management of energy data, but would also provide momentum for further energy savings efforts.

While the construction and integration of new meters will require funding and time commitment, it will provide swift and tangible benefits that will only further the goal of this policy. Therefore, it is advisable that the legislation require and fund the implementation of electric, natural gas and other fuel meters for all buildings that are part of state agencies, U of M, or MnSCU facilities.

Smart meters could be evaluated as to their effectiveness in gathering such disparate data into a central location. One cost effective smart meter option is through an Application Service Provider (ASP), providing detailed information on all aspects of building use, including energy, such as NorthWrite Inc's "WorkSite" program. An ASP is a software program for facilities management that can be accessed by facilities through a web browser and internet connection (Bramley et al., 2004: 1). Using smart meters in State Entity facilities could serve as a pilot project for utilities across the state.

Requiring energy sub-metering for all state buildings was also a recommendation by state agencies in their Saving Energy Report to the Governor (DOA and DOC, 2007: 11).

Studies have also demonstrated that metering energy consumption "actually provides one of the highest returns on investment of any energy expenditure" (Lewis, 2005). Discussions with facilities managers and other energy experts indicated a similar message echoed by other studies – namely that "you cannot manage what you cannot measure." Expected energy savings can be from 2% - 5%, however they can be as high as 5% - 15% if there are also periodic reviews of energy consumption (e.g., three to four times per year per building) (Lewis, 2005). The costs of implementing meters and software vary as shown below:

- A Data Acquisition Server (DAS), which connects to all meters, time dates the information, then sends the information to a remote server. The cost would be $1000-$1500 to install.

- Electric meters can vary greatly in price. For instance, Lewis (2005) estimates that they can cost between $500-$1000, depending on the size and information provided (e.g., just energy use or also quality of power). However, a study by the Congressional Budget Office examining the feasibility of installing electric meters on federal government buildings, using information from the DOE, estimates that installing electric meters would cost about $4,000 per building (CBO, 2003: 10).

- Natural gas meters can vary greatly in price (differences in size, pressures, etc.), ranging from $200 - $3000.

- Steam meters generally cost over $1000 to install (Lewis, 2005).

The quickest way to implement this policy would be for the legislature to provide funds for this initiative. Recognizing the magnitude of this task – for instance, it has been suggested that installing meters to obtain the necessary data would cost about $3 - 5 million for MnSCU campuses alone (Personal Communication, MnSCU, Office of the Chancellor, February 2008) – legislative appropriation of funds would be necessary. Some options for implementation include, as a first step, having a series of pilot projects such as a state agency, a MnSCU and U of M campus, or a group of buildings within agencies and campuses (Lewis 2005). Perhaps State Entities can serve as a pilot project for smart meters for the utilities. Alternatively, it may be more practical to start by metering larger buildings (e.g. > 5,000 SF) and aggregate electricity use from smaller buildings.

The State of Wisconsin, also recognizing the need for meters in order to determine accurate energy use, is launching an effort to install more building meters, planning sub-metering equipment, and installing internet-based energy tracking software which tracks energy use in real-time from a central location (Mapp et al. 2006: 127).

Funding Options

Policy Recommendation 7:
Expand the Use of Existing Funding Sources for Energy Savings Projects and Consider Appropriating Additional Funding

i) *Revolving Loan* – make better use of, establish or modify an existing loan fund using funding sources separate from capital and operating budgets (e.g., financed through government bonds, or a one-off cash investment). Projects eligible can be all of those that help organizations meet this energy savings goal. Thus, projects with major energy savings but longer payback times can also be considered. Criteria to assist prioritizing projects could include payback time, return on investment (ROI), overall energy savings, and other benefits (e.g. amount of reduced GHG emissions and other pollutant emissions).

One fund that can be drawn from is the **Shared Energy Savings** program. Here, CenterPoint Energy (formerly Minnegasco) established a grant in 1984 (Minnesota Statute 16B.32 Subdivision 3) for $580,000 for state agencies and MnSCU to conduct energy savings activities in areas serviced by CenterPoint Energy. The fund is managed by the Department of Administration, where the borrower receives the loan at 0% interest, and pays the loan back through energy savings. However, one challenge with this fund is that it only covers those territories in Minnesota serviced by CenterPoint Energy.

Another existing revolving loan fund for energy savings for Minnesota public buildings is the **Energy Conservation Financing** program. This loan is available to city, county, and private and public school buildings (DOA and DOC Report, 2006: 10). However, in the past, this fund has not been utilized to its full potential as school boards were finding it difficult to access (e.g. school boards would have to receive a waiver from the federal government in order to obtain finances through this mechanism). In addition, this experience has yielded the following challenges:

- the need to draw on external expertise in order to identify and pursue energy savings measures;
- the perception that any action on energy savings will mean that other areas will have to "go without";
- the trepidation by potential borrowers to undertake projects as the energy savings forecast may not actually occur.

For this reason, the Department of Commerce is proposing the **Minnesota Public Building Enhanced Energy Efficiency Program (P-BEEEP)**. Under this program, the state would provide technical assistance to identify and pursue energy savings measures. Borrowers would be eligible for financing through a private finance entity and the state would guarantee that cash-flow during the finance period would be neutral (i.e. taking on these energy savings measures would not have negative implications for their programming and/or operations budget (the cost of, or when actual energy savings are less than those predicted). When actual energy savings exceed those predicted, the borrowing agency or campus could put "surpluses" (Personal Communication, Department of Commerce, January 2008).

However, another challenge with these existing funds is that, generally speaking, due to overhead costs these funds require proposals of a minimum of a few hundred thousand dollars. Many facilities managers therefore suggested that there be two types of funds – one for large projects, and one for small projects (e.g. $50,000 or less -- those at the Energy Management System level).

New revolving loan fund ideas include:

- Establish a non-profit organization, financed through bonds modeled on the State of Iowa's Facilities Improvement Corporation. The proceeds from the bond sale were used for energy improvements to buildings managed by several state agencies. In 1999, the program paid off its original bond issue a year early, saving $130,000 in interest (EPA (draft), 2007).

- Alternatively, a loan using below-market interest rates (initially established by creating a fund) can finance energy efficiency projects. As initial loans are paid off, the payments replenish the fund for future projects. An example is the Texas LoanSTAR program, which is a legislatively mandated program administered by the State Energy Conservation Office (SECO). This loan program has generated more than 127 loans to public institutions since 1989 and has saved more than $100 million in energy costs (EPA (draft), 2007).

ii) *Establish a minimum percentage of the cost of new buildings projects for energy efficiency initiatives* - This could be called "Percent for Energy" and would be similar to Minnesota's Percent-For-Art in Public Places program, established in 1984 and managed by the Minnesota State Arts Board, where 1% is set aside in capital budgets to purchase public art for building construction or remodeling projects. This could be a requirement to receive project funds. The advantages of such a program are that it is easily understood, it automatically scales with project size, and it puts energy saving expenditure decisions in context with the overall budget. For example, with a $70 million new building project, a certain minimum percentage, for instance 2% ($1.4 million), would be set aside for use on energy efficiency components of the building. A single minimum percentage should be determined to be used for all projects. While some projects might set higher goals, this would reserve a minimum amount of funds devoted to energy savings. It will be important to consider how to enforce this directive. For instance, the University of Minnesota's Regents agreed to allocate 1% of new building projects for energy efficiency efforts. However, this policy is not consistently implemented when it conflicts with competing programming needs (Forecast Public Artworks 2002; Personal communication, University of Minnesota, Twin Cities, December 2007; Personal Communication, Greg Maxam, Architectural Alliance, February 2008).

iii) *Set aside a fixed dollar amount to do energy savings projects* – an example could be drawn from the University of Minnesota-Twin Cities campus which has a division specifically for energy savings and a budget of $3 million / year (this includes staff salary, analyses, etc.). If they find an opportunity with a payback of five or six years or less "they go for it" (Personal Communication, Facilities Management, U of M, Twin Cities, January 2008). Perhaps this model could be

applied to MnSCU (e.g., Office of the Chancellor), state agencies (e.g., at the DOA's Energy Management Services division), and the rest of the University of Minnesota's campuses could also have an energy savings division similar to the Twin Cities campus.

iv) *Third party financing* – Energy performance contracting is the most common method of third party financing. Typically a contractor or vendor, such as an energy service company (ESCO), will provide the upfront costs required to undertake energy savings measures. The ESCO guarantees that energy use will be reduced by a quantifiable amount after the recommended energy savings measures are implemented (DOE, 2007).

As noted above, one example of this type of financing in Minnesota already in existence is the Guaranteed Energy Savings program (Minnesota Statute 16C.144). In this program, funding is obtained through a private financing entity with guaranteed energy savings by the vendor. A vendor completes a detailed energy audit, recommending energy savings actions (e.g. lighting – changing T-12 to T-8 fluorescent lights, controls - putting on new additions for energy management systems, etc.) prior to entering into a Guaranteed Energy Savings program agreement. Once the State Entity agrees to undertake the suggested measures, the costs of the energy audit will be considered part of the implementation cost. The payback period, including financing, is expected to be 15 years or less. Although other co-benefits can often occur (e.g. switching from T-12 to T-8 lighting often results in better lighting for building users) the benefits considered are energy savings: 1) reduction in energy consumption (utility costs) 2) reduction in operations and maintenance costs. As of January 2008, the Department of Administration's Energy Management Services (EMS) completed three projects under this program, saving $144,000 annually in utility and maintenance costs and has a fourth project under construction (DOC and DOA Report, 2007: 10; Personal Communication, Energy Management Services, DOA, January 2008).

One important public-private partnership state agencies and campuses can draw from is the Energy Services Coalition (ESC). This initiative began in Utah and Colorado but now operates nationally.

The Michigan Department of Corrections hired an Energy Service Company (ESCO) to perform a thorough energy audit on two state prisons. The ESCO also developed a series of energy efficiency recommendations (e.g. lighting upgrades, variable speed motor drives, etc.) at an estimated cost of US $454, 426. However, energy savings over the term of the agreement was $955, 364 (16% more than forecast). Under state law, the agency was allowed to retain 75% of the savings each year to be put toward future energy efficiency projects (EPA 2007, p. 3-12).

Harvard's Green Campus Loan Fund – was based on Harvard's Resource Conservation Incentive Program (RCIP) which provided interest-free loans for conservation activities on campus and had a budget of $1.5 million. In 2001 $3 million was provided by Harvard Bank to provide an interest free loan for conservation projects with payback of 5 years or less. This Loan Fund has since grown in Fiscal Year 07 to a budget of $12 million, and includes new construction projects as well as conservation projects (Harvard Green Campus Initiative, 2007).

v) *Draw from CIP funds* – other suggestions included creating more awareness about CIP opportunities among facilities managers and establishing links between CIP project managers and facilities managers. However, one challenge with this option is the fact that a number of individual utilities in Minnesota do not have the capacity to support such a program – a challenge particularly acute in the case of those agencies and organizations located in greater Minnesota (e.g. MnSCU, Department of Military Affairs, Department of Transportation). The Department of Commerce is encouraging cooperatives and municipal utilities to aggregate CIP funds to finance larger projects.

In sum, efforts to provide financing for energy savings have met hurdles, but lessons have been learned from this past experience. For this reason, of the models suggested, we recommend focusing on those options that are least costly for the State, that have clear performance and return criteria and that ensure energy savings measures do not come at the cost of other budgets (i.e. a separate source of funds). Previous studies in this area show that loans can be a particularly effective energy savings tool for those energy customers that do not have sufficient cash to finance energy savings efforts. Financial incentives are particularly important because they often help to increase program participation and energy savings (Nadel, 1992: 518 and 521).

Outreach and Training

Policy Recommendation 8:
Establish a One-stop Shop for Energy Efficiency

A number of respondents suggested that having one "'go to" place would be very useful in helping them to achieve the energy savings goal. It will be important to ensure that any such place receives appropriate funding and resources to carry out these responsibilities.

This could be something similar to Canada's Office of Energy Efficiency (OEE), which includes the private and residential sectors across the country. This one-stop shop could provide training, serve as a clearing house for information sharing, advice on resources available with respect to retrofitting and building design/construction, conducting research on energy savings technologies and regional performance, and tutorials on establishing and maintaining baselines. In addition, this shop could

provide a guidebook for facilities managers – with a uniform set of standards and assumptions for the state. This could feed into current efforts to establish an ongoing inventory of sound energy efficiency programs under the CIP. Moreover, this shop could house a website for all agencies to regularly report energy data, and share information. This energy efficiency shop could also help organizations use energy modeling programs for new and existing buildings. For example, the Energy Design Assistance program used by Xcel Energy and the Weidt Group, could be modified to incorporate existing buildings. This energy efficiency group could also have in-house engineers to travel to various campuses and agencies.

In the case of the State Government, MnSCU and University of Minnesota, this could be housed within the Department of Commerce. Legislation had previously assigned the Commissioner of Commerce (Minnesota Statute 216C.02, Subdivision 1 (b)) similar duties but sufficient funding has not been made available to carry out these tasks.

Another alternative is to extend the responsibilities of the one-stop shop to serve as a "go to" place for not only State Entities , but also other public buildings (e.g. schools, municipal offices) and types of buildings (e.g. residential). This center could be a regional hub for energy savings in new and existing buildings – drawing from experiences in Minnesota and beyond, ensuring features unique to the region, state and parts of the state (e.g. energy saving features for colder climates).

Policy Recommendation 9:

Require Energy Savings Training for Building Operators and Users

To get continued energy savings and to help integrate energy savings into day-to- day practices it is important to have experts and champions. There are two aspects of this training: 1) experts – building operators, and energy managers, and 2) users.

With respect to experts, building operators with sufficient training are essential to understand when maintenance is necessary. A Building Operator Certification program, such as the course run by the Midwest Energy Efficiency Alliance could be subsidized by all utilities and required by all State Entities

.

To maintain consistent reporting and goal setting, a standard training program and resource library should be developed to teach facilities managers how to measure, energy use and achieve energy savings goals. Training should be done at the start of any new employee's position, and should be implemented for current employees.

