Energy Design Assistance:
Energy Modeling Protocol
Colorado
ASHRAE 90.1-2007

Xcel *Energy*℠

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1. General

1.1   Introduction

This document describes the Protocol for energy modeling for the Energy Design Assistance (EDA) program.

The goal of the EDA program is to provide timely results on a wide range of design options, early enough so that those options are still viable within the context of the project. The results emphasized are the *energy savings*—a differential—between options or different proposed designs and the baseline. This effort, undertaken in the design phases, does not assert an ability to forecast actual operating energy consumption, either for a proposed building or the baseline.

It is important to note that the EDA program does not attempt to provide feedback or documentation on whether or not a building is complying with the referenced energy code or standard.

For purposes of program administration, the Xcel Energy Protocol employs accepted modeling conventions, which simplify the modeling effort and provide overall consistency for our customers. This allows for our energy consultants to provide results for a wide range of possible energy savings options in a limited time period.

A computer model of a baseline design is developed for each project that has been accepted into the program. Development of the baseline building and proposed building design options follows the Protocol outlined in this document. This document primarily focuses on the Basic Energy Design Assistance service, while Enhanced is addressed separately.

The EDA Protocol is based on a utility modified version of the *ANSI/ASHRAE/IESNA Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings utilizing Appendix G.* The exception to this rule is when the local energy code for the building is more stringent. In all cases the ASHRAE 90.1-2007 standard baseline model shall be set up according to this Protocol and reported to Xcel Energy. For locations where more stringent local energy codes apply, the Energy Consultant is required to use an approach similar to this Protocol and document the energy savings compared with the more stringent energy code.[1] As jurisdictions that fall under this category are discovered, appendices shall be added to the document for clarification. Refer to local jurisdictions websites for local code.

EDA now accepts low-rise multifamily projects which are 50,000 sf and bigger. The protocol has been updated to include modeling of these projects. The modeling protocol is the same as that used for multifamily projects four stories and above, except for the baseline assumptions. The baseline assumptions refer to the 2009 International Energy Conservation Code for insulation levels, fenestration performance and mechanical equipment efficiency

1.2 Scope

The purpose of this document is to specify the method for determining the proposed building performance of a customer's proposed design relative to the reference standard for the purpose of calculating energy savings results and Xcel Energy construction rebates for the EDA program.

Results are determined with the use of a computer simulation approved by Xcel Energy. Currently approved energy simulation programs are: DOE2.2, DOE2.1e, EnergyPlus, and eQuest.

1.3 Definitions

As Modeled	As modeled includes the savings identified within the modeled bundle during early design.
As-Specified Results	Results for a version of the building, selected by the design team and owner, that is operated in the model according to criteria in the Protocol AND according to discretionary parameters *not* governed by the Protocol but that are set or accepted by the design team and owner during the design phase. The results are adjusted for variances found during the <u>construction document </u>review.
As-Verified Results	Results for a version of the building selected by the design team and owner that are operated in the model according to criteria in the Protocol AND according to discretionary parameters *not* governed by the Protocol but that are set or accepted by the design team and owner during construction. The results are adjusted for variances found during the <u>verification</u> visit.
Building Energy Model	A computer simulation of the projected energy use and associated energy costs of a building.
Baseline	The energy performance and associated energy costs developed with use of a computer representation of a hypothetical design based on the parameters defined in this Protocol.
Bundle	An integrated group of strategies or Energy Conservation Measures that represent a potential version of the building.
Energy Code	The legal requirement, as defined by a local governing agency that must be followed in designing and building the subject project. The locally adopted energy code may vary from jurisdiction to jurisdiction within Xcel Energy territory.
EDA Energy Consultant	Providers of energy modeling services.
Energy Conservation	A strategy that represents a technology, design or operation improvement for saving energy that may be considered for

Measure (ECM)	the subject building.
Design Team	The architects and engineers of record for designing and constructing the project.
Process Load	The load on a building resulting from the consumption or release of process energy.
Proposed Building	The building that the Design Team is planning to build without energy enhancements. ***This should be the basis for Bundle 1.***
Proposed Building Performance	The annual energy cost calculated for a proposed design.
Proposed Design	A computer representation of the actual proposed building design or portion thereof used as the basis for calculating the design energy cost. For the Energy Design Assistance program a minimum of 3 proposed designs/bundles will be provided to allow the customer to view different options.
Measurement and Verification (M&V)	For the purpose of this Protocol, M&V includes the review of a constructed building for energy conservation measures installed. Measurement is limited to selected strategies as noted in this Protocol.
Simulation Program	A computer program capable of building energy modeling on an hour-by-hour basis, (e.g. DOE 2).
Results	Energy usage and cost projections for the baseline building as compared to the modeled building versions to be considered as part of the EDA program developed using processes and rules defined in this Protocol.

1.4 Protocol Standard

The Energy Design Assistance program in Colorado uses ASHRAE Standard 90.1-2007. For multifamily buildings under four stories, EDA uses the insulation levels prescribed in 2009 International Energy Conservation Code.

Specifically the EDA program uses the methodology of Appendix G with modifications listed in Section 3.2 of this document. Modifications are a result of three specific concerns surrounding Appendix G:

- Appendix G allows cross fuels: The primary metric for the Appendix G is energy costs. The accounting of what happens with individual energy units as required by Demand Side Management (DSM) programs is not an area of focus for Appendix G. The EDA Protocol adjusts this focus to meet the requirements of the DSM program. See Appendix A for the detailed policy on cross fuels policy

- Appendix G is written for use in evaluating completed designs: EDA is structured to work with participants during the early design phases before designs are finalized. This helps customers and Design Teams identify energy savings early in the design process when they have better opportunities to make design changes. Appendix G

sets baseline criteria after the design decisions have been made. If the baseline is reset at the end of the design process, there can be a change in calculated savings compared to that which was forecasted in the earlier stages of design. Since Xcel Energy claims credit for the influence on design, the resetting of the baseline is not required within this Protocol unless there is a significant building change; this is thus further discussed in section 3.2 and 4.4.3.