The resource library should provide examples on calculating a baseline and energy reduction goal, and recording the information in a standardized form. This information could be provided online, perhaps at the same site where annual energy reports may be submitted.

For instance, MnSCU provides many of the state's building operator programs. Ensuring this curriculum encompasses energy efficiency opportunities (ways to identify, the short term investments required to ensure long term benefits, etc.) could be an important opportunity. Also, by offering higher salaries, facilities management could be a more attractive career option for graduates.

With respect to users, drawing from the Department of Administration and Department of Commerce's Energy Savings program where seminars were given to state government employees, these seminars could be given to campus administrators and faculty. Schools for Energy Efficiency (SEE) is a comprehensive program designed for K-12 schools to save energy and money by changing behavior throughout a district. Participating schools have seen immediate and sustainable results with annual energy use reduction ranging from 10-20% and most schools achieving national recognition through ENERGY STAR awards. The SEE program helps guide school districts through a unique approach using strategies for both efficient facility operations and engaging energy awareness materials for staff and students. The comprehensive plan begins by empowering everyone in the school district to make changes in day-to-day habits to save energy. Each year new energy-awareness campaigns and no-cost and low-cost strategies are added to continue the district's successful energy savings. SEE provides a multi-year plan with training, materials, utility tracking and support required to manage an energy efficiency program in a school district. In less than five years the SEE program has expanded into 400 schools and of the 250 schools reporting current results, the annual energy use savings range from 10-20% with a total of $10 million dollars in avoided utility costs so far (Personal Communication, DOC, January 2008).

In cooperation with gas and electric utilities in the state, the Department of Commerce has identified a set of minimum qualifications for residential energy auditors who will be doing work for utilities. The Department is in the process of developing and implementing courses of instruction, as well as procedures to verify the competencies of auditors according to minimum qualifications. Efforts are also underway in Minnesota to streamline requirements for commercial energy auditors, which will be useful in establishing a state-wide energy savings strategy.

Another target audience for energy savings training is the senior management personnel of these entities, such as Commissioners and University and College Chancellors, Provosts and Presidents. For instance, EnVINTA Corporation's One-2-Five software program is a diagnostic tool that can be used by senior managers to assess their internal systems and procedures to manage energy costs and risks across their agency and/or campus(es) – comparing their organization's practices with best corporate practices (EnVINTA, 2008).

This need for training on energy savings has also been recognized in previous studies, such as the Department of Administration and Department of Commerce's State Agencies Energy Conservation Report (2007: 10).

3.3 The Legislature Should Adopt Policies that Ensure Long-Term Success in Achieving Energy Savings Goals Across All State Entities

The third type of policies identified were those that would enable agencies and campuses to reach the energy savings goal. Specific questions that came up include:

- Ways to help agencies and campuses reach this goal
- How to verify measurements
- How to integrate energy savings into everyday practices

To answer these questions, the following policy recommendations emerged:

Methods to Encourage Energy Savings

Policy Recommendation 10:
Provide Incentives

i) Integrate the decision process for construction, operating and programming budgets
ii) Make existing rebates easier to access and encourage utilities to offer more
iii) Provide recognition for energy efficiency champions
iv) Allow flexibility to reach the Energy Savings Goal – within and / or between agencies and campuses
v) Translate the energy savings into GHG emissions as well as dollars and energy metrics (e.g. MMBTUs, kWhs)

Financial

i) *Integrate the decision process for construction, operations and programming budget.*

Facilities managers repeatedly noted that those involved in building construction were not engaged with those involved in building operations. These budgets are often separate, resulting in decisions being made that were less costly in the short term (bringing down the construction project overall cost), but ultimately proving to be more expensive for agencies and campuses in the long run. Also, for a number of state agencies, funds for energy savings measures came out of their operations budgets, making them unattractive options for building operators. In essence, all facilities managers emphasized that energy savings measures should not come at the expense of reducing other operations or programming needs.

One model to look to regarding energy savings is MnSCU's. Investment decisions are taken strategically, linking those charged with construction with facilities managers and programming staff. Under their system, management considers all of these aspects when undertaking a project decision. For example, MnSCU's buildings generally use a built-up-slope to drain the roof, which lasts at least 40 years, rather than single ply roofs (which cost 20-30% less), which generally last between 15-20 years (Personal Communication, MnSCU Office of the Chancellor, January 2008).

Thinking long term, these budgets could be linked by incorporating energy savings measures as another aspect in the capital bonding process. For instance, major remodeling or new building plans that incorporate significant energy savings could be given the higher rankings in project priorities.

Another suggestion is to link operations with programs. Here agencies, departments, or campuses that reduce operation costs as a result of energy savings measures are allowed to use this money for their programs. As an example, the University of Minnesota recently went to a new budget model. In this model, departments pay for their own energy use. Any money saved from being spent on energy costs can be used for their own programs. So that departments or agencies are not penalized for their efforts, energy budgets are normalized based on the past five years of energy use data (Personal Communication, Facilities Management Team, University of Minnesota, Twin Cities, January 2008). If energy savings projects were financed through a loan, they could be given flexibility in terms of the time needed to pay it back. For instance, 50% of the savings could go towards paying back the loan and the other 50% can be used for their programs. In order to ensure the effectiveness of any such endeavor, it is important to place a cap relative to the size of the agency or campus' budget on how much of these savings can go into programs (Personal Communication, Jay Kiedrowski, University of Minnesota, January 2008).

ii) *Make existing rebates easier to access and encourage utilities to offer more.*
Many MnSCU, U of M and State government department campuses were aware of and applied for rebates offered by utilities, through CIP, for energy efficiency measures. However, some MnSCU campuses noted that it should be easier to access them. As a note, CIP is undergoing substantial changes because of the legislation and it is likely that increased partnership with utilities to obtain energy savings will be occurring.

Other Incentives

iii) *Provide recognition for energy efficiency champions.*

It is important to promote energy efficient buildings so that other building owners, state employees, and Minnesota citizens understand the State Entities ' efforts. This recognition could occur by providing awards to those agencies, campuses and/or buildings that follow the Minnesota Sustainable Building Guidelines, Leadership in Energy and Environment Design (LEED), or even Architecture 2030 as it evolves.

iv) *Allow flexibility to reach the energy savings goal – within and/or between agencies and campuses.*

Given the diversity of factors affecting energy use, including population of buildings, priorities, and energy sources, there is no one size fits all approach in achieving this energy savings goal. Thus, it is important to structure incentives to allow for decision-making at the operational level.

Although it is important to point out that a number of uncertainties exist around this option, allowing for flexibility in achieving the goal would be helpful for State Entities. Defining a specific goal for a 1.5% energy usage reduction per year is helpful in maintaining constant efforts and mindfulness in energy savings. However, it may be unreasonable to expect an entity to conform annually to a 1.5% target. Some years may include renovation or procurement of new equipment and buildings which would provide a very large increase in efficiency. Other years may include planning for such measures that may not be scheduled to be implemented until the next period. Therefore, it is necessary to provide some *flexibility* from year to year in achieving annual energy savings targets.

Within agencies and organizations
For instance, if an agency were ahead of its goals one year, its efforts could roll over into the next or be saved or "banked" for future years when the goal might not be met. Alternatively, an agency or campus could be responsible for its own efforts for a number of years while an external entity verifies their efforts after a period of time. An agency might not meet a 1.5% target every year, but may achieve 4.5% or an equivalent average, after 3 years.

Between agencies and organizations
Similar to the carbon trading system, or Renewable Energy Certificates, this would be along the lines of offsets, or "energy efficiency certificates." As an example, if one campus was able to achieve a reduction of 3% of annual energy use in a particular year, perhaps these savings (or "credits") could be transferred to another campus that was unable to reach the energy savings goal. Agencies or departments could "bank," or save these credits for use in another year to help them achieve their energy savings goal for that year, or trade these "credits" with other agencies and / or campuses.

It is also important to provide equivalent incentives across all agencies/campuses without penalizing an entity for being in a certain environment or at a certain level of progress. In other words, these State Entities can be treated as a single enterprise.

We recommend allowing each agency or campus to determine how they can best operationalize this goal.

One way to help agencies and campuses determine which strategies to pursue would be to look at those yielding the most energy savings. According to discussions with facilities managers, two key areas that realize major savings in energy use are district heating (e.g. steam) and roof insulation. An alternative way is to pursue energy savings opportunities which yield the highest return on investment (ROI). For instance, with respect to existing buildings, Minnesota's B3 building energy program can help to guide effective allocation of energy conservation investments. The process relies on a web-based tool through which building representatives enter data, including physical characteristics and utility bills. The user can immediately see how their building compares to an individualized benchmark of energy consumption. Buildings with actual energy use significantly above their modeled benchmark are most likely to have a better ROI for conservation investments. Buildings are stack-ranked in order of best opportunity for energy savings.

For some entities, maintaining an absolute energy reduction target regardless of the size of physical facilities, employee operations, or growth may appear burdensome and discouraging to the agency or campus mission. Therefore, the legislature may wish to consider use of an *energy intensity* target rather than an absolute energy reduction amount. An energy intensity measurement would find the amount of energy used per each unit of some departmental operation. Examples of energy intensity include BTU/ft^2 and kWh/person. For example, if faced with a growing prisoner population, the Department of Corrections may find it difficult to achieve absolute reduction, but could improve performance on an energy use per square foot or per inmate basis.

vi) *Translate the energy savings into GHG emissions as well as dollars and energy metrics* (e.g. MMBTUs, kWhs).

As more organizations (e.g. cities, universities, state and countries) are moving to a voluntary or mandatory carbon trading system – attaching a monetary value to the amount of carbon emissions saved – any carbon credits that are generated as a result of energy savings could be another incentive for State Entities to reach the established goal. It will be important to pay attention to who receives the benefits from any generated carbon credits.

Methods to Ensure Energy Savings Occur

Policy Recommendation 11:
Establish a group charged with goal enforcement.

While this report has emphasized incentives to help achieve the goal rather than penalties for not achieving this goal, in designing an energy savings program, the Legislature may want to consider negative consequences for failure to achieve goals. One way to do this would be by setting up an agency within the government or by using an independent source whose task would be enforcement of the goal through various activities such as requiring agencies to conduct energy audits, verifying data and highlighting potential "red flag" areas. This would be similar to requirements already in place under CIP, which stipulate that energy managers must track energy use to get savings.

Policy Recommendation 12:
Institutionalize policies and measures to reach the energy savings.

One of the conclusions from the survey demonstrated that while there are some definite energy savings champions throughout these organizations (e.g. Winona State University, Department of Natural Resources, among others). Generally speaking, however, energy savings is not part of the "culture" of every state organization. For example:

- Only about 60% of MnSCU campuses, parts of the University of Minnesota, and about 70% of MnSCU and state government departments feel their campus or department is energy efficient.
- Only two thirds of MnSCU's campuses, the U of M campuses and a little more than half of government departments have had an energy audit done. Moreover, these audits are not always updated.
- As noted earlier, about three quarters of MnSCU campuses, departments and U of M campuses met several times per year or more with their Commissioner or Chancellor's office, or with employees, students (in the case of MnSCU and the U of M) and other stakeholders. However, some never meet with these groups of people.
- Numbers vary greatly regarding how much has been spent on energy efficiency projects from 2002-2007 – ranging from none to $15-20 million.
- Just over one third of MnSCU campuses and a little less than two thirds of government departments have conducted energy savings analyses.
- These numbers indicate that there are likely many opportunities for campuses and departments to reduce energy use and costs.

On the other hand, it is clear that energy savings are on the "radar screen" of almost all campuses and departments, which are thinking of ways to become more energy efficient and have undertaken various actions in the past five years to become more energy efficient.

Moreover, numerous energy informants indicated that communication between campuses and departments on this issue was either done on an *ad hoc* basis, or was non-existent. However, there are mechanisms that exist (e.g., in the case of state government departments, the State Facilities Managers Group) which can provide a "space" for lateral communication on energy savings. In addition, each of the three organizations could identify a group to take on the role of coordinator between the various facilities managers.

B3 Database

The B3 database is a potentially powerful tool for supporting efforts to achieve energy savings in all public buildings. Because the B3 database has had a good start on building data collection for state buildings, perhaps this database could be modified to incorporate this additional information, such as accounting for weather and on-site electricity generation. To help institutionalize policies and mechanisms to reach the energy savings goal, the legislature could require ongoing submission of data to the B3 database. In addition, it will be important to create a process to verify this data (e.g. periodic energy audits).

Policy Recommendation 13:

Conduct further study to achieve this energy savings goal.

One main result our study revealed was that, although numerous energy savings efforts have been undertaken, some serious gaps remain. Furthermore, in order to be effective in achieving these energy savings goals, more precise measurements are necessary. The aggregated data we have received provides a good starting point, but ultimately this data needs to be examined at a finer grain level.

Potential scopes for any future study could be:

- An expansion of applicable entities (e.g. include other state agencies such as the Minnesota Historical Society, or include other public buildings such as schools and local and county offices);
- A focus on the carbon footprint of individual buildings or sites;
- A source energy-based study;
- Work with rating agencies and investment banks to determine whether energy savings projects with positive cash flow returns by the state will not affect the state's borrowing capacity.

3.4 Costs and Benefits

Costs

Discussions with energy experts identified financial costs as the main cost to be examined. However, other costs are also important, such as the time needed to train building operators and building users on energy efficiency issues, and to integrate energy efficiency considerations into general organizational practices – from building operations, construction and renovation, to procurement policies.

Many informants (e.g. 70% of MnSCU campuses) felt the most viable place for energy savings measures to be undertaken is when buildings are being constructed or renovated. When looking at new building plans or under construction for the three organizations over the 2008-2012 timeframe, the total is a little less than 3 million SF. Looking at renovation for existing buildings, in this same time period, the total is almost 3.5 million SF. Using an estimate of 80 million square feet for these agencies (state government departments, the University of Minnesota and MnSCU), these projects together represent about 6.5 million SF, or about 8% of total square feet – important opportunities to achieve energy savings.

Generally speaking, it is more costly to do energy efficiency retrofitting measures than to design and construct a new building efficiently. For example, adding $300,000 onto a construction budget for various energy efficiency measures that can yield up to $100,000 of annual energy savings, has a payback time of three years. Alternatively, to achieve $100,000 of annual energy savings in an existing building can cost $1,000,000, having a 10-year payback (Mark Ruud, Personal Communication, January 2008). Other studies indicate the same:

> "At the time a home or office building is constructed, many conservation measures can be installed for only an incremental cost beyond standard construction practices. To retrofit these measures later is usually much more expensive and sometimes impossible…" (Nadel, 1992: 526).

On the other hand, when looking at energy savings within a building fleet, opportunities for energy savings among existing buildings – even if the measures are more expensive to retrofit than if they had been there in the first place – are often still cheaper to do versus constructing a new building. In addition, it is important that commissioning of buildings is taking place, or the entire building envelope is periodically assessed for a "tune up" to ensure the building is functioning optimally. Once a building is built, it needs to be monitored and measured continuously so that the energy savings realized by the renovations continues. This is a similar message found in previous studies assessing the effectiveness Demand-Side Management (DSM) programs – to ensure projected energy savings actually occur, it is important that these measures are properly installed and maintained regularly (Nadel, 1992: 531).

The Minnesota Sustainable Building Guidelines require that all new buildings and major renovation projects be commissioned to ensure delivery of the highest energy efficiency which they are capable. However, to sustain that high level of energy efficiency it is imperative that energy performance be regularly monitored, so that any reduction in efficiency is identified early to ensure developing problems, caused by normal equipment wear or inappropriate changes in building operation, can be corrected. Ensuring that all State Entities participate annually in benchmarking all buildings in the B3 benchmarking will help in finding those buildings who have developed problems.

Benefits

This study revealed a number of benefits for state government by undertaking energy savings efforts. First of all, state government can reap financial rewards from these savings by reducing operating and utility costs, which benefit the tax payers by "freeing up" more funds for programming initiatives. Moreover, environmental benefits at the local level (e.g., reduced air pollution) and the global level (e.g. reduced GHG emissions) can accrue through implementing these measures.

Thirdly, state government is in a unique position to think long term. For this reason, state government can help to develop markets for relevant technologies and services. In addition, through conducting pilot projects and using these technologies, the private sector can also be encouraged to adopt these practices and products. Finally, regular measurement, reporting as well as planning and undertaking these energy savings efforts raises awareness and encourages an energy savings 'culture' among building operators and users.

Examining costs and benefits are important in order to determine which energy savings projects to pursue – as noted earlier, the main driver being those which have the best Return on Investment (ROI). The B3 database is an important tool that agencies and campuses can use to

help determine which actions and buildings would yield the greatest energy savings results. However, it is important to point out that models sometimes do not take some peculiarities into account, and so agencies and campuses may need to tailor results to their particular situation. For instance, when looking at Minnesota's DOT (where the principal use of their SF is devoted to garages and warm storage space), only 60% of DOT's SF is heated (Personal Communication, DOT, December 2007).

Specific Examples of Costs and Benefits – MnSCU, University of Minnesota and State Government Departments:

The University of Minnesota-Twin Cities has realized some major benefits by reducing energy use through various savings measures, despite growth. For instance:

- Campus square footage increased 11.3% from 1998 to 2006.
- Carbon emissions from the steam plant are down ~38% since 2000 due in part to energy conservation programs and new boiler technology.
- Since 1998 the carbon footprint from utilities had remained flat to a slight downward trend in spite of the campus growth.
- Since 1994 steam consumption has decreased 27% and electricity consumption increased 27% (University of Minnesota, Fact Sheet, 2007; Personal Communication, Facilities Management Team, February 2008).

Monetary benefits include the fact that since 1985, the University of Minnesota has received over $3.3 million in utility rebates as a result of implementing energy savings measures (University of Minnesota, Fact Sheet, 2007).

MnSCU Lighting Retrofit Project Example

Institution/Campus	Century College
Project Description	Replace light fixtures, Brighter/more reflective paint
Monthly Electric Energy	1,078 kW
Annual Electric Energy Saving	3,653,022 kWh
Annual Fuel Savings	6,001
Annual Dollar Saving	$196,135

The Minnesota Army National Guard rehabilitated 610 fluorescent light fixtures at Camp Ripley. The new energy efficient bulbs were estimated to have an energy savings of 72,475 KWh per year, which amounts to an annual cost saving of $3,919, offsetting the cost of the project within 6.4 years (Department of Military Affairs).

The University of Minnesota Morris Campus has completed an energy audit of the campus and is in the process of implementing various energy saving technologies. Assuming all the recommendations of the audit are applied, the campus will save an estimated $269,000 in annual utility cost, and will reduce carbon emissions by 9,400 metric tons (University Of Minnesota Morris, 2007). Some measures include:

- A plan for energy education and awareness
- Installing Vending Miser technology on machines (lights power down when not in use)
- Upgrade plumbing fixtures and shift to low-flow shower fixtures, to increase performance and reduce heating costs
- Heat the competitive swimming pool with a thermal solar system

Compressed air is used throughout the AHC for various applications including building controls, laboratory compressed air, and dental air.

The new central system is comprised of 4 large air compressors totaling 350 hp. Approximately 40 air compressors were taken off-line as a result. The compressed air delivered by the new system is of higher quality than what was produced by the old system. There are also maintenance savings associated with centralizing systems.

System startup ..... August 2006 (partial functionality
System operational ..... October 2006 (full functionality)
Estimated annual savings $240,000
Estimated total cost $560,000
Payback ..... 2.33 years
Electricity savings ..... 1,750,000 kWh ($95,000) per year
Water savings ..... 21,000,000 gallons ($145,000) per year

State Government

Various state government departments have also realized savings through implementing energy efficiency and conservation measures. For instance, the Minnesota Department of Natural Resources, which has participated in the state benchmarking program, showed a decrease of 11.9% in energy use. Moreover, the St. Peter Regional Treatment Center, run by the Department of Human Services, implemented a number of energy savings measures, such as installing a new plant automation and control system, which is expected to reduce energy consumption by 15 percent (DOA and DOC Report, 2007: 8).

MnSCU – Guaranteed Energy Savings Program Project

A project at MnSCU funded by the Department of Administration's Guaranteed Energy Savings Program including a series of lighting and heating efficiency efforts which is estimated to result in the following savings.

Project Cost $567,556
Guaranteed Annual Savings $69,915
Annual Electric Savings ..... 710 KW
795,740 KWh
Annual Natural Gas Savings ..... 4,119 MMBTU
Annual Water Savings ..... 3,115,000 Gallons

4.0 Conclusions

4.1 Major Findings

Findings from the report indicate that energy savings are on the "radar screen" of almost all campuses and departments. Many have undertaken energy savings measures and are looking for ways to become more energy efficient. The main areas where campuses and departments have implemented or are planning to implement energy savings measures are in the areas of lighting, as well as overall building envelope and Energy Management Systems (EMS). Many campuses and departments have considered various energy savings measures, but have been unable to act upon them. In addition, many campuses and departments are aware of outside resources regarding energy savings, but are unable to access them due to a lack of funds, time and / or staff to work with external resources with energy expertise.

The principal barriers to energy savings measures revealed by the study were inadequate data and information to make decisions regarding energy savings, a lack of resources – whether funds, personnel, capacity and / or time, the diversity of Minnesota's State Entities' building fleet, the difficulty involved in trying to ensure this policy's sustainability over the long-term, communication and information challenges, and challenges faced by State Entities in changing rapidly to achieve energy savings.

Another finding is that, when speaking about these State Entities as a whole, energy savings is still not a part of the "culture" of these organizations. However, certain sub-groups within these organizations are energy savings champions.

Discussions with facilities managers and outside energy experts suggested several policy changes including more funds for energy savings efforts on a long-term basis, from a separate source of funds, so as not to 'take away' from other budgets (e.g., programming, operations and construction), allocating a certain percentage of project funds for energy savings projects, having a clear energy savings goal for all to work towards, while at the same time allowing for flexibility for individual departments and campuses to reach the goal, and finally, many survey respondents and interviewees suggested mechanisms to encourage more collaboration and communication between departments and / or campuses.

4.2 Summary of Recommendations

Using this feedback and information from other studies regarding energy savings, specific policy recommendations emerged of three types: i) policies to help clarify the energy savings goal, ii) policies that enable State Entities to meet the energy savings goal, iii) policies to help ensure the long-term sustainability of the energy savings goal. To recap, specific policy recommendations include the following:

The Legislature should clarify energy savings goals and how they are measured

Measuring and Units

1. Require standardized reporting of natural gas and other fuel use in BTUs (or MMBTU) and electricity use in kWh

Annual Energy Savings Targets

2. Choose a method to determine annual energy savings targets with periodic verification.

Baseline

3. Find the energy use baseline for each building using common assumptions (site energy) and then sum for agency or campus totals
4. Determine the energy use baseline for a recent year such as 2007 without waiting to obtain better individual building data

Applicable Entities

5. Clearly identify each State Entity responsible for achieving energy savings

The Legislature should adopt policies that enable State Entities to meet energy savings goals

Measurements

6. Install electric and fuel use meters on all existing and new state-run buildings

Funding Options

7. Expand the use of existing funding sources for energy savings projects and consider appropriating additional funding

Outreach and Training

8. Establish a One-stop shop for Energy Efficiency
9. Require Energy Savings Training for Building Operators and Users

The Legislature should adopt policies that ensure long-term success in achieving energy savings goals across all State Entities

Methods to Encourage Energy Savings

10. Provide Incentives
    - *i) Integrate the decision process for construction, operations and programming budgets*
    - ii) *Make existing rebates easier to access and encourage utilities to offer more*
    - *iii) Provide recognition for energy efficiency champions*
    - *iv) "Level the Playing Field" among agencies and campuses*
    - *v) Allow flexibility to reach the energy savings goal – within and / or between agencies and campuses*

vi) *Translate the energy savings into GHG emissions as well as dollars and energy metrics (e.g.,* MMBTUs, kWhs)

Methods to Ensure Energy Savings Occur

11. Establish a group charged with goal enforcement
12. Institutionalize policies and measures to reach the energy savings goal
13. Conduct further studies to achieve this energy savings goal

To summarize, there are several key messages this report has revealed. First of all, state-owned buildings are a potential source for energy savings. Excellent work has already been done on energy savings in Minnesota and this can serve as a solid foundation for future measures to reach this important energy savings goal.

However, despite these efforts much remains to be done. There are information, organizational and resource barriers to achieving energy savings in Minnesota government buildings. Despite these obstacles, Minnesota has a wide-range of policy options available to achieving energy savings in government buildings.

These policy recommendations have been established to help agencies and campuses meet the energy savings goal of 1.5% annually. These policy options should be viewed as part of a comprehensive energy savings plan; a range of policy and program approaches are often more effective rather than implementing a few isolated programs. For instance, research from utilities' energy savings programs indicate that some options, such as information programs, on their own, result in only limited participation rates, but are useful as complements with other program approaches (Nadel 1992: 520).

As noted in Tables 3.2 and 3.3, implementing an annual energy usage reduction of 1.5% for these State Entities will result in annual savings of at least $22 million and a cumulative savings of at least $258 million. After 20 years, annual reductions will also prevent at least 3,267,238 tons (this may change) of CO2 from being released into the atmosphere. These projections present an unmistakable benefit in both economic and environmental terms. Given the diversity of factors affecting energy use, including population of buildings, priorities, and energy sources, there is no one size fits all approach in achieving this energy savings goal. Thus, it is important to allow for decision-making at the agency operational level as far as which methods will provide them with the most energy savings.

Minnesota has been and continues to be a leader in sustainable development by formulating a number of efforts to address the economic, environmental, and social challenges involved in governing a state as we move to a carbon-constrained world.

To ensure a comprehensive and cohesive sustainable strategy for the state, it will be important for this goal to feed into other energy and environmental efforts the state has embraced, such as the Governor's Climate Change Advisory Group, the Renewable Portfolio Standard requirement, calling for 25% of electricity used in the state to be from renewable sources by 2025, and the Demand Efficiency conservation improvement program.

Ultimately energy savings must become integrated into the programming, operating, and construction and design practices of organizations -- requiring a shift in the day-to-day actions of these organizations. This energy savings goal represents an important step in that direction.

Notes

[1] The Weidt Group, B3 Database, February 2008

[2] Information was not solicited from these campuses at this time due to a lack of information on energy costs and savings.

[3] For example, in Minnesota, the average commercial price of natural gas was $7.52/thousand cubic feet (cu ft) in 2001 and $10.31/thousand cu ft in 2006. Please see:
http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm
Combined Heat and Power (CHP), also known as cogeneration, is a process by which heat generated in power plants as a by-product in producing electricity is captured and used for industrial or residential purposes, rather than emitted as waste heat (Rubin 2000: 208).

[4] Improvements to energy efficiency are evaluated based on an agency's ability to reduce its energy intensity (energy consumption / square foot).

[5] The U.S. Green Building Council (USGBC), a non-profit organization, runs the Leadership in Energy and Environment Design (LEED) program -- a building project certification process for the design, construction and operation of buildings used for commercial purposes (although residential buildings which have four or more habitable stories are also eligible to receive the LEED certificate) and homes (USGBC 2008).

[6] Specifically, those electric utilities that operate nuclear-power plants (i.e. Xcel energy) must devote at least 2% of their gross operating revenue to CIP, other electric utilities, at least 1.5% of their gross operating revenue, and natural gas utilities, at least 0.5% of their gross operating revenue. This does not apply to municipal utilities with $5 million or less of natural gas sales to retail customers (OLA 2005: 3)

[7] Due to lower carbon dioxide emissions that occurred as a result of favorable weather conditions, higher energy prices, an increase in natural gas (the least carbon-intensive fossil fuel) use to generate electricity (which often displaced other fossil fuels), and an increased use of non-fossil fuel energy sources (EIA 2007).