- <u>This EDA Protocol requires the use of the prevailing system type used in the market for that building type, taking into consideration fuel use (to avoid fuel switching).</u> This may or may not correspond with the system as prescribed by Appendix G. If the Energy Consultant determines that the Appendix G Baseline system type does not address these requirements, the proposed HVAC system may be used in the baseline model instead, taking into consideration fuel switching. The Energy Consultant will document use of Appendix G.

2. Simulation Requirements

2.1 Process

The Energy Design Assistance program requires an hour-by-hour energy simulation program to determine the baseline model energy use and calculate as well as savings for individual energy conservation strategies and bundles.

2.2 Software Requirements

2.2.1 Simulation Program

An hour-by-hour simulation program capable of predicting annual energy use and energy cost for a building, including both energy consumption and peak energy by fuel source.

2.2.2 Weather

A standard typical year weather file for the building location is used. Typical Meteorological Year weather files for many Colorado locations are available from http://rredc.nrel.gov/solar/old_data/nsrdb/1961-1990/tmy2/ (TMY2 files) or http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/ (TMY3 files). If a weather file is not available for the exact location a weather file is chosen based on proximity to the building location and or climate region.

2.2.3 Utility Rates

All utility rates used in the modeling shall be documented in the preliminary report and/or bundle report to document the values used in the model. Electric rates shall be based on the most recent rates available in the quarter the project is first modeled. Rates should be updated up until the time of bundle selection.   If the project goes on hold or the design is stalled for a period of time, the Energy Consultant should update rates when the design re-starts if rates have changed by >+-10%.

2.2.3.1 Electric Rates

While many of our programs use base rates as described in our most recent filings, EDA does it differently for electric rates. Other programs are based on energy costs savings while EDA uses rates to do projections for two to three years in the future. Therefore, please use the most available electric rates possible. Use the actual Xcel Energy rate structure(s) on which the building will be when occupied. The rates account for peak, consumption, and meter charges. Any time of day or seasonal variations are also accounted for.

This information can be found quarterly at our website: http://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/rates/CO/psco_elec_entire_tariff.pdf. Weighting winter and summer months is acceptable. For all questions, please call Xcel Energy to determine reasonableness. As always, please note any differences in rates within each report.

2.2.3.2 Gas Rates

Use an average gas rate as provided by Xcel Energy January of each year and modified for specific project circumstances for Xcel Energy retail gas customers only[2]. Monthly meter charges are included in this information provided by Xcel Energy.

Gas rates can be found on Xcel Energy's website at:
http://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/rates/CO/psco_gas_entire_tariff.pdf

2.2.3.3 District Heating and Cooling Rates

Use actual district energy charges for the proposed building provided by the building owner when the project is first modeled, including demand and consumption charges as well as ratchets and seasonal variations.

2.2.3.4 Campus Heating and Cooling Rates

Use actual campus energy charges for the proposed building provided by the building owner when the project is first modeled, including demand and consumption charges as well as ratchets and seasonal variations.

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[2] Non-Xcel Energy gas customers cannot receive a gas rebate. Also note for transport (non-Xcel Energy) gas projects: Once bundle has been selected, the customer cannot switch to Xcel Energy gas and receive a gas rebate, as customer would be considered a free-rider at this time.

3. Baseline Protocol

The Baseline for the Energy Design Assistance Program is determined using this Protocol, based mainly on the ASHRAE Standard 90.1-2007 Appendix G methodology. Please note that the rating authority listed in the following tables is Xcel Energy. Once baseline is established and modeling has been conducted, the baseline should not change.

The changes with regard to the low-rise residential baseline reference the 2009 International Energy Conservation Code and only apply to the residential spaces in the building; common areas and commercial space follow the Non-residential protocol.

3.1 Baseline Assumptions

3.1 Number of People

The number of people and heat and moisture gain per person shall be based on values suggested in the ASHRAE Handbook of Fundamentals for the modeled space types. The number of people shall be held constant between the Baseline, all strategies, ECMs, bundles and design versions.

3.1.2 Infiltration Rates

Infiltration rates are based on ASHRAE Handbook of Fundamentals 2009 Chapter 16 suggested values for the different building types. Infiltration rates are the same for the Baseline and all strategies, ECMs, bundles and design versions, unless measures are identified that have a quantifiable effect on infiltration. Infiltration strategies need to be approved by Xcel Energy before inclusion in bundle(s) for rebates.

3.1.3 Plug/ Process Loads

Plug and process loads are mainly based on ASHRAE Handbook of Fundamentals suggested values; however there are exceptions as noted below. As such, values other than ASHRAE must be validated by the engineers of record and **approved by Xcel Energy before inclusion in energy alternatives/bundle(s) for rebates.**

Plug Loads - Projects types such as labs and hospitals that may have large plug loads can be disadvantaged if the plug loads are not available for energy savings due to the EDA program limitations. On a per project basis and approved by Xcel Energy, exceptions can be made to separate the plug load from the total energy savings and use this as the final requirement for minimum savings.

Types of plug load examples:
- Computers/monitors, laptops, IPADs
- Hospital plug-in equipment
- Coffee makers, refrigerators, microwaves, dishwashers
- Clothes washters
- Fans
- Desk and table lamps
- Televisions

3.1.4   Process Energy

Process energy is that which is consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.

Buildings with sizeable process loads such as data centers and other process end uses (examples below) that are not regulated by ASHRAE 90.1-2007 shall document the baseline and ECM parameters used in the energy model as *Exceptional Calculation Methods* as described in Appendix G.

Types of process energy examples:
- Cooking
- Special HVAC, process systems
- Hospital systems
- Special motor driven systems
- Data centers[3]
- Exhaust systems
- Refrigeration systems[4]

Many times these process systems can be integrated with the building services and reduce the overall energy consumed. An example would be the use of hot gas from a refrigeration system to preheat service water.

While the modeling of these particular process loads is not defined by this Protocol, Xcel Energy has significant documentation on these areas and should be notified regarding their use. Please contact Xcel Energy to discuss process loads prior to modeling completion, as Xcel has process loads experience.

When process loads are estimated during the time of early modeling, Xcel Energy requests that these loads be updated if significant changes are made during design and if prior knowledge of these changes occurs before Construction Document Review. Final rebate estimates are not provided to the customer until after this time.