[8] See http://www1.eere.energy.gov/femp/,

[9] Energy data from the B3 database was gathered from the most recent consecutive 12 months between 2004 and 2007.

[10] It is likely that these numbers are substantially larger than reported. This analysis used only the data that was available; in numerous cases, departments, agencies or campuses were unable to report monthly energy billing data. Furthermore, this analysis looks only at natural gas as a heat source. Further study is needed to determine the contribution of energy sources such as fuel oil or steam.

[11] These numbers are only approximations of minimum totals combined for State Entities . For determining baselines for a 1.5% percent annual reduction, it is recommended that each department internally determines the annual energy consumption from billing and metering information. Baselines should be found for each site or building for maximum accuracy.

[12] Emissions for MnSCU are substantially larger than the emissions from the UMN Twin Cities campus. This is likely because the Twin Cities campus receives heat from steam rather than natural gas, while many MnSCU campuses primarily utilize natural gas for heating. In this brief analysis, CO2 emissions from steam were not considered due to the variety of measurement methods and fuel sources. Further study is needed for a comprehensive integration of steam as a contribution to total energy use and CO2 emission.

[13] The information for this analysis was taken from the Departments of Administration, Corrections, Human Services, Military Affairs, Natural Resources, Transportation and the Veterans Home Board. Detailed information was available for the Departments of Administration, Military Affairs and Transportation. Information for all other departments was taken from the Weidt Group's B3 Benchmarking Report.

[14] For instance, 1 Therm is the equivalent of burning 100 cubic foot of natural gas. For reference, 1 MMBTU = 1,000,000 BTU and 1 Therm = 1CCF = 100,000 BTU.

[15] Other than Xcel Energy which has a goal of 2%, as noted earlier.

[16] Energy prices are expected to continue to increase over the next 20 years. Therefore, it is likely that this number will be appreciably larger.

[17] (http://www.boccentral.org/index.php),

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Please note that additional insights for this report were obtained from numerous informal conversations, comments at the January 9th meeting and interviews.

Appendix A STUDY SCOPE and DATA COLLECTION

- This legislation is focused on energy consumption and calls for an annual reduction of 1.5% of energy use. Using this assumption as a guideline, money spent on fuels stockpiled but not consumed is not included in this study
- The principal focus of the study was on management systems (e.g., building design and management, agency management and operational decisions) rather than individual behavior of employees or people served by the organizations.
- The study focused on decisions involved with building design, construction and use / operations. Operational decisions include those involved with food service, computer databanks, lighting systems, etc.
- Some organizations occupy leased buildings and so they may not be able to make some decisions regarding energy consumption, which may rest in the hands of property owners.
- The study will focus on three principal ways to achieve this target:
  - New buildings (design and implementation) – decommissioning old, inefficient buildings
  - Retrofitting existing buildings
  - Building use (e.g., operational adjustments, switching from incandescent light bulbs to Light-Emitting Diode (LED) lighting, etc.)

Survey respondents were facilities managers and / or financial officers of the various State Government departments, as well as MnSCU and U of M campuses. The survey was open from December 11th, 2007 – January 18th, 2007. Regarding MnSCU, 49 campuses (of 53) completed Parts I and II of the survey (response rate = almost 93%). Thirteen of 18 State Government departments completed Part I the survey (response rate = 72.2%). For Part II, the Department of Administration provided energy data for state government departments – apart from the Department of Natural Resources who provided their own energy data. Three of four campuses solicited (response rate = 75%) from the University of Minnesota (U of M) completed Parts I and II of the survey – Twin Cities, Morris and Duluth. Detailed information on survey results can be found at Appendix *.

1 Although the University of Minnesota owns facilities in many locations, the focus of this study was on four of the main campuses (Twin Cities, Morris, Crookston, Duluth) as information to complete the survey was readily available.

*It is important to mention some qualifiers with respect to this information. First of all, the survey was issued with a very short time frame. In addition, the survey timeframe occurred over a holiday period as well as an official campus break for MnSCU and the University of Minnesota. Many of the campuses (or parts of campuses) shut down the facilities for parts or all of this holiday period in an effort to save energy. Also, in the case of MnSCU, two of their campuses had recent vacancies in the facilities position.

Appendix B

Energy Savings Survey
Summary of Results
Minnesota State Colleges and Universities (MnSCU) Responses
January 2008

EXECUTIVE SUMMARY

This document summarizes the results of the on-line survey on Energy Savings for State Government Departments, Minnesota State Colleges and Universities (MnSCU), and the University of Minnesota (U of M).

The 2007 Legislative session established an Energy Conservation Policy Goal to achieve **annual energy savings equal to 1.5 percent** of annual retail energy sales of electricity and natural gas through various indirect and direct energy efficiency measures. This goal was codified as Minnesota Statutes (MS) 2007 Chapter 216B.2401.

> "The commissioner of commerce, in coordination with the commissioners of the agencies listed in 15.01, the chancellor of the Minnesota State Colleges and Universities, and the president of the University of Minnesota, shall identify **policy options, barriers, and economic benefits and costs** for state government operations to achieve the energy savings goals in section 216b.2401 and the resulting carbon emission reductions. The commissioner of commerce must issue a report to the legislature by February 1, 2008." section 216C.03

The Department of Commerce has commissioned the Center for Science, Technology and Public Policy (CSTPP), Humphrey Institute for Public Affairs, University of Minnesota to draft a report, working with State Government, Minnesota State Colleges and Universities and the University of Minnesota.

In this view, the CSTPP sought advice from experts involved in facilities management, finances, and / or overall systems management. The main method of collecting this information was through an electronic survey, with some follow up interviews and informal discussions.

There were two parts to the survey. **Part I** was a series of questions answered electronically. **Part II** was an Excel spreadsheet asking for detailed information on energy cost and use from the 2007 Fiscal Year (FY 2007).

Survey respondents were facilities managers and / or financial officers of the various State Government departments, as well as MnSCU and U of M campuses. The survey was open from December 11th, 2007 – January 18th, 2007. Regarding MnSCU, 49 campuses (of 53) completed Parts I and II of the survey (response rate = about 92%) provided energy data. 13 of 18 State

Government departments completed Part I the survey (response rate = 72.2%). For Part II, the Minnesota Department of Administration provided energy data for state government departments – apart from the Minnesota Department of Natural Resources and the Minnesota Department of Military Affairs who provided their own energy data. Three of four campuses solicited (response rate = 75%) from the University of Minnesota (U of M) completed Parts I and II of the survey – Twin Cities, Morris and Duluth.

The following information provides a brief summary of results from the survey.

The purpose of the first section, entitled General Details, and asking for information about number of employees, students (where applicable), etc., was to give a sense of the magnitude of energy use and costs in general and per person.

The aim of the second section, entitled Facilities, was to obtain detailed information on facilities in which these organizations operate and information on renovations and construction planned or already underway. We also asked for detailed information on energy cost and use for the FY2007 which respondents provided separately in an Excel spreadsheet (Part II).

In the third section, entitled Energy Efficiency (EE) information, questions were asked in order to determine how much energy efficiency was a part of the culture of the organization, as well as obtaining information on costs and benefits of implementing various energy efficiency actions.

The final section Opinions was to provide respondents with an opportunity to determine where to focus efforts to address barriers and develop policy options.

Detailed Results

The following is a question-by-question detailed summary of results based on survey responses, follow up interviews, and by information provided by the MnSCU Office of the Chancellor. The majority of the quantitative information provided by MnSCU, the University of Minnesota and State Government departments was based on the 2007 Fiscal Year (FY2007), which runs from July 2006-June 2007.

It is important to point out that only certain departments have custodial responsibility for state government buildings. In Minnesota, the Department of Administration (DOA) owns many state department buildings. The DOA manages all buildings on the Capital Complex, which consists of 12 buildings including the Armory, the DOA building, the Minnesota Department of Transportation, the Centennial building, the Capitol, the Judicial building, the State Office, Maintenance, Stassen Revenue building, the Minnesota Department of Veterans Affairs, AgHealth Lab, and the Freeman building. The DOA also serves as the spokesperson for agencies on buildings policies and procedures.

In addition, in the state government responses, some departments skipped questions. Although there was no time for follow up, this is probably because these departmental facilities or financial managers were unaware of the answers, or the question did not apply to their situation, as these aspects are under the responsibility of the DOA.

Also, although the focus of this survey is energy efficiency and conservation (what we term as energy savings), a number of respondents noted renewable energy actions, and so we have included these responses.

SECTION A - GENERAL DETAILS

Please note that detailed information on the survey results for MnSCU, State Government departments and the University of Minnesota can be found in the attachments to this document.

The first section of the survey was labeled General Details and asked questions about the campus, the person filling out the survey **(Questions 1 and 2),** as well as estimated number of employees, estimated number of full time students (in the case of MnSCU and U of M), and estimated number of visitors annually.

Question 3 – State the overall number of employees by Full Time Employee Equivalent (FTE) for FY2007.

More than half (53.2%) of MnSCU's campuses indicated there were between 101-500 employees working at their campus. The majority of State Government departments however had more than 500 employees (58.3%). The University of Minnesota had over 500 employees in the Twin Cities campus and between 101-500 employees at the Morris and Duluth campuses.

Question 4 – State the Full Year Equivalent (FYE) of students for the campus for FY2007 (MnSCU and U of M only).

The majority of MnSCU's campuses have between 1,001 – 5,000 full time students (over 48.4%) in the 2007 fiscal year. The University of Minnesota has over 20,000 students at the Twin Cities campus, between 10,001 and 20,000 students at the Duluth campus and fewer than 2,500 at the Morris campus.

Question 5 – Estimate the number of annual campus visitors. Count as trips to campus versus individuals. (MnSCU and U of M)

Question 4 – Estimate annual number of people DIRECTLY serviced by the department (e.g., number of visitors to state parks) versus indirectly (e.g., number of web "hits" on government information webpage). (State government departments)

With respect to MnSCU, more than half (53.3%) of their campuses estimate they receive between 1,001-10,000 visitors yearly (counted as trips to campus versus individuals). Two

campuses (St. Cloud State University, St. Cloud, MN and Century College, White Bear Lake, MN) have more than a half a million visitors annually. The University of Minnesota differs depending on the campus. Twin Cities estimates that it receives over half a million visitors annually, Duluth estimates that it receives between 10,001 and 100,000 visitors per year and Morris suggests it receives between 1,000 and 10,000 people per year. Responses varied for state government departments. Even though the majorities (36.4%) of State Government departments estimate they served between 10,000 – 100,000 people directly on an annual basis, others estimated they served between 100,001 – 500,000 (27.3%) or 500,001+ (27.3%) people per year.

To give an idea of the energy used per person, the United States Department of Energy (DOE)'s Energy Information Administration and the U.S. Bureau of the Census estimates that average annual energy use per person was 350.8 MBtus (**1999**).

Please provide estimated square footage of your department (please include all locations) (Questions 5 and 6 State Government departments and University of Minnesota).

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Of the departments that responded, they indicated that they use almost 20 million (19,676,909) SF in space. Three quarters of departments that responded to the survey indicated they lease rather than own all of their space that they use – more than 1.6 million SF (1,634,677 SF), or almost 10% of space used. Looking at the Facilities Condition Audit for FY07, the estimated SF for the State Government departments that were a part of this study is 26 292 863 SF. This number includes active buildings (25 285 052 SF) and inactive buildings, a little over 1 million SF, (1 007 811 SF), which do require some energy use (e.g., minimum amount of heat in the winter) even if it is significantly less.

The estimated SF for the University of Minnesota is 21.2 million SF for Twin Cities and a little under 1 million for Morris. Duluth has about 3.1 million SF and Crookston has about 610,000 SF, for a total of 27.8 million SF. The Morris and Duluth campuses own all their space used and the Twin Cities campus leases 600,000 SF.

The Office of the Chancellor provided square footage for MnSCU camp,ses. The estimated total square footage (SF) of MnSCU's campuses in 2007 is over 26 million (26,007,167). MnSCU owns all of this SF, except for one building, representing a little less than 50,000 SF (49,263 SF, located at Minnesota State University, Moorhead). The rest of the buildings and parking ramps are academic buildings (21,029,858 SF), "other" buildings, such as student housing buildings (118,624 SF), revenue fund buildings and ramps 4,624,931 SF), and mothballed buildings (166,392 SF).

SECTION B – FACILITIES

Question 6 - Are there new buildings currently under construction, or at the planning stage, to be completed in the next four years?

More than half (50.9%) of MnSCU's campuses are planning or have new buildings currently under construction for a total of about

The Twin Cities, the Duluth and the Morris campuses are planning or have new buildings currently under construction in the next four years (December 2007 – 2011).

About one quarter of government departments (25%) indicated they are planning or have already begun new construction in the next four years.

Question 7 – From Question 6, if yes: a) Estimate the total square footage of new construction b) Provide the occupancy date for each increment of new construction if known

With respect to MnSCU, respondents indicated that there is a total of almost 1 million SF (956,860) as of December 2007 either under construction or planned for new buildings at MnSCU campuses between 2008-2012. Of this amount, the largest new building is the Integrated Science Facility at St. Cloud State University (100,000 SF by 2012).

The University of Minnesota has a little over 1 million SF at the Twin Cities campus, about 110,000 SF at the Duluth campus and 20,000 SF at the Morris campus planned or under construction for a total of 1,185,720 SF.

Government departments have 889 000 new SF in planning or under construction in the next four years.

TOTAL = 3,041,580 SF

Question 8 – Are there buildings under renovation, or at the planning stage, to be completed in four years?

Sixty percent of MnSCU's campuses are currently renovating or planning on renovating buildings in the next four years (December 2007 – 2011) for an estimated total of a little more than 1 million SF (1,114,944 SF). In addition to this number, one college, Rochester Community and Technical College, noted that they were planning a retrofit of their entire campus.

The three U of M campuses that responded are planning or currently have buildings under renovation for an estimated total of 568,000 SF.

Half (50%) of government departments are currently renovating or planning on renovating buildings in the next four years (December 2007 – 2011) for a total of 380,400 SF.

TOTAL 2,063,344 SF

Question 9 – Are there buildings to be recommissioned in the next four years? (State government departments)

One quarter (25%) of government departments are going to recommission buildings over the next four years for a total of about $4,435,000 (the bulk of this action is at the DOT).

Question 9 – Please note the campus or department energy suppliers: contact information (name of company, name of contact person, email and phone) for all utilities and energy sources.

With respect to MnSCU, the majority of campuses rely on electricity suppliers (100%) and natural gas suppliers (93.3%). Only 28.3% rely on propane suppliers, 21.7% on district energy

suppliers, and 30.4% rely on other energy suppliers – mainly fuel oil, which serves as a back up fuel, but also other alternatives (e.g., steam heat). As their campuses are state-wide, they rely on a large number of energy supply vendors.

The Twin Cities and Morris campuses have electricity, natural gas and district energy suppliers. The Twin Cities campus relies on other energy suppliers including propane, and those providing fuel oil, coal, wood and oat hulls, which they use as fuel sources. Duluth's main energy suppliers are for electricity and natural gas, however Duluth also relies on other energy suppliers for fuel oil.

Some state government departments (those located throughout Minnesota) also rely on a large number of energy vendors – Department of Transportation (all utilities), Department of Military Affairs, Department of Natural Resources (the main energy sources used are electricity and propane). In addition, some government departments were unaware of their energy suppliers as this is all under one envelope (Capital Buildings Loop) managed by the Department of Administration. Those department buildings located in downtown St. Paul receive their heat through district steam, provided by District Energy St. Paul.

SECTION C - ENERGY EFFICIENCY INFORMATION

Question 10 – Do you consider the campus or department to be Energy Efficient?

Regarding MnSCU, interestingly, only a little over 60% (62.2%) of respondents feel their campus is energy efficient.

One U of M campus felt it was not energy efficient, while another felt the campus was energy efficient. A third campus answered the question as "Yes and no" as even though work on having the campus become energy efficient was continuous, at the same time many opportunities for further work remained. On other words, there are always some opportunities to make the campus more energy efficient.

A little over 80% (81.8%) of government departments consider their agency to be energy efficient.

Question 11 – Are you thinking about ways to become more Energy Efficient?

All 49 MnSCU campuses that responded to the survey, except one, indicated they were thinking about ways to become more energy efficient.

All U of M campuses are thinking of ways to become more energy efficient.

Over 80% (83.3%) of departments are thinking of ways to become more energy efficient.

Question 12 – Has your campus or department improved its energy efficiency in the last five years?

All MnSCU campuses, except one (which noted that they have done actions but that no measurable affect on energy consumption could be measured), have undertaken actions to help their campus become more energy efficient in the last five years. Specific actions include:

- a $1.2 million energy retrofit for five campuses of the Midwest Community and Technical College,
- Minnesota State University's Mankato campus energy retrofit project (which actually occurred between 1994-1997),
- Three Guaranteed Energy Savings projects (e.g., lighting and temperature control systems), working with the Department of Administration, and
- energy audits and / or projects specifically targeting certain areas – the main ones being the HVAC system, lighting, roof insulation, and windows.

All U of M campuses noted their campus has improved its energy efficiency in the last five years. Specific activities include the St. Paul Central Chiller Plant where the U of M Twin Cities is still analyzing data from the first full year of operation but they estimate approximately $2 million per year savings in energy, maintenance and water savings from this project. (10% drop in overall energy on the campus). The Morris campus has undertaken district heating and cooling improvements and served as platforms for renewable energy sources including wind and biomass. Duluth has also done a range of activities including replacing windows and roofs, changing lighting and upgrading HVAC systems.

Over 90% (90.0%) of respondents indicated their department has improved its energy efficiency in the last five years. Specific activities include:

- participation in the state benchmarking program, where the Department of Natural Resources, showed an 11.9% decrease in energy use
- projects targeting certain areas (e.g., going from T-12 to T-8 fluorescent lights, windows, changing from Cathode Ray Tube (CRT) to Liquid Crystal Display (LCD) computer monitors
- relocating some offices to newer, more efficient buildings (e.g., Minnesota Department of Health)
- renovating buildings (e.g., Minnesota Department of Employment and Economic Development's North Minneapolis Workforce Center building)
- changing departmental culture (e.g., turning off personal computers on evenings and weekends)

Questions 13 and 14 – Are you aware of other resources that can help your campus become more Energy Efficient?

Generally speaking, MnSCU campuses are aware of outside resources that provide energy efficiency services (86.7%). Specifically, the main outside resources known are energy services

providers (92.7%) (e.g., Xcel energy), as well as external consultants (80.5%) (e.g., Johnson Controls, Inc., Ed Cook and Associates and Stanley Consultants), the Office of the Chancellor (78%), industry associations (8.50%) (e.g., APPA) and state government departments (70%). The least known resources were federal agencies (only 12.2%).

The Twin Cities, Duluth and Morris campuses were aware of outside resources to help on energy efficiency projects. The resources known by the three campuses included energy services providers, external consultants, industry associations, and manufacturers. Twin Cities and Morris also mentioned state and federal agencies, energy conservation organizations and third party financing from vendors as potential sources. Morris also mentioned the Office of the Chancellor as a resource.

Over 60% (63.6%) of state agencies were aware of outside resources regarding energy efficiency. Of this group, the most common resources known were energy service providers (e.g., Xcel Energy and Centerpoint Energy), state agencies and manufacturers. One department (Department of Commerce) mentioned their Office of the Commissioner as a potential resource.

Questions 17 and 18 – Have you used energy efficiency services offered by these other resources?

Over 90% (93.3%) of MnSCU campuses have used these resources. The most popular resources used include external consultants (81.4%), energy service providers (83.7%), and the Office of the Chancellor (55.8%). The least popular were energy conservation organizations (none) and federal agencies (only used by one respondent). Services provided by Xcel energy and Ottertail power were specifically mentioned, as well as MnSCU's Office of the Chancellor. A number of respondents specifically mentioned the Guaranteed Energy Savings project of the Department of Administration. The reasons they used these resources varied but included the fact that they were readily available, long term relationships existed, and some incentives (e.g., low or no interest loans, rebates) offered by energy providers were attractive.

The three U of M campuses that responded have drawn from these outside resources. They have used energy providers, external consultants, state agencies, federal agencies, industry associations and manufacturers. No U of M campus has used the Office of the Chancellor for energy efficiency initiatives. They have used these resources as ways to partner with utilities on their Conservation Improvement Programs (CIPs), where utilities provide co-financing for projects.

Only a little more than 50% (54.5%) of state government departments have used these services. The most popular services used were energy providers (83.3%). Also, external consultants (83.3%), state agencies (66.7%) and manufacturers (83.3%), were popular. The least popular resources used were the Commissioner's Office (one), energy conservation organizations (two respondents), as well as federal agencies, and third party financing from vendors (one respondent for each resource). The main reasons these resources were used was to find new and better ways at making buildings more energy efficient, and to ensure energy savings measures were in sync with guidelines established at the federal level, such as those developed by the Department of Energy's Federal Energy Management Program (FEMP).

Question 19 – Why haven't they been used?

The main reasons cited by MnSCU campuses included the fact that there was insufficient staff and time, and that these resources had not come to their campus locations.

One outside resource noted by the U of M Twin Cities campus that has not been used there is third party financing. They indicated that the financial office does not approve third party financing as it can potentially affect the bond rating of their campus.

The main reasons why these resources have not been used by state agencies are due to the fact that they lease rather than own their buildings (and so had limitations when making energy savings decisions), cost and insufficient staff.

Questions 20, 21 and 22 – Has an energy audit been conducted for your campus(es) or department? And if so, when and is it updated?

About two thirds (67.4%) of MnSCU campuses have had an energy audit done. The earliest noted was at Pine Technical College (late 1980s / early 1990s) and the most recent audit was done at Rochester Community and Technical College (November 2007). Of this group, only a little over 20% (20.4%) update these audits.

The Twin Cities and Morris U of M campuses have had an energy audit undertaken and they have been updated. The most recent energy audit for Morris was done in Fall 2007 Twin Cities indicated that building energy audits are done on a continual basis. Duluth has not had an energy audit conducted to date.

Of the 12 government departments that responded to the survey, only four have had energy audits done (the earliest date noted was January 2003) (DOA and Revenue as a part of the Capitol Buildings Complex, Department of Natural Resources and Department of Military Affairs). The DOT and the DOA and Revenue have audits done periodically and the DNR documents energy information monthly.

Question 23 – Do you meet regularly with the internal campus administration, faculty, students and staff regarding Energy Efficiency? Or, do you meet with departmental staff regarding Energy Efficiency?

The majority of MnSCU campuses indicated they met with these relevant parties several times per year (39.1%) or once per year (26.1%). However, almost one third of campuses (32.6%) noted they never meet with these groups about energy efficiency issues.

The U of M Twin Cities, Duluth and Morris campuses stated that they met with these groups several times per year.

The majority (44.4%) of government departments meet with staff once a month on energy issues. However three departments noted that they never meet with staff about this issue.

Question 24 – Do you meet regularly with the Office of the Chancellor or the Commissioner / Commissioner's staff regarding Energy Efficiency?

The majority of MnSCU departments indicated that they met yearly (43.5%) or several times per year (28.3%) with their Office of the Chancellor. However, a little more than one quarter (28.3%) noted that they never met with this Office.

The U of M Morris campus noted that they meet once a month and Duluth indicated they meet several times a year with their Chancellor's Office.

Half (50%) of government departments noted that they never meet with the Commissioner's Office about this topic. On the other hand, two government departments noted that they meet once a month with their Commissioner's Office regarding Energy Efficiency.

Question 25 – Have Energy Efficiency measures (particularly those relating to electricity and heating and cooling of buildings) been implemented in the past 5 years?

The most common measure undertaken at MnSCU campuses (84.1%) is the implementation of Energy Management Systems. Next common are lighting measures – occupancy sensor control of lighting (70.5%) and lighting design (77.3%). Other actions include the use of central chillers and high efficiency motors at St. Cloud State University and insulated garage doors at Mesabi Range Community and Technical College in Eveleth.

The Twin Cities and Morris campuses of the U of M have implemented the 11 measures identified in the survey, while Duluth has implemented 7 measures. These included actions in the areas of the building envelope, lighting, the HVAC system, computer equipment and Energy Management Systems.

For state government departments, the most common actions undertaken were to do with lighting (occupancy sensor control of lighting and lighting design)(70% each) and computers (replacing Cathode-Ray Tubes (CRT) with Liquid Crystal Display (LCD) monitors) (60%). Other actions include the DOT's change from steam to hot water and move to in-floor heating.

Question 26 – In total, please estimate how much has been spent on Energy Efficiency measures in the past 5 years (estimate staff time, equipment and/or contract services)?

Responses for MnSCU campuses varied greatly – depending on the size of the campus and projects completed – from none (Itasca Community College) to $10 million at St. Cloud State University (considering construction and roofs).

The Twin Cities campus of the U of M suggested that $15 million has been spent on Energy Efficiency measures in this time period. The Morris campus of the U of M noted that $11 million has been spent on renewables and $1 million on energy conservation and sustainability issues. Duluth estimated that between $750,000 and $1 million has been spent on energy savings efforts.

As the Department of Administration is in charge of building policies and procedures (e.g., all design and construction), for some government departments, this question did not apply. The larger departments (in terms of SF and / or number of buildings) spent $15 - $20 million (DOT), $10 million (Military Affairs), and $ 1 million (DNR) or were unable to quantify this amount (DOA).

Question 27 – How important are the factors listed below for deciding which Energy Efficient measures to implement? Answer = 1 to 5 with 1 not being important and 5 being very important

With respect to MnSCU campuses, the most important factor in deciding which Energy Efficiency measures to undertake was a demonstration of successful monetary return on the investment (65.2%). A high energy savings to cost ratio: payback and good return on investment, as well as helping to decrease baseline energy use and to reduce peak energy demand were also important. Least important factors were whether the measure was popular among employees (13%) and / or students and campus organizations (10.9%).

The U of M Twin Cities and Morris campuses also echoed this emphasis on showing a successful return on investment and a high energy savings to cost ratio, and reducing energy baseline use. Morris also indicated reducing peak demand, marketing to show environmental sensitivity, and campus perception for public stewardship as the most important factors.

The two most important factors for deciding which Energy Efficiency measures to implement were high energy savings to cost ratio: payback and good return on investment (55.6%) and helping to reduce baseline energy use (66.7%) among state government agencies. The least important motivations were whether or not these measures were popular among employees, whether the funds for retrofit were bondable, and to do as a marketing effort to show environmental sensitivity.

Question 28 – Are projects carried out using the Minnesota Sustainable Buildings Guidelines? Leadership in Energy and Environment Design? Question 29 - Have all of your buildings been inputted into the Buildings, Benchmarking and Beyond (B3) inventory? (state government departments and U of M campuses only)

All MnSCU campuses use the MnSCU Design Standards. A little less than 60% (59.5%) use the Minnesota Sustainable Buildings Guidelines and 26.8% use LEED guidelines.

The Twin Cities, Duluth and the Morris campuses at the U of M use the Minnesota Sustainable Buildings Guidelines and the LEED guidelines. Twin Cities noted that all their buildings are in the B3 inventory and Morris and Duluth indicated that they are not.

Three government agencies indicated that they use the Minnesota Sustainable Building Guidelines. Three government agencies use the LEED guidelines. However, the rest skipped this question. Only one government department indicated that all of their buildings were inputted into the B3 inventory.

Question 30 – Are you planning any Energy Efficiency measures in the near future?

The most common action being planned by MnSCU campuses is increasing the energy efficiency of the building envelope (68.3%). Increased insulation (63.4%), ENERGY STAR compliant equipment (65.9%) and lighting measures (design and occupancy sensors) (63.4% and 65.9%) are next common.

Twin Cities, Duluth and Morris campuses at the U of M are also planning a number of energy efficiency measures including areas of the building envelope, lighting, the HVAC system, computer equipment and Energy Management Systems. Morris is also planning an environmental / carbon master plan.