3.1.5 Hours of Operation

Lighting, equipment, and fan hours of operation shall be based on published data and experience from past projects and updated with input from the owners, architects, and engineers of record.

3.1.6 Temperature Set points

Baseline temperatures set points shall be as shown in the table below unless directed otherwise by the design team or owner. These set points can be used to take credit for programmable thermostats for multifamily housing projects

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[3] Please note that Xcel Energy does have a Data Center Efficiency program and whenever possible, customers should combine efforts between Energy Design Assistance and this program.
[4] Baseline refrigerated display merchandisers shall be modeled as outlined by the Department of Energy document 10 CFR Part 431 and ANSI/AHRI Standard 1200-2010.

	Occupied	Unoccupied
Heating	70	65
Cooling	75	82

3.1.7 Additional Mechanical Operation Assumptions-Fans and Fan Power

- Outside air dampers shall be assumed to be closed when the fans are scheduled off (5% leakage) and fans cycle on as needed to maintain unoccupied temperature settings.

- **Fan energy peak demand** can be verified through a review of the test, adjust, and balance (TAB) report, if available, along with fan motor data logging. To verify demand savings through fan motor data logging, fan motor amp draw, fan airflow volume and duct static pressure can be monitored either from the BAS or independent data logging. If the fan does not run at full speed during the trending period, fan laws can be used to calculate peak fan kW from operational kW. Measured fan peak kW should then be compared to the calculated baseline kW to verify estimated peak fan kW savings in the energy model.

  Fan energy use for variable volume systems will be verified through short-term (2 week) or long-term (4 week) trending to verify savings from reduced fan kW relative to the baseline.

3.2 ASHRAE Standard 90.1-2007 Appendix G Modifications

The Baseline shall be determined according to the methodology of the 90.1-2007 Appendix G with the changes outlined in Table 3.2, below.

Table 3.2 EDA Baseline Modifications to Appendix G

Item reference from App G	Brief Description of Appendix G Approach	Summary/clarification of Modification
G2.4	Utility Rates - use actual or DOE published	See section 2.2.3
Table G3.1 No. 1	(c) Where space classification is not known model as office space	Where space classification is not known model your best estimate of space type and document assumption in the report. Final classifications will be needed to define savings during verification.
Table G3.1 No. 3	Space use classification can use either the building type or space type lighting classifications	Only the space-by-space classification method is accepted, with the exception of speculative office buildings that do not have tenants at the time of modeling

Table G3.1 No. 5	Existing building envelope shall be modeled as built	Existing building envelope can be modeled as built in the baseline and proposed building design when it shall not be updated as part of the construction work. Envelope that shall be replaced/updated needs to be modeled according to the following: • If either the use of the building or the occupancy of the building will change as a result of the project, the appropriate baseline assembly U-factor from Tables 5.5-1 through 5.5-8 shall be used. • When either the use of the building or the occupancy of the building will <u>not</u> change as a result of the project, the existing building assembly U-factor shall be used.
Table G3.1 No. 5	Manual fenestration shading devices such as blind or shades shall not be modeled.	Don't model in baseline; consider effects on visible transmittance when modeling daylighting controls.
Table G3.1 No. 5	Rotate baseline building by 90, 180, 270 degrees and average the results	Rotation and averaging is optional.
Table G3.1 No. 6	(c) Where lighting neither exists nor is specified used the building area method allowance	The preferred method is to use the space-by-space method lighting power density for those areas. Where lighting is not specified or designed such as tenant spaces in speculative office buildings, model expected tenant use. The building area method may be used for this purpose. Where possible model tenant lighting strategies to develop a tenant package. However, other methods may be acceptable. **Please discuss with Xcel Energy**.
Table G3.1 No. 6	Additional lighting power allowances have not been clarified	Lighting power allowances of section 9.6.2 can be added to the lighting power densities in the baseline model if the design of those spaces meets the criteria for allowance
Table G3.1 No. 6-d	Receptacle lighting loads (switched outlets) should be identical in proposed and baseline	Multi-family dwelling units should be modeled as follows: • Baseline LPD = 1.54 Watts per square foot • Annual usage = 750 hours per year or hours appropriate to building type • Installed fixtures in dwelling units should

		follow 90.1-2007 Section 9.1.4 to determine luminaire wattage (exception noted below).
		• Rooms that use switched outlets as the only light source should model the proposed LPD matching the baseline LPD for that area of the dwelling unit.
		• Spaces with hardwired lighting should use the actual luminaire wattage to determine LPD.
		• Spaces with a mixture of hardwired lighting and switched outlets can claim savings if the calculated lighting levels (weighted avg. footcandles) provided by the hard wired lighting fixtures are capable of meeting IESNA's recommended 16 footcandle minimum average lighting level. If the lighting level provided via hardwired fixtures is below the recommended level, calculate the supplemental switched outlet lighting required (assuming 26 lm/Watt) to meet the recommended lighting level. The total wattage of the hard wired and supplemental lighting will be used as the LPD.
		• Unswitched receptacles are unregulated loads and are included in the process load energy use.
		• Screw-in bulbs (i.e. compact fluorescent, incandescent, LED) light bulbs are counted towards energy savings, per Xcel Energy.
		• If the design LPD is above 1.54 w/sf or no apartment LPD strategy is selected, the Baseline LPD shall be increased from 1.54 w/sf to match the design LPD.[5]
Table G3.1 No. 6	Only automatic controls can be modeled in the proposed building	See Special Baseline Considerations in section 3.4

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[5] A cautionary note that if the LPD is not met the EDA goal requirement will probably not be met.