Among government departments, many are considering lighting design measures (87.5%). The second most common measures being planned are occupancy sensor controlled lighting (62.5%), ENERGY STAR compliant equipment (75%), and replacing CRT monitors with LCD monitors (62.5%).

Question 31 – Have analyses been conducted on specific energy efficiency measures – including information on estimated savings in cost, energy consumption (kWh or kW, or MWh and MW), and carbon emissions?

A little over one third (34.9%) of MnSCU campuses have conducted analyses on specific energy efficiency measures.

The Twin Cities, Duluth and Morris campuses at the U of M have undertaken analyses on specific energy efficiency measures.

Regarding government departments, 37.5% of respondents have conducted these studies, and 62.5% have not.

Questions 32 and 33 – Have you considered ways to become more energy efficient but been unable to implement to date some energy efficiency measures for electricity, heating and cooling of buildings, or general operations (e.g., food services, IT) for various reasons? If yes, what energy efficiency measures have you considered but not acted upon?

Many MnSCU campuses (82.6%) have considered some energy efficiency actions but been unable to implement them. The most common measures identified as an opportunity but not acted upon were increasing the energy efficiency of the building envelope (61.1%) and having high efficiency boilers (61.1%).

The Twin Cities, Duluth and Morris campuses of the U of M have considered but been unable to implement some energy efficiency measures. These included increased insulation, increased energy efficiency of the building envelope and lighting design and lighting occupancy sensors (implemented in some buildings but not all). Duluth campus specifically mentioned photovoltaics as something they have considered but not acted upon as well as upgrading the main heating plant.

The majority of government departments (75%) have considered but been unable to act upon some energy efficiency measures. The most common actions that have been planned but not implemented are some form of renewables (e.g., photovoltaics, wind) and calibrated daylighting control. Another action being planned but which has not been implemented to date is demand-controlled ventilation by the Department of Military Affairs and ground-source heating by the DOT.

Question 34 – What were the barriers to implementing these measures?

The most common barriers for MnSCU campuses were insufficient funds (91.9%) and the fact that there were competing demands all seeking funds from the same source (84.2%). A lack of data was also identified as a barrier (e.g., North Hennepin Community College noted that they need an electrical consultant to conduct a feasibility study with specifics on payback time before these planned measures were undertaken).

The U of M campuses at Twin Cities, Duluth and Morris also noted that a lack of funds available and competing demands on these funds were key barriers. Morris also noted a lack of financing options. Twin Cities also noted a lack of staff time. Duluth mentioned insufficient bond funds from the system.

The most common barriers among government departments also had to do with funds – a lack of them and the fact that the funds required to do energy efficiency project would take away from other competing demands. Several governments departments – DOT, DNR and DOA – argued that insufficient data to help support purchases and decisions was also a barrier.

OPINIONS

Question 35 – Please identify up to three of the most viable Energy Efficiency measures that would impact and reduce energy use in the next twenty years?

Most MnSCU campuses (70%) saw the most viable place for energy efficiency actions to be undertaken when buildings were being constructed or renovated.

The U of M Twin Cities, Duluth and Morris campuses suggest a number of viable options, including controls and smart meters and improving HVAC systems and the building envelope. Duluth also mentioned focusing on increasing plant efficiency for heat and conservation and scheduling as ways to reduce electricity. Duluth also suggested having campus wide temperature control policies as being useful, although the previous study on the implementation of Executive Order 05-16 by state agencies noted the challenges involved in adhering to this directive (e.g., concerns with mold growth from air that is more moist in the cooling months).

State agencies claimed that the most viable measures that would have the most impact would be a database for energy use analysis (e.g., Archibus), and providing adequate funding for maintenance regarding buildings and / or programs overall, and changing computer use / design to reduce electricity consumption.

Question 36 – In your opinion, what are the key barriers to implementing Energy Efficiency measures in your campus or department?

The majority of MnSCU campuses identified funding and a lack of staff time as key barriers that should be addressed. Some also highlighted a lack of awareness of energy efficiency issues and also awareness of funds as a barrier.

The Twin Cities U of M campus felt that culture, as well as building use and staff to do the jobs were barriers. They noted that, speaking long term, there was a lack of capacity – they suggested more focus on facilities management by engineering programs. The Morris campus felt that return on investments and capital investments were the key barriers. Duluth highlighted a lack of funds as well as the fact that they compete with other priorities.

The key barriers identified by government agencies included a lack of funds, the fact that buildings were leased and not owned, a lack of resources and staff, and also the fact that buildings were spread over a large geographic area made energy efficiency measures difficult to implement.

Question 37 – How do you think these barriers can be addressed?

Many MnSCU campuses suggested that more funds being allocated by the State for energy efficiency as being a way to address these barriers. A number specifically noted more Higher Education Asset Preservation and Rehabilitation Funds (HEAPR) funds or third party financing options. To give an idea of the difference between funds requested and funds received from HEAPR from MnSCU: since 1998, MnSCU has received between 30% and 60% of funds requested.

The U of M Morris campus suggested energy bonds and Energy Service Companies (ESCOs) as ways to overcome barriers. Twin Cities suggested the importance of creating awareness among people and training personnel on energy efficiency as key ways of overcoming these barriers. Duluth also pointed out the need for a campus wide policy on conservation measures. The campus noted that users often have maximum comfort in mind, without taking into account the amount of extra energy this would require. Some examples cited include running the entire chiller system on a warm day in April and leaving windows open in the winter. Duluth also suggested focusing on off-peak hours – noting that energy suppliers do not provide incentives to use energy at off-peak times.

Many agencies indicated that they are struggling just to keep buildings operating and there is a major maintenance backlog. For instance, according to the Facilities Condition Audit from FY07, there is more than half a billion dollars ($555, 621,056) in deferred maintenance. Government agencies identified more resources from a separate source – which would not eat into their capital or operating budgets – to do energy efficiency work as a way to overcome these barriers. Some agencies suggested that a directive from the legislature would be useful. Another agency (which leases the majority of their buildings from owners outside of state government indicated that they are not interested in becoming a building owner – likely due to the increased demands that would be placed on the department).

Question 38 – Please suggest policy changes needed to achieve energy savings in the next 20 years?

The majority of MnSCU campuses suggested that more resources for renovations and / or new buildings would be an important policy recommendation. Some suggested "fencing" some facilities allocations for renovation and energy conservation measures. Bemidji State University suggested that reducing night classes could reduce the energy consumption of their campus by 20% or more. Hennepin County Technical College (Eden Prairie and Brooklyn Park campuses) mentioned that they are starting a "green" initiative on the campuses to raise awareness about energy savings. They have also requested funds to replace lighting in hallways, replace boilers with more efficient ones, and to have improved insulation.

The U of M campuses suggested that more funding for renovations and / or new buildings and allocating a certain percentage of project funds for energy efficiency would be useful policy recommendations. Duluth suggested incentives and matching grants as opportunities for energy savings.

Government departments also suggested that more resources for renovations and / or new buildings would be useful, as well as staff available for building maintenance. The Department of Commerce suggested that energy improvements funds could be included in lease payments to building management. One department pointed out that any energy savings measure must also take into account sustainability issues – e.g., the energy used in constructing a new building may be "worse" in terms of ground, air and water pollution than if a current building were used (even if considered "inefficient").

Question 39 – The focus of this survey has been on stationary energy sources; i.e. obtaining information regarding building use in support of academic and related support programs. Are there other areas where you see a strong potential for energy savings at your campus, such as transportation or other areas?

MnSCU campuses suggested alternative energy sources (e.g., Lake Superior College noted that it is in a good location for wind energy), reducing staff travel time, incentives for car pooling and public transit, implementing a recycling program on campus and reducing the use of single energy users (e.g., space heaters, refrigerators), among others.

Regarding the U of M, Morris noted the use of hybrids and ethanol on vehicle fleet as well as alternative generators (hydrogen and ammonium). Twin Cities saw opportunities but noted that more time would be needed to identify specifics.

Government agencies suggest a number of other areas including telecommuting and Light Rail, installing default two-sided printing, having computers automatically go to hibernation mode after a period of time of inactivity, as well as, focus on the vehicle fleet and getting more staff buy-in – turning off lights, computers, etc.

Question 40 – Estimate the time (staff hours) it has taken to gather this data and complete this survey:

Estimates for MnSCU campuses ranged from 30 minutes to 40 hours (including all of the utilities information).

Estimates for the U of M campuses ranged from 1 – 40 hours.

Estimates for government departments ranged from 30 minutes to 12 hours.

PRELIMINARY CONCLUSIONS

Facilities

- Half of MnSCU's campuses, two U of M campuses, and over one third of government departments are planning or have new buildings under construction in the next four years.
- About 60% of MnSCU's campuses, two U of M campuses and almost two thirds of government departments are planning or currently have buildings under renovation in the next four years.
- More than 2,865,860 new SF and 3,448,544 SF for renovation is being planned or currently under construction, together making a little less than 6.5 million in SF.
- Using an estimate of about 80 million total SF for those organizations under the study, these projects represent 8% of SF -- important opportunities to achieve energy savings.

Energy Efficiency Information

- Energy efficiency is still not a part of the "culture" of these organizations, when speaking generally. Having said this, certain sub-groups within these organizations are energy efficiency champions.
- For example, as noted above:
    - Only about 60% of MnSCU campuses, parts of the University of Minnesota, and 70% of MnSCU and state government departments feel their campus or department is energy efficient.
    - Only two thirds of MnSCU's campuses, the U of M campuses and a little more than half of government departments have had an energy audit done. Moreover, these audits are not always updated.
    - Some MnSCU campuses, departments and U of M campuses met several times per year or more with their Commissioner or Chancellor's office, or with employees, students (in the case of MnSCU and the U of M) and other stakeholders. However, some never meet with these groups of people.
    - Numbers vary greatly regarding how much has been spent on energy efficiency projects.

  - These numbers indicate that there are likely many opportunities for campuses and departments to reduce energy use and costs.
  - Only some MnSCU campuses and government departments have conducted energy savings analyses.
- On the other hand, it is clear that energy savings are on the "radar screen" of almost all campuses and departments, who are thinking of ways to become more energy efficient and who have undertaken various actions in the past five years to become more energy efficient.
- Many are aware of outside resources but do not always draw from them because of insufficient time, resources, do not come to their campus, or they are leasing their buildings and so are unable to control many energy efficiency decisions.
- Main areas where energy efficiency measures have been undertaken and where they have been planned are in lighting, as well as overall building envelope and Energy Management Systems.
- A common problem was that many campuses and departments have considered energy efficiency measures but have been unable to act upon them.

Opinions

The most common barriers identified were:

- Lack of funds
- Competing demands for funds
- Lack of data and lack of standardization of information
- Lack of staff time
- Organizational inertia – e.g., lack of awareness, organization systems
- Lack of capacity and training

Policy changes included:

- More funds for energy efficiency on a long term basis – from a separate source
- Allocating a certain percentage of project funds for energy efficiency projects
- Allowing for a common vision and yet flexibility for individual departments and campuses to reach this goal
- More collaboration and communication between departments and / or campuses (e.g., lateral sharing of energy efficiency experiences)

[i] These agencies include the Department of Commerce, the Department of Administration, the Department of Transportation, the Department of Natural Resources, the Department of Health, the Department of Human Services, the Department of Education, the Department of Employee Relations, the Department of Finance, the Department of Revenue, the Department of Employment and Economic Development, the Department of Military Affairs, the Department of Human Rights, the Department of Agriculture, the Department of Labor and Industry, the Department of Corrections, the Department of Public Safety, and the Department of Veterans Affairs.

[ii] Although the University of Minnesota owns facilities in many locations, the focus of this study was on the four main campuses (Twin Cities, Morris, Crookston, Duluth) as information to complete the survey was readily available.

[iii] It is important to mention some qualifiers with respect to this information. First of all, the survey was issued with a very short time frame. In addition, the survey timeframe occurred over a holiday period as well as an official campus break for MnSCU and the University of Minnesota. Many of the campuses (or parts of campuses) shut down the facilities for parts or all of this holiday period in an effort to save energy. Also, in the case of MnSCU, two of their campuses had recent vacancies in the facilities position.

[iv] This information was included because is important to look at energy conservation and efficiency measures as one part of addressing sustainability. For instance, an alternative way of examining energy use is through Life Cycle Energy Analysis (LCEA), where a cradle-to-grave approach is taken, assessing not only energy used in the manufacturing of products (e.g., wind turbines), but also the energy used to produce the primary products that make up a "finished product". Using this approach, it may make more sense to use existing buildings, which may not be the most "efficient" – focusing efforts on renovations, rather than building new buildings.

[v] See http://web.lmic.state.mn.us/mm/indicator.html?Id=55

vi See http://www.admin.state.mn.us/recs/cs/fca/reports/20071127-AS.pdf, using information as of November 27, 2007

[vi] Information from survey respondents and http://www1.umn.edu/urelate/00_pdfs/FactsNov06.pdf

[viii] Please note that parking ramps require little energy use (mainly lighting), versus parking garages, which require more energy use (e.g., adequate ventilation) as they are enclosed.

[ix] Please note that even though buildings are mothballed, in order to maintain their preservation, generally some energy use is required as buildings are kept heated in the winter to ensure pipes do not freeze.

[x] "The recommissioning process involves revisiting the systems at regular intervals and checking/retesting systems using the same checklists and test procedures used during the original commissioning or retrocommissioning project." Many see the goal of recommissioning to be part of a business-as-usual process, rather than being something done "specially", or only if there is time and money (Thatcher Ellis 2001).

[xi] It is important to note that currently, the B3 database covers buildings more than 5,000 SF. Some departments (e.g., the DNR and DOT) have a number of small buildings and so these ones could not be inputted into the B3 inventory at present.

[xii] Information provided by MnSCU's Office of the Chancellor, January 7, 2008.

[xiii] However, one challenge with this option is that it may mean that other resourcing issues may be affected (e.g., hiring support staff and / or faculty), Personal Communication, Office of the Chancellor, January 7, 2008.

Appendix C 1.5% ENERGY REDUCTION ANALYSES

Linear Reduction from an Initial Baseline

Linear reduction from an initial baseline will result in an annual reduction of 1.5% of the initial baseline level through the entire 20 year period. After 20 years, the annual energy consumption will be 70% of the initial baseline consumption level, with an annual savings of 30% of the initial baseline. This method will result in a cumulative savings of 315% of the initial baseline after 20 years.

Table I. Linear Reduction from an Initial Baseline

Years Passed	Reduction (% Savings)	After Reduction (%)	Cumulative Savings (%)
1	1.5	98.5	1.5
2	3.0	97.0	4.5
3	4.5	95.5	9.0
4	6.0	94.0	15.0
5	7.5	92.5	22.5
6	9.0	91.0	31.5
7	10.5	89.5	42.0
8	12.0	88.0	54.0
9	13.5	86.5	67.5
10	15.0	85.0	82.5
11	16.5	83.5	99.0
12	18.0	82.0	117.0
13	19.5	80.5	136.5
14	21.0	79.0	157.5
15	22.5	77.5	180.0
16	24.0	76.0	204.0
17	25.5	74.5	229.5
18	27.0	73.0	256.5
19	28.5	71.5	285.0
20	30.0	70.0	315.0

Linear Reduction with a Rolling Three Year Baseline

Annual linear reduction from a rolling three year baseline consists of three year cycles where the annual reduction is based on 1.5% of the energy consumption level of the year previous to the start of the cycle. For example, the reductions for years four, five and six are based on 1.5% of the consumption level of year three. The energy consumption goal for year five would be 1.5% of the year three level subtracted from the consumption level of year four. The energy consumption goal for year eight would be 1.5% of the year six level subtracted from year seven.

After 20 years, the annual energy consumption will be 76.420% of the initial baseline consumption level, with an annual savings of 23.580% of the initial baseline. This method will result in a cumulative savings of 269.293% of the baseline after 20 years.

Table II. Rolling 3 Year Baseline

Years Passed	Annual Reduction from Initial Value (% Savings)	After Reduction (%)	Cumulative Savings (% of Initial Value)
1	1.5	98.5	1.5
2	3.0	97.0	4.5
3	4.5	95.5	9.0
4	5.9	94.1	14.9
5	7.2	92.8	22.1
6	8.5	91.5	30.6
7	9.8	90.2	40.4
8	11.0	89.0	51.5
9	12.3	87.7	63.7
10	13.4	86.6	77.1
11	14.5	85.5	91.7
12	15.7	84.3	107.3
13	16.7	83.3	124.1
14	17.8	82.2	141.9
15	18.8	81.2	160.7
16	19.8	80.2	180.5
17	20.8	79.2	201.3
18	21.8	78.2	223.0
19	22.7	77.3	245.7
20	23.6	76.4	269.3

Linear Reduction with a Rolling 5 Year Baseline

Annual linear reduction from a rolling five year baseline consists of five year cycles where the annual reduction is based on 1.5% of the energy consumption level of the year previous to the start of the cycle. For example, the reductions for years six, seven and eight are based on 1.5% of the consumption level for year 5. The energy consumption goal for year seven would be 1.5% of the year five level subtracted from the consumption level of year six. The goal for year twelve would be 1.5% of the year ten level subtracted from year eleven.

Table III. Rolling 5 Year Baseline

Years Passed	Annual Reduction from Initial Value (% Savings)	After Reduction (%)	Cumulative Savings (% of Initial Value)
1	1.5	98.5	1.5
2	3.0	97.0	4.5
3	4.5	95.5	9.0
4	6.0	94.0	15.0
5	7.5	92.5	22.5
6	8.8	91.2	31.3
7	10.0	90.0	41.3
8	11.3	88.7	52.6
9	12.5	87.5	65.2
10	13.7	86.3	78.9
11	14.9	85.1	93.8
12	16.0	84.0	109.7
13	17.0	83.0	126.8
14	18.1	81.9	144.9
15	19.2	80.8	164.1
16	20.2	79.8	184.2
17	21.1	78.9	205.3
18	22.1	77.9	227.4
19	23.0	77.0	250.5
20	24.0	76.0	274.4

Compounded Annual Reduction

Compounded annual reduction from an initial baseline will result in an annual reduction of 1.5% of the energy consumption level of the previous year. A year's energy usage target can be found by the equation $P = C(.985)^t$ where C is the baseline or the previous year's usage and the t is the number of years after the baseline.

For example, to find the energy usage target for year 20 from an initial baseline of 100, the equation would be $P = 100(.985)^{20} = 73.914$.

After 20 years, the annual energy consumption will be 73.914% of the baseline consumption level, with an annual savings of 26.086% of the baseline. This method will result in a cumulative savings of 286.996% of the baseline after 20 years.

Table IV. Compounded Reduction from Initial Baseline

Years Passed	Annual Reduction from Initial Value (% Savings)	After Reduction (%)	Cumulative Savings (% of Initial Value)
1	1.5	98.5	1.5
2	3.0	97.0	4.5
3	4.4	95.6	8.9
4	5.9	94.1	14.8
5	7.3	92.7	22.1
6	8.7	91.3	30.7
7	10.0	90.0	40.8
8	11.4	88.6	52.2
9	12.7	87.3	64.9
10	14.0	86.0	78.9
11	15.3	84.7	94.2
12	16.6	83.4	110.8
13	17.8	82.2	128.6
14	19.1	80.9	147.7
15	20.3	79.7	168.0
16	21.5	78.5	189.5
17	22.7	77.3	212.1
18	23.8	76.2	235.9
19	25.0	75.0	260.9
20	26.1	73.9	287.0

Comparison of End Results

Table V. Comparison of End Results

Method	Effective Reduction	After Reduction	Cumulative Savings
Linear – Initial Baseline	26.1	73.9	287.0
Compounded	30.0	70.0	315.0
Linear – Rolling 3yr Baseline	23.6	76.4	269.3
Linear – Rolling 5yr Baseline	24.0	76.0	274.4

Appendix D

B3 Benchmarking Report for State Agencies: Annualized Snapshot

Prepared January 15, 2008

Prepared by The Weidt Group

Annual Cost

State Organization	Total Area (sf)	Total Number of Sites	Average Energy Cost Per SF ($/sf)	Total Energy Cost ($)	Electricity ($)	Natural Gas ($)	Fuel Oil ($)	Propane ($)	Purchased Chilled Water ($)	Steam ($)	Other ($)
Department of Administration	3,982,938	17	$ 2.02	$ 8,026,359	$ 5,267,282	$ 895,641	$ 85,911	$ 18,902	$ 622,895	$ 1,135,728	$ -
Department of Correction	5,822,545	9	$ 1.66	$ 9,644,605	$ 4,133,483	$ 3,846,974	$ 435,841	$ -	$ -	$ 1,228,307	$ -
Department of Human Services	2,935,477	7	$ 1.90	$ 5,588,372	$ 2,406,482	$ 2,019,380	$ 598,277	$ 176,750	$ 302,756	$ 84,728	$ -
Department of Military Affairs	1,712,790	60	$ 1.26	$ 2,152,438	$ 1,161,997	$ 972,065	$ 3,720	$ 491	$ -	$ 14,166	$ -
Department of Natural Resources	770,838	64	$ 1.07	$ 828,163	$ 471,595	$ 133,521	$ 72,735	$ 150,311	$ -	$ -	$ -
Department of Transportation	3,994,913	153	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minnesota State Colleges & Universities	24,364,990	62	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
University of Minnesota	21,214,627	225	$ 2.00	$ 42,345,582	$ 22,588,739	$ 1,769,342	$ -	$ -	$ 2,316,405	$ 15,671,075	$ -
Veterans Home Board	765,492	5	$ 2.43	$ 1,857,484	$ 932,664	$ 924,820	$ -	$ -	$ -	$ -	$ -
Total	65,564,610	602	n/a	$ 70,442,984	$ 36,962,243	$ 10,561,744	$ 1,196,483	$ 346,455	$ 3,242,056	$ 18,134,004	$ -

Annual Energy Consumption

State Organization	Total Area (sf)	Total Number of Sites	Average Energy Use Per SF (kBtu/sf)	Total Energy Use (thousand kBtu)	Total Electricity (MWh)	Total Natural Gas (thousand therms)	Total Fuel Oil (thousand gallons)	Total Propane (thousand gallons)	Total Purchased Chilled Water (thousand kBtu)	Total Steam (thousand kBtu)	Total Other (kBtu)
Department of Administration	3,982,938	17	129	513,169	75,247	896	34	16	3,461	119,012	-
Department of Correction	5,822,545	9	127	739,354	59,050	3,847	174	-	-	128,713	-
Department of Human Services	2,935,477	7	135	395,289	34,378	2,019	239	147	1,682	8,879	-
Department of Military Affairs	1,712,790	60	91	155,592	16,600	972	1	0	-	1,484	-
Department of Natural Resources	770,838	64	67	51,859	6,737	134	29	125	-	-	-
Department of Transportation	3,994,913	153	-								
Minnesota State Colleges & Universities	24,364,990	62	-	-	-	-	-	-	-	-	-
University of Minnesota	21,214,627	225	145	3,074,878	322,696	1,769	-	-	12,869	1,642,154	-
Veterans Home Board	765,492	5	180	137,956	13,324	925	-	-	-	-	-
Total	65,564,610	602	n/a	5,068,097	528,032	10,562	479	289	18,011	1,900,241	-

Annual CO2 Emissions

State Organization	Total Area (sf)	Total Number of Sites	Average CO2 Emissions Per SF (tons/sf)	Total CO2 Emissions (metric tons)	Electricity (tons CO2 emissions)	Natural Gas (tons CO2 emissions)	Fuel Oil (tons CO2 emissions)	Propane (tons CO2 emissions)	Purchased Chilled Water (tons CO2 emissions)	Steam (tons CO2 emissions)	Other (tons CO2 emissions)
Department of Administration	3,982,938	17	0.018	72,632	54,184	4,769	345	91	-	13,242	-
Department of Correction	5,822,545	9	0.014	79,079	42,521	20,486	1,751	-	-	14,321	-
Department of Human Services	2,935,477	7	0.014	39,753	24,755	10,754	2,404	852	-	988	-
Department of Military Affairs	1,712,790	60	0.010	17,312	11,953	5,176	15	2	-	165	-
Department of Natural Resources	770,838	64	0.009	6,579	4,851	711	292	725	-	-	-
Department of Transportation	3,994,913	153	0.000	-							
Minnesota State Colleges & Universities	24,364,990	62	0.000	-	-	-	-	-	-	-	-
University of Minnesota	21,214,627	225	0.020	424,507	232,369	9,422	-	-	-	182,716	-
Veterans Home Board	765,492	5	0.019	14,519	9,594	4,925	-	-	-	-	-
Total	65,564,610	602	n/a	654,383	380,229	56,243	4,808	1,671	-	211,433	-

Institution	Campus	Natural Gas		Electricity		
		Total Usage Cost	Total Usage Quantity	Total Usage Cost	Electricity Total Usage Quantity	
		$	MMBTU	$		KWH (energy used)
Alexandria TC	Alexandria	$183,495.00	17803.00	$211,802.91		3687533.00
Anoka TC	Anoka	$230,183.00	207287.74	**$233,828**		3177600.00
Anoka-Ramsey CC	Cambridge	$51,441.66	48654.00	$63,900.53		1437844.00
Anoka-Ramsey CC	Coon Rapids	$247,014.00	25445.00	$281,503.00		3766349.00
Bemidji SU	Bemidji	$1,087,552.80	126078.93	$867,522.94		14837965.00
Central Lakes College	Brainerd	$229,906.22	60284.00	$269,731.00		4299620.00
Central Lakes College	Staples	$41,640.29	52184.00	$105,530.00		1154276.00
Century College	White Bear Lake	$343,740.82	41036.20	$562,481.12		8286605.00
Dakota County TC	Rosemount	$229,936.86	25574.00	$383,625.40		5508679.00
Fond du Lac T&C	Cloquet	$9,144.51	906.10	$21,032.89		317600.00
Hennepin TC	Brooklyn Park	$249,943.90	296514.00	$307,280.90		4030806.00
Hennepin TC	Eden Prairie	$271,141.40	323062.00	$337,880.82		4204643.00
Inver Hills CC	Inver Grove Heights	$215,650.00	27320.30	$295,494.52		6480.00
Lake Superior College	Duluth	$124,764.00	14955.00	$270,761.00		3514971.00
Metropolitan SU	St. Paul	$178,250.55	22009.60	$381,607.22		5703049.00
Mpls C&TC	Minneapolis	$348,607.00	351572.00	$659,539.00		13252494.00
MSC-SETC	Red Wing	$31,318.61	33579.20	$56,949.35		765165.00
MSC-SETC	Winona	$106,446.96	117625.00	$161,686.00		1972466.00
MSCTC-Detroit Lakes	Detroit Lakes	$95,245.79	2384.60	$94,317.05		1529793.00
MSCTC-Fergus Falls	Fergus Falls	$89,033.67	11757.60	$141,223.55		1959710.00
MSCTC-Moorhead	Moorhead	$104,263.63	11587.20	$109,207.74		1796900.00
MSCTC-Wadena	Wadena	$35,119.60	3640.30	$77,318.85		1265743.00
MSU Moorhead	Moorhead	$1,099,563.00	150006.00	$1,082,216.10		40571233.00
MSU, Mankato	Mankato	$1,935,777.75	281264.00	$1,733,971.44		30554566.00
Mwest C&TC	ALL	$254,394.77	307069.00	$330,738.27		4136431.00
NEHED-Hibbing	Hibbing	$32,274.77	33259.00	$224,784.44		2938600.00
NEHED-Itasca	Grand Rapids	$113,175.57	135565.00	$137,943.00		2149680.00
NEHED-Mesabi	Eveleth	$39,662.03	39572.00	$57,837.83		1617640.00
NEHED-Mesabi	Virginia	$349.80	237.00	$107,492.13		1066200.00
NEHED-Rainy River	International Falls	$41,591.71	4960.15	$51,258.00		833056.00
NEHED-Vermillion	Ely			$109,953.00		1952540.00
Normandale CC	Bloomington	$225,356.43	21226.50	$648,545.00		9283992.00
North Hennepin CC	Brooklyn Park	$238,936.89	27338.90	$363,588.76		5232200.00
Northland C&TC	East Grand Forks	$1,620.15	7888.01	$95,547.00		102822.55
Northland C&TC	Thief River Falls	$284,808.00	27707.90	$258,438.90		4569194.00
Northwest TC	Bemidji	$47,488.00	8473.00	$68,991.43		953938.00
Pine TC	Pine City	$35,731.00	4675.00	$74,958.00		977183.00
Ridgewater C&TC	Hutchinson - Main	$89,741.56	1011850.60	$207,807.31		2067550.00
Ridgewater C&TC	Hutchinson - East	$2,181.55	3149.00	$7,977.60		485810.00
Ridgewater C&TC	Willmar	$230,007.91	24860.20	$202,348.21		3871450.00
Riverland CC	Albert Lea	$48,317.63	64699.00	$89,147.13		1026489.00
Riverland CC	Austin		286122.00			4470568.00
Rochester C&TC	Rochester	$109,385.00	130885.00	$632,346.57		632346.57
South Central College	Faribault	$35,432.70	4084.80	$63,039.87		3552.00
South Central College	North Mankato	$35,432.70	40848.00	$63,039.87		3552.00
Southwest MSU	Marshall	$2,737.96	269.40	$825,453.71		35282319.00
St. Cloud SU	St. Cloud	$1,551,218.00	201072.80	$1,983,537.00		28954189.00
St. Cloud TC	St. Cloud	$153,168.60	19680.94	$244,712.50		3387.25
St. Paul College	St. Paul	$168,342.24	178014.00	$391,758.02		17496.00
Winona SU	Winona	$1,115,332.00	145078.00	$1,162,561.00		19747537.00
TOTAL		**$12,395,867.99**	**4981114.98**	**$17,114,216.28**		**289,981,812.37**