Table G3.1 No.1	(b) All conditioned spaces in proposed building shall be heated and cooled even if no heating or cooling system is being installed	Heating/Cooling may only be modeled in areas where heating/cooling systems are installed. However, the baseline shall have identical areas of heating and cooling as the proposed building design.
Table G3.1 No. 10	Where no heating system exists or no heating system has been specified the heating system classification shall be assumed to be electric.	This is only allowed for additions and then use the same heating system as the rest of the building
Table G3.1 No. 10	Where no cooling system exists or no cooling system has been specified the cooling system shall be identical to baseline.	Baseline building shall have same heating/cooling areas as proposed building. It is possible to have areas with no cooling system. This shall be identical between proposed and baseline.
Table G3.1 No. 10	Baseline HVAC systems shall be based on usage, number of floors, conditioned floor area and heating source as specified in Table G3.1-1A.	The baseline HVAC system is based on the Appendix G system selection protocol. The cooling/heating fuel type shall be the same type between the baseline and proposed models. Use the prevailing system type used in the market for the building type, taking into consideration fuel use and building type. If the Appendix G baseline system does not meet these requirements, the baseline system may be based on the proposed system. For projects where the baseline system is different from the Appendix G baseline system or the proposed system, approval is needed from Xcel Energy's Energy Efficiency Engineer.
Table G3.1 no. 12	Receptacle Loads shall be estimated based on the building type or space type category.	Use the actual plug and process equipment loads in both the baseline and building design. If these are not known use a space-by-space approach per relevant published data and/or engineering judgment to determine receptacle loads for each space use in the model. Uniform building receptacle loads are not allowed.
G3.1.2.9	Supply fan power for baseline system based on supply fan cfm	Use methodology prescribed by the section 6.5.3. • For residential projects use the 0.3 W/cfm approach of Appendix G • For Heated Only Storage spaces use the approach of the 90.1-2010 standard for

		system types 9 and 10 listed in section G3.1.2.10 For fan system nameplate hp below 5 hp savings need to document the baseline and proposed fan parameters in order to claim savings
G3.1.3.5	Hot water pump sizing and VFD requirements	The requirement for VFD control of the pump shall be determined by the requirement of section 6.5.4.
G3.1.3.7	Electric chillers shall be modeled in baseline regardless of proposed chiller energy source	Cooling fuel source (electricity or gas) shall be identical between baseline and proposed models. District or campus cooling systems shall be used in baseline model if used in proposed design.
G3.1.3.10	Chiller water pump power and VFD requirements	The requirement for VFD control of the pump shall be determined by the requirements of section 6.5.4.1.

3.3 *Enhanced* *Energy Design Assistance*

The EDA Enhanced program track provides energy consulting services early in design. This program also provides energy modeling support where design teams have a stated goal for achieving certification with other 3rd party verified rating systems, such as Designed to Earn the ENERGY STAR, LEED® and Enterprise Green Communities

When energy modeling and consulting is provided in early schematic design phases, the building design has the potential for more energy savings with optimization strategies that are applied later in the process. It is possible that the building has additional savings for design decisions made at this stage such as in an appropriate building massing strategy. The results due to such early design decisions shall be reflected in the way savings increase due to a more efficient overall building design through better daylighting, thermal zoning, etc. The savings shall be reflected in the calculations done using the defined Protocol. No separate, additional savings shall be claimed for these early design analysis decisions that are not regulated by the ASHRAE 90.1-2007 Standard.

For projects pursuing certification options with a different baseline requirement than the EDA baseline (i.e. LEED v4 2012 requires use of ASHRAE 2010), two baselines and two versions of the as-specified and as-verified models shall need to be run: (1) for claiming energy savings under the EDA program and providing customer rebates, and (2) for certification analysis. As part of the consulting process provided under the Energy Design Assistance program, it is the responsibility of the Energy Consultant to provide clarity in the presentation of the results so as not to confuse the design team and owners, while meeting the requirements of Xcel Energy for internal documentation and

consistency of results. It is also the responsibility of the Energy Consultant to be familiar with the current requirements and interpretations thereof associated with the certification effort approved by Xcel Energy for the subject project, and to follow those requirements for the subject project. Program Requirements can be found at www.xcelenergy.com/businessnewconstruction.

3.4 Special Baseline Considerations

3.4.1 Cross-Fuel Policy for Colorado

Cross-fuel - Baseline systems shall be selected to eliminate the situation where an end use's energy source is changed from one energy stream to a different energy stream in the bundle. The Cross-fuel policy in Colorado, according to regulations is: "Fuel switching from natural gas to other fossil fuel derived energy sources shall not be included in the gas utility's DSM program. Programs to save natural gas through switching to renewable energy sources such as solar heating and ground source heat pumps are allowed." Xcel interprets this rule to mean switching from electricity sources to other fossil fuel sources as well.

An example of an allowable fuel switching is where a customer implements a ground source heat pump strategy which will reduce gas consumption but increase electric consumption. Calculations for cross fuel, savings and an incentive shall be followed in accordance with the policy attached in Appendix A of this protocol.

An example of what is fuel switching but NOT allowable is where a customer implements a gas-fired absorption chiller instead of an electric chiller which will reduce electric consumption but increase gas consumption. To avoid fuel switching, an appropriate baseline for this system would be a gas fired absorption chiller modeled with an efficiency equal to that prescribed in the protocol.

In the case where a project is considering a number of systems for a given strategy, it may be necessary to create multiple baseline models in order to prevent incentives for fuel switching.

Projects with an introduction meeting after June 1, 2010 will not receive any incentive if there is negative energy savings (kWh*).*

3.4.2 Load Shifting

CO – Load shifting shall be defined as a measure that shifts electrical energy and demand usage to an off-peak period, without reducing the total load served over a defined time period (for example, one day or one week). Energy consumption to meet the loads of the affected end use shall not be significantly reduced. Example load shifting measures include thermal energy storage (examples - ice storage, chilled water, or eutectic solutions) and equipment rescheduling. Peak shaving and demand control technologies (for example, lighting voltage reduction) shall not be classified as load shifting if they reduce the total load being served.

Load shifting strategy results shall be developed as an independent modification and **shall be reviewed by Xcel Energy** for potential eligibility for inclusion in incentive calculations. (See Appendix B for specific policy and calculation details.)

3.4.3 On-Site Generation/ Renewable Energy

On site generation including co-generation, on-site wind, or photovoltaic (PV) systems shall not be rebated through the EDA program as they are not deemed "conservation" by Xcel Energy. While the overall impact of these systems should be analyzed for the overall building, switching from one source to another is considered fuel switching.

3.4.4 Solar Thermal Systems

Projects including solar thermal systems for heating of service hot water, building heat or pool water heat can include the solar thermal system's energy savings in the model. However since the DOE-2 program does not currently support the direct calculation of solar thermal systems, the consultant shall document in the project report(s) the methodology of calculating the energy savings of these systems. Multiple software packages are available to analyze solar thermal systems. Calculations are required to be based on 8,760 hours per year weather file for the project location as described in Section 2.2.2; and heating load calculated from DOE-2 for the service hot water, building heating water, or pool water heating load from the project's DOE-2 run. In order to avoid incentives for fuel switching, the solar thermal system energy savings shall be of the same fuel type as the backup or supplemental heat source designed for that heating end use. For the solar thermal system, if there is no back up fuel source, the baseline system shall be electric heat if the rest of the building is all-electric and natural gas fired if the building has a gas line for other uses.

3.4.5 District Heating Systems

Projects that shall use district heating (ie. purchased steam heat) shall use the following methodology to determine the district component of the natural gas savings impacts for the project. All energy simulations runs shall use district heating as the source for heating. The difference between the baseline model annual heating energy use and the proposed bundle annual heating energy use shall be divided by 80%. The district component of the natural gas savings shall then be added to the building natural gas savings, the sum of these two shall comprise the total natural gas savings that the incentive is based on. The project is only credited an incentive for saving natural gas if the district system uses Xcel Energy's retail gas.

The previous methodology is developed to approximate the energy savings without detail information on the district heating system. The true differential energy performance cannot be determined without detailed knowledge and even simulation of each system's equipment and operation. For the EDA program, we determine an energy value that can be assigned to these load reductions for purposes of calculating an incremental incentive.

3.4.6 District Cooling Systems

Projects that shall use district cooling shall use the following methodology to determine the district component of the electricity use and demand savings impacts for the project. All energy simulations runs shall use district cooling as the source for cooling. The cooling energy use and demand reductions from the EDA baseline to the proposed bundle are used to calculate kW and kWh savings based on a default baseline assumed efficiency of the respective system. The difference between the baseline model peak cooling energy use and demand and the proposed bundle peak-cooling energy use and demand shall be determined using a default efficiency of 0.58 kW/ton and 0.58 kWh/ton (if the actual district cooling plant efficiency is not known). The district cooling electricity use and demand savings shall then be added to the building use and demand savings, the sum of these two shall comprise the total demand savings that the incentive is based on. The project is only credited an incentive for saving electricity if the district system uses Xcel Energy's electricity.

The previous methodology is developed to approximate the energy savings without detailed information on the district cooling system. The true differential energy performance cannot be determined without detailed knowledge and even simulation of each system's equipment and operation. For the EDA program, Xcel Energy determines an energy value that can be assigned to these load reductions for purposes of calculating an incremental rebate.

3.4.7 Campus Heating Systems

Buildings or additions to buildings that are added to an existing heating plant that is not being updated or to a central campus heating plant that serves buildings or areas not in the study shall use the same modeling approach as the listed in Section 3.4.5 for District Heating Systems. Condenser water loop system should be modeled in the baseline and proposed models. The fan power and pump power should be the same between the baseline and proposed models for the condenser water loop system.

3.4.8 Campus Cooling Systems

Buildings or additions to buildings that are added to an existing cooling plant that is not being updated or to a central campus cooling plant that serves buildings or areas not in the study shall use the same modeling approach as the listed in Section 3.4.6 for District Cooling Systems.

3.4.9 Ground Source Heat Pump Systems

Refer to table 3.2

3.4.10 Underfloor Air Distribution and Thermal Displacement Ventilation

Projects using underfloor air distribution (UFAD) or thermal displacement ventilation (TDV) HVAC systems shall use the following modeling methodology for modeling in energy simulations.

Adjust the amount of internal gain to the space from the baseline case with all lighting, people, and equipment loads assigned to the space, to a case were a portion of the

loads are assigned to the plenum or return air duct. This is to account for the stratification of the internal heat gain that is not in the occupied zone.

	Percent Load to Space		Percent Load to Plenum/Return Duct	
	Underfloor Air Distribution	Thermal Displacement Ventilation	Underfloor Air Distribution	Thermal Displacement Ventilation
People	75%	67%	25%	33%
Lights	67%	50%	33%	50%
Equipment	67%	50%	33%	50%

Adjust the minimum supply air temperature from the traditional 55°F for overhead systems, to the 60°F to 67°F used in the UFAD or TDV system design. The minimum supply air temperature set point shall be obtained from the engineer of record and match the supply air temperature that the project shall be designed to use.

The outside air quantity provided to the zone is allowed to be different from the baseline overhead supply system since the ventilation effectiveness is greater with the UFAD or TDV systems. The baseline system outside air for the overhead supply system should be obtained from the engineer of record if available.

The supply air quantity of the UFAD or TDV system is allowed to be different from the baseline overhead supply system designed for a 20°F ΔT. The baseline system supply air for the overhead supply system should be obtained from the engineer of record.

3.4.12 ENERGY STAR® Rated Equipment

Projects that shall be installing new appliances and equipment can include the energy savings of the ENERGY STAR rated equipment in the model. The baseline shall use comparable sized appliance or equipment that just meets the minimum efficiency rating of the appliance or equipment

3.4.13 Lighting Control Savings

    3.4.12.1 Occupancy Sensors

- Modeled as schedule changes
- Schedules changed differently to account for peak savings versus annual hour savings
- Two different types of occupancy sensors are modeled although not all are applicable for all space types
  - **Occupancy sensor control** is appropriate for most space types where it is common for lights to be on when no one is present for periods throughout the day. To reduce "False-On's" the sensor should not view out a door or into adjacent spaces. A wall switch is still required to allow occupants to turn lights off when space is occupied.

- o **Dual level occupancy sensor control of lights** is applicable for smaller enclosed spaces. The control comprises an occupancy sensor with two switches that control two separate lighting circuits in the room. The circuits connect separate fixtures in the space or separate lamps in each fixture. As the wall-mounted sensor detects occupancy, it switches 'on' one of the lighting circuits. The other circuit has to be manually turned 'on'. If no occupancy is detected for an extended period, the occupancy sensor switches 'off' both circuits. If the space has access to daylighting, the savings can increase further.