Appendix E MnSCU

Fuel Oil			Steam	
Total Usage Cost	Number 2 - Total Usage Quantity	Number 6 Total Usage Quantity	Total Usage Cost	Total Usage Quantity
$	Gallons	Gallons	$	Pounds
$11,760.00	6000.00			
$3,016.86	2200.00			
$6,604.46	3422.00			
$17,200.00	10000.00			
$27,366.90	14001.00			
41774.34	22502			
	1000*			
$892.18	458.00			
$77,491.23	40135.00			
155374.4	81776	0	2091152.2	181180241
$12,959.80	6200.00	0.00	$0.00	0.00
			$131,535.03	12015.00
			$70,585.98	58180.00
$181,806.52	85302.00			
$1,529.40	617.00			
$3,421.00	1407920.00			
$3,180.00	1000.00			
$20,272.00	9629.00		$87,531.00	5962.00
$3,000.00	1100.00			
$3,000.00	1100.00			
$149,339.00	0.00	154597.00	$1,459,776.00	148237000.00
			$261,034.22	
$72,483.00	43488.00	0.00	$316,583.00	106549899.00

Cost and Usage Information for Fiscal Year 2007

UMN Duluth

Month	Natural Gas: Total Usage Cost	Natural Gas: Total Usage Quantity (MMBtu)	Electricity: Total Usage Cost	Electricity Total Usage Quantity (KW)	Electricity Total Usage Quantity (KWH)	Fuel Oil: Total Usage Cost	Fuel Oil: Number 2 - Total Usage Quantity (Gallons)	Fuel Oil: Number 6 Total Usage Quantity (Gallons)	Steam: Total Usage Cost	Steam: Total Usage Quantity (Pounds)
Jul-06	$72,670	8,600	$146,658	5,273	2,808,400	0	0	0	Unknown	6,888,000
Aug-06	$74,529	8,820	$165,634	5,832	3,326,400	0	0	0	Unknown	7,265,000
Sep-06	$114,498	13,550	$159,160	5,903	3,189,200	0	0	0	Unknown	11,047,000
Oct-06	$207,518	24,102	$162,035	5,802	3,031,000	0	0	0	Unknown	19,492,000
Nov-06	$199,078	30,440	$151,442	5,157	3,080,000	0	0	0	Unknown	24,578,000
Dec-06	$295,697	37,430	$141,719	5,263	3,019,800	0	0	0	Unknown	29,528,000
Jan-07	$301,052	45,203	$134,060	5,091	2,837,800	0	0	0	Unknown	36,456,000
Feb-07	$297,574	43,002	$162,769	5,449	3,197,600	0	0	0	Unknown	35,319,000
Mar-07	$234,454	32,563	$158,452	5,389	2,896,600	0	0	0	Unknown	25,979,000
Apr-07	$235,269	24,007	$168,513	5,137	2,928,800	$10,271	0	9,010	Unknown	20,372,000
May-07	$142,097	16,020	$168,984	5,116	2,891,000	0	0	0	Unknown	13,072,000
Jun-07	$114,446	10,910	$173,159	5,389	2,742,600	0	0	0	Unknown	9,023,000
TOTALS	$2,288,881	294,647	$1,892,584	64,801	35,949,200	$10,271	0	9,010	Unknown	239,019,000

Cost and Usage Information for Fiscal Year 2007

UMN Morris

Month	Natural Gas		Electricity			Fuel Oil			Steam	
	Total Usage Cost	Total Usage Quantity	Total Usage Cost	Electricity Total Usage Quantity		Total Usage Cost	Number 2 - Total Usage Quantity	Number 6 Total Usage Quantity	Total Usage Cost	Total Usage Quantity
		Therms		KW	KWH		Gallons	Gallons		Pounds
Jul-06	$15,598	17,332	$53,793		849,200					1,341,000
Aug-06	$24,413	27,126	$56,183		981,453					2,469,000
Sep-06	$37,214	41,350	$49,210		807,685					5,589,000
Oct-06	$46,055	51,173	$48,348		803,535					8,275,000
Nov-06	$94,837	105,375	$51,745		838,155					10,175,000
Dec-06	$119,292	132,547	$44,517		705,269					10,692,000
Jan-07	$132,347	146,508	$47,781		773,770	$14,609	7,699			11,469,000
Feb-07	$111,107	122,425	$48,498		772,995	$14,722	7,700			11,954,000
Mar-07	$90,385	101,304	$44,994		714,259					8,062,000
Apr-07	$63,004	78,397	$51,104		790,035					6,622,000
May-07	$15,532	29,766	$51,831		784,191					2,522,000
Jun-07	$21,378	25,065	$49,314		808,138					1,624,000
TOTALS	**$771,162**	**878,368**	**$597,318**		**9,628,685**	**$29,331**	**15,399**			**80,794,000**

Fiscal Year 2007

Cost and Usage Information for Fiscal Year 2007

Month	Fiscal Year 2007									
	Natural Gas		Electricity			Fuel Oil			Steam	
	Total Usage Cost	Total Usage Quantity	Total Usage Cost	Electricity Total Usage Quantity		Total Usage Cost	Number 2 - Total Usage Quantity	Number 6 Total Usage Quantity	Total Usage Cost	Total Usage Quantity
	$	MMBtu	$	KW	KWH	$	Gallons	Gallons	$	Pounds
Jul-06	754,064	139919	2,676,698	55214	41079582	-	0	0	2,268,402	113420100
Aug-06	725,121	143894	2,704,104	51273	38147022	-	0	0	2,799,182	139959100
Sep-06	565,424	115059	2,426,076	44391	31961518	-	0	0	1,894,490	94724500
Oct-06	533,823	105433	1,751,676	39046	29049877	-	0	0	2,779,168	138958400
Nov-06	1,167,333	197754	1,423,116	35258	25385511	722	553	0	3,347,580	167379000
Dec-06	1,436,818	204991	1,555,033	30169	22445508	581	434	0	4,335,972	216798600
Jan-07	1,101,527	156465	1,516,364	27367	20361388	3,261	2334	0	5,166,290	258314500
Feb-07	1,298,288	196491	1,334,024	32974	22158364	-	0	0	5,322,976	266148800
Mar-07	696,530	111789	1,605,987	32758	24371722	1,221,971	727241	0	3,547,432	177371600
Apr-07	941,674	151295	1,992,516	39466	28415585	-	0	0	2,808,572	140428600
May-07	1,108,732	180274	615,575	45734	34025920	-	0	0	2,042,166	102108300
Jun-07	739,990	135293	2,771,835	50486	36350246	-	0	0	1,917,854	95892700
TOTALS	**11,069,324**	**1838657**	**22,373,004**	**484135**	**353752243**	**1,226,535**	**730562**	**0**	**38,230,084**	**1911504200**

FY07 Energy Usage & Costs - Administration Department

	Electricity		Natural Gas		Fuel Oil #2		Propane		Hot Water		Chilled Water-Retail		Chilled Water-Wholesale		Total
	Cost	KWH	Cost	MMBTU	Cost	Gallons	Cost	Gallons	Cost	MWH	Cost	Ton-Hour	Cost	KWH	Cost
Admin Bldg.	---	---							$57,959	936					
BCA	$431,726	6,529,600	$235,505	31,669		10,003									
Capitol	---	---							$146,833	2,601					
Centennial	---	---							$132,932	2,248					
Judicial	---	---							$69,430	1,126					
Maintenance	---	---							$40,374	644					
Stassen Revenue	---	---	$19,713	1,924					$115,243	1,829					
State Office	---	---							$87,136	1,603					
Transporta-tion	---	---							$207,329	3,853					
Veterans	---	---							$33,791	2,154					
321 Grove St.	$23,282	257,437	$13,449	1,284											
Gov. Res.	$20,667	265,366	$17,559	1,740											
Dept. of Rev.-Ely	$20,326	287,680					$27,349	20,775							
Surplus Warehouse	$7,283	81,560	$18,479	1,913											
Andersen	$622,796	8,850,000	$21,157	2,065					$141,710	1,994	$312,635	1,845,809			
AgHealth Lab	---	---	$63,248	5,446					$323,418	6,480					
Freeman	---	---	$14,046	1,369					$174,434	2,870					
History Center	$707,073	1,016,520	$406,342	55,262		8,924									
Retirement	$171,378	3,158,800	$6,499	621					$119,650	1,753					
Grove 2	$2,638	26,560	$2,715	245											
Armory	---	---	$802	50					$110,455	4,906					
Capitol Complex Loop	$3,501,878	52,636,669											$416,245	3,700,535	
Total	$5,509,047	73,110,192	$819,514	103,588		18,927	$27,349	20,775	$1,760,694	34,997	$312,635	1,845,809	$416,245	3,700,535	$8,845,484

Appendix G
MENU OF OPTIONS

January 9, 2008

Policy Challenges:

- Should Legislature set 1.5% reduction per year energy consumption goal?
- How should the legislation define energy consumption for a quantifiable measurement and reduction requirement?
- How can the policy be sustainable over a long-term through political and administration changes?
- Legislation needs to provide flexibility for agencies and campuses to achieve goals that are passed down from above.

Barrier	Description	Example
Inadequacy of Data	Clarity on what to measure Clearly defined goals and achievement qualifications Implementation: Measurement & Reporting	Electric meters measure multiple buildings – need on individual buildings. Meters measure for billing, not for consumption goals. No standard energy reporting method or system
Long Term Sustainability of Policy	State government and organizations in a unique position to think long term Mindset of departments or administrations Need to institutionalize policy and measures for goals over long term	Changing administrations Short term goals of departments
Diversity of Agencies and Buildings	Hard to describe a central solution with varying environments and activities of agencies Need to provide equivalent incentives across all agencies without penalizing an agency for being in a certain environment or at a certain level of progress	DNR's or Mn/DOT's array of locations and building types versus Correction's large, centralized buildings
Resource Scarcity	Budget Need dedicated staff, time and money Lack of communication channel between agencies for conservation/efficiency topics	Efforts draw from operating budget Funding competes with efforts that yield greater fiscal returns Need staff with the capacity and training for efficiency considerations
Inertia	Organizational Systems Established process for energy accounting, construction and renovation planning	Environmental impact consideration vs. Fiscal return and cost Cost is the deciding factor for many decisions

Policy Option	Description	Example
"One Stop Shop"	Centralized source of literature and training Place to exchange information laterally	Website for all agencies to regularly report energy data, receive and share information Office or department to oversee implementation and sustainability of energy efficiency measures
Separate funding for energy efficiency projects	3rd party loans of below-market interest loans Capital funding pool for energy efficiency projects Modified Energy Investment Loan Program	State of Iowa's Facilities Improvement Corporation Texas LoanSTAR program administered by State Energy Conservation Office
Energy Audits	Regularly completed across all agencies and organizations Consistent standards and study considerations	Washington State, House Bill 2246: Requires audits at state facilities. If audits produce energy-saving opportunities, the improvements must be implemented using performance contracting.
Public Reporting	Regularly report energy consumption, intensity Publishing will promote institutionalization of energy efficiency mindset	Australia's EEGO Policy: Organizations must annually report energy intensity performance to their Ministers and the Department of the Environment and Heritage
Procurement Policies	Efficiency requirements Bulk purchasing of efficient products Energy rating labeling of products and buildings	State and local governments can save $750 million annually through efficient product procurement (EPA 2007)
Incentives	Provide incentives to organizations that make a concerted effort to achieve efficiency and conservation goals	Energy or carbon "credits" – financial awards from funding pool assigned proportionately to agency efforts

Benefits	Costs
State government in unique position to think long term, so government practices can help develop unique markets for relevant technology and services Encourage adoption of practices and products in public and private sectors Fiscal Rewards: Reduced operating and utility costs, credits in future carbon exchange agreements Regular measurement and reporting raises awareness and encourages efficiency and conservation 'culture' Reduced carbon and greenhouse gases	Requires financial and human resources (internal and external) Time commitment: integrating energy efficiency considerations into processes of building, renovating, procurement and operation Development of training system for facilities and energy managers

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