3.4.12.2 Vacancy Sensors

- o Vacancy sensors are occupancy sensors that require manual on versus auto-on. Studies show that vacancy sensors achieve 21% savings as compared to 10% for standard occupancy sensors[6]. Based on this, Xcel Energy allows for an additional 11% more energy and demand rebate credit beyond the Appendix C tables.

3.4.12.3 Dual Level Fixtures

- Dual level fixture use is applicable for rooms with variable light level requirements Manual switches should provide two or more levels of light output from each fixture, and must be readily accessible and located such that occupants can see the controlled lighting from the switch location. The controlled lighting should have at least one control step between 30% and 70% (inclusive) of full lighting power in addition to all off. This can be accomplished by inboard/outboard lamp switching or stepped ballasts.

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- Gymnasiums are modeled as 30% reduction on both peak and annual hours.
- All other space where applicable are modeled as 15% reduction on both peak and annual hours.

Manual Dimming

- Manual dimming is applicable for rooms with concentrated Audio/Visual requirements. Electronic dimming ballasts are used with manual dimming controls in place of wall switches.
- Where applicable modeled as a 25% reduction on both peak and **annual hours**.

Bank Switching

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[6] This is the basis for Title 24 calculations in a report by HMG titled "Savings Estimates for Lighting Controls and Interactions", 2012.

- Five percent (5%) credit can be given for bank switching for kW and kWh as long as there is clear evidence of bank switching. For example, they can be specifically metered, and/or one light switch controls at least 33% of the fixtures.

3.4.14 Adjustments

The goal of the EDA program is to provide timely results on a wide range of design options, early enough so that those options are still viable within the context of the project. We acknowledge that the window of opportunity to complete this is often very short and therefore assumptions shall need to be made in early modeling on such things as window area, ventilation rates and process load. These assumptions are made to allow for timely comparative analysis so that the customer is able to make decisions on energy efficiency and take advantage of potential incentives. Discretionary parameters are always an estimate until the building is completed and operating for an extended period in time. As such, while discretionary parameters may change throughout the process, the savings and incentives are determined based on the initial moment in time and as such should not be adjusted unless physical changes occur.

Adjustments for physical changes in the building such as square footage, window area, equipment governed by this Protocol should be made if the results are expected to be affected in a significant way. It is the responsibility of the Energy Consultant to monitor the progression of design during the design, CD review and M&V stages of the EDA process and make adjustments to the baseline or alternate versions of the building such that the results provide accurate results for the purposes of the program. This includes both the reporting of results to Xcel Energy for demand-side management accounting and (if applicable) any necessary adjustments needed for third-party certification efforts approved by Xcel Energy as part of the scope of work on a particular project.

3.4.15 Excess Chiller Capacity

In the case that a design team has purposefully over-sized a mechanical system to accommodate expected future growth and that mechanical system would otherwise be eligible for prescriptive rebates from other programs offered by Xcel Energy, the following steps will be taken:
- The energy consultant will reduce the capacity of the system within the energy model to meet the modeled building load.
- The excess capacity (i.e. the difference in the capacity of the actual system and the theoretical system created for the energy model) will be treated as a separate piece of equipment with characteristics identical to those of the modeled equipment apart from capacity.

The excess capacity system will be subject to the current prescriptive rebates and deemed energy savings available at the time of the bundle meeting. These rebates and impacts will be absorbed by the EDA program (i.e. the prescriptive rebate is then added to the EDA rebate).

4. Reporting and Submissions

4.1 Simulation Outputs

The results shall include reporting of total annual energy cost in current dollars and also a cost breakdown by energy end-use (heating, cooling, service hot water, fans and pumps, lighting, refrigeration, and equipment). Similar output information shall be provided for all strategy, energy conservation measures (ECM) and bundle simulations.

The energy use shall be reported in total annual energy use per square foot and also a breakdown of energy use by end-use per square foot.

Total energy consumption shall be reported for all energy sources, e.g. total annual kWh electric energy use (kWh) and Dekatherms for energy gas use.

Peak energy use shall be reported for electric (kW), cooling (tons) and gas (kbtu/h). Peak electric kW is defined to occur between 9 am and 9 pm, excluding holidays, in the months of June thru September.

Emissions shall be reported in tons of CO_2 using the most recently provided average generation system emissions data from Xcel Energy provided in March of each year.

4.2 Simulation Inputs

Simulation inputs shall include the following:

- Description of any differences between the baseline and proposed models
- Description of energy analysis work done to quantify things that the simulation program was not capable of doing
    - Wall mass types and R-value
    - Glazing U factors and SHGC
    - Window-to-wall ratio
    - Wall areas by orientation
    - Glazing area by orientation
    - Roof R-values
    - Space type, floor area, and other design parameters
    - Space internal gains
    - Hourly space schedules
    - Lighting/equipment power densities
    - Full load equivalent hours of operation for lighting, equipment and occupancy
    - Mechanical (HVAC) system characteristics

- Supply and outdoor ventilation air capacities

- Supply and fan total static pressure

- Service hot water system characteristics

- Utility schedules

- Weather (meteorological) data

- Energy conservation measure descriptions

4.3 Project Reviews

Xcel Energy will perform project reviews on EDA projects. Four levels of reviews will be completed at random.
- All EDA Enhanced projects
- 10% of all projects below 1.5 GWh saved
- 40% of all projects between 1.5 GWh saved and 2 GWh saved
- 100% of all projects over 2 GWh saved

Once a project has been modeled at the schematic design phase and preliminary savings analysis numbers are known, the selection mechanism will identify whether or not the project will require an audit. The exception to this rule would include EDA Enhanced projects. These projects will initiate at the beginning of the process during the goal setting meeting. Reviews will initiate at this time. A description of review requirements follows.

4.3.1 Project Reviews below 1.5 GWh & EDA Enhanced projects
As part of the reviews, the EDA Energy Efficiency Engineer will be incorporated into the project team, and will be included in all related activity, including project meetings, correspondence, and verification activities.

4.3.2 Project Reviews over 1.5 GWh
As part of these reviews, the EDA Energy Efficiency Engineer will also review modeling parameters. As modeling parameters are specific to a given project and modeling software, the EDA Energy Efficiency Engineer will work with the Energy Consultant to obtain relevant information on a case-by-case basis. Below are a sampling of reports types that may be requested:

DOE 2 Reports (eQuest reports)
- Report LV-B: Summary of Spaces
- Report LV-D: Details of Exterior Surfaces in the Project
- Report LS-C: Building Peak Load Components
- Report LS-D: Building Monthly Loads Summary
- Report SV-A: System Design Parameters (for all systems)
- Report SS-A: System Loads Summary (for all systems)
- Report SS-D: Building HVAC Load Summary

- o Report PS-A: Plant Energy Utilization
- o Report PS-B: Utility and Fuel Use Summary
- o Report PS-C: Equipment Loads and Energy Use
- o Report PS-E: Energy End-Use Summary for all Meters
- o Report BEPS: Building Energy Performance
- o Report BEPU: Building Utility
- o Report ES-D: Energy Cost Summary
- o Report ES-E: Summary of Utility-Rate

4.4 Measurement and Verification Requirements

4.4.1 Construction Document Review

Construction documents are reviewed for measures identified through the EDA process, and selected by the design team for implementation in the project. The design team and customer are notified whether or not these measures were found within these documents. Results should be modified at this time if significant changes in the following occur:

- Window area

- Ventilation rate

- Square-footage

- Space use

- Parking garage area

- Equipment modeled as part of the EDA analysis

Xcel Energy shall be provided with a report called Construction Document Review.

4.4.2 Project Verification Plan

The Energy Consultant shall provide a verification plan to Xcel Energy for review. This plan shall describe the extent of verification for the project.

4.4.3 On-site Verification Requirements

Site visit 1 - Shortly after construction completion, resolution of related commissioning items, and occupancy[7] (exceptions are made for certain building types such as jails, retail or hospitals), the Energy Consultant shall visit the project site and verify that specified measures were installed and functioning. Reasonable effort will be made to allow the Customer to repair measures that are found to be not functional before verification is complete. Dataloggers can be placed during site visit 1, but monitoring

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[7] Late 2011 this process was updated from the "two months" of occupancy requirement to allow for site visit 1 to be held closer to construction completion and occupancy to give design teams and controls contractors more time to fix problems for optimized strategies. Energy consultant will still complete full 2-4 weeks of data logging and determine any major changes affecting the project and/or Xcel Energy's goals.

should begin (data loggers activated) after approximately 2 months after at least 80% occupancy[8].

Site visit 2 – A second site visit will be conducted to verify equipment installation and operation (if not fully completed in site visit 1 due to equipment not operating or installed at time), and to remove dataloggers.

Monitoring/datalogging:

Selected equipment and systems are monitored for a two-four week timeframe, as appropriate, to evaluate performance variables against modeling assumptions.

Monitoring should begin approximately 2 months after occupancy.

For projects where **individual measures** that have savings greater than or equal to 1.0 GWh or 20,000 Dth per year, data logging is required for a time period of **four** weeks. Less than 1.0 GWh or 20,000 Dth per year, data logging is required for a two week time period.

Verified results:

Verify the operational hours with the design team. Provide the assumed modeled operation hours along with the verified operational hours prior to completing the verification.

The verified results shall be used to adjust the estimated savings to determine the final rebate. If the actual results are not within 15% of the as-specified energy savings (kWh or Dth) identified within the model finalized during CD review, the consultant completes an as-verified model to determine final energy savings.

Operation Hours
Weekday
Seasonal / Weekday Alternate
Weekend
Holiday

4.4.3 Reporting requirements

The following reports shall be provided to Xcel Energy in order to meet verification compliance:

- Construction Document Review
- Project Verification Plan
- Final Verification Report

A final verification report shall be provided to Xcel Energy and forwarded to the customer and design team as a last project deliverable.

Further, a final document for Xcel Energy must be included with the following data points:

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[8] At least 80% occupancy is required because certain measures operate at maximum energy consumption based on occupants. Example- Laboratory fume hoods.

- Date of Introductory Meeting
- Date of Bundle Meeting
- Dates of onsite verification
- Installation dates of equipment monitoring equipment
- Removal dates of equipment monitoring equipment

5. Professional Judgment

Certain modeling techniques and compliance assumptions applied to the proposed design(s) are fixed or restricted by the Xcel Energy Protocol.   That is, there is no discretion to choose input values regarding specific input variables for compliance modeling purposes. However, there remain other aspects of computer modeling for which professional judgment is necessary. In those instances, it is important to verify whether a given assumption is appropriate.

Xcel Energy has full discretion to question the appropriateness of a particular input, especially if the user has not substantiated the value with supporting documentation.

Two questions may be asked in order to resolve whether good judgment has been applied and are taken from the *2005 Nonresidential Compliance Manual for California's Title 24:*

- Is the approach or assumption used in modeling the proposed design(s) consistent with the approach or assumption used in generating the baseline?
    - The rule is to model the proposed design(s) using the same assumptions and/or techniques used by the program to calculate the baseline unless drawings and specifications indicate specific differences that warrant conservation credit or penalties.
- Is a simplifying assumption appropriate for a specific case?
    - If simplification reduces the energy use of the proposed building when compared to a more explicit and detailed modeling assumption, the simplification is not acceptable.

Acknowledgement

The Energy Design Assistance Protocol was collaboration between several parties. These parties are acknowledged for presenting modeling ideas and input into this document.

- The Weidt Group®
- Group14 Engineering
- Xcel Energy

Appendix A: EDA/Custom Cross-Fuel/Combo-Fuel Project Policy

Background: This policy covers all EDA projects that involve a change in both electric and gas consumption. For projects that result in a change in consumption in other fuels – propane, heating oil, solar, etc. – the change in consumption for these fuels shall be treated as O&M impacts only.

EDA projects baseline choice to avoid cross-fuel
Baseline systems shall be selected to eliminate the situation where an end use's energy source is changed from one energy stream to a different energy stream in the bundle. Xcel must serve the fuel that is conserved and rebates must be paid from the program for that fuel to eliminate fuel-switching cases.

This policy addresses the following topics:

1. Definition of each of the possible Cross-Fuel/Combo-Fuel scenarios
2. Source BTU Analysis for Cross-Fuel
3. Screening for Cross-Fuel Analysis
4. Treatment of Achievements, Rebates, other Utility Costs
5. Treatment of Incremental Capital and O&M Costs or Savings

Significant policy points are **bolded.**

The MN DOC Docket No. G008/CIP-00-864.07 Reply Comments of May 23, 2003 state that Staff supports performing a BTU comparison for "determining whether a measure results in a net reduction in energy use." If a project does result in a net BTU savings, a "benefit-cost analysis that examines the changes in the specific fuels costs should also be conducted." The Docket does not address the treatment of achievements, rebates and Admin and Marketing costs.

Cross-Fuel / Combo-Fuel Scenarios

The possible scenarios include:

Cross-Fuel Project: Reduced consumption for the primary, rebated fuel, increased consumption for the secondary fuel. Xcel must serve the fuel that is conserved and rebates must be paid from the program for that fuel to eliminate fuel-switching cases.

Full Combo Project: Reduced consumption for both fuels and Xcel Energy serves both fuels.

Partial Combo Project: Reduced consumption for both fuels but Xcel Energy serves only the primary fuel. Achievements are credited and rebates paid just for the primary fuel savings. The secondary fuel savings are treated as Incremental Energy O&M Savings in all tests.

Cross-Fuel Project Policy (Reduced consumption for the primary, rebated fuel, increased consumption for the secondary fuel)

Source BTU Analysis
For each cross-fuel project, the Source BTU Impacts from the two fuels should be combined to produce a Net Source BTU Savings. **For a project to be rebated, it must result in positive Net Source BTU Savings.**

To calculate the Source BTU Impacts, the following conversion factors are used. The MN DOC Docket No. G008/CIP-00-864.07 Reply Comments of May 23, 2003 state that Staff supports performing a BTU comparison for "determining whether a measure results in a net reduction in energy use." If a project does result in a net BTU savings, a "benefit-cost analysis that examines the changes in the specific fuels costs should also be conducted." The comments provide the following methodology to calculate the Source BTU savings resulting from each fuel:

Source BTU to Generator kWh

> **Source BTU Impact (Electric) = 7500 BTU/Generator kWh * Generator kWh**, based on typical Heat Rate for Combined-Cycle Natural Gas-fired Plant

> Efficiency of CC (Generator BTU / Source BTU) = BTU to kWh conversion (Generator BTU / Generator kWh) / Heat Rate of CC (Source BTU / Generator kWh)

Where,

> BTU to kWh conversion (Generator BTU / Generator kWh) = 3412.3

> > 1 BTU = 1.055 kilojoules. 1 joule per second = 1 watt, or 1 joule = 1 watt.sec.

> > 1 kWh =1000 x 3600 watt.secs = 1000 x 3600 joules = 3600 kilojoules = 3600/1.055 BTU = 3412.3 BTU

> Heat Rate of CC (Source BTU / Generator kWh) = 7500

> > Based on typical Heat Rate of 7500 BTU/kWh for CC's from Steve Wishart e-mail of 10/28/09.

> Efficiency of CC (Generator BTU / Source BTU) = 3412.3 (Generator BTU / Generator kWh) / 7500 (Source BTU / Generator kWh) = 45.5% (Generator BTU/Source BTU)

This 45.5% efficiency value is slightly higher than the value estimated in the MN DOC Docket of 42%, reflecting the higher efficiency of newer combined-cycle natural-gas-fired plants.

Source BTU to Customer Dth

> **=** BTU to Dth conversion (Source BTU / Source Dth) / (1 - Gas Line Loss Factor (Customer Dth / Source Dth))

Where,

> BTU to Dth conversion (Source BTU / Source Dth) = 1,000,000
>
> > 1,000,000 BTU = 1 MMBTU. 1 MMBTU = 1 Dth. 1,000,000 BTU = 1 Dth
>
> Gas Line Loss Factor (Customer Dth / Source Dth) = 2%
>
> > Based on loss factor estimate form MN DOC Docket.
>
> = 1,000,000 (Source BTU / Source Dth) / (1 - 98% (Customer Dth / Source Dth))
> **Source BTU Impact (Gas) = 1,020,408 Source BTU / Customer Dth * Customer Dth**

Net Source BTU Savings

> **Net Source BTU Savings = Source BTU Impact (Primary Fuel Savings) - Source BTU Impact (Secondary Fuel Increase)**

Screening for Cross-Fuel Analysis
Performing a Cross-Fuel Analysis means reducing the primary fuel savings by the secondary fuel increase according to the method specified above.

To perform a Cross-Fuel Analysis, the Source BTU Impacts of the fuel that has increased consumption must be greater than 10% of the Source BTU Impacts of the fuel that is being conserved. If the increased consumption is due to changes in a conditioned space, such as in a lighting project, a Cross-Fuel Analysis should not be performed. If the project does not qualify for Cross-Fuel analysis, the increased consumption shall be treated as an O&M cost. If the increased consumption is not due to changes in a conditioned space, unless the increased usage is produced by a renewable energy source, the project must be rejected, in accordance with Colorado Gas Rules – 4756(b):

> (b) Fuel switching. Fuel switching from natural gas to other fossil fuel derived energy sources shall not be included in the gas utility's DSM program. Programs to save natural gas through switching to renewable energy sources such as solar heating and ground source heat pumps are allowed.

The following equation shall be used to determine if the project qualifies for cross-fuel. If this equation is true, the project must go through cross-fuel analysis:

Source BTU Impact (Primary Fuel Savings) < 10 * Source BTU Impact (Secondary Fuel Increase)

To illustrate application of the cross-fuel rules, here are five general cases:

1. A large piece of machinery that uses electricity but also provides waste heat that is used in another process. If a high-efficiency electric option results in significant electric savings but also in a reduction in waste heat that must be made up with increased gas usage, and this increased gas usage exceeds 10% of the electric savings, the electric savings must be reduced by the gas usage increase. If the gas usage is less than 10% of the electric savings, the gas increase should be considered participant energy O&M costs.

2. A whole-building project which includes several electric energy-savings measures - such as windows, insulation, lighting, process loads - but results in net increase in gas usage, the electric savings must be reduced by the gas usage if the gas usage increase exceeds 10% of the electric savings. The gas usage increase can exclude for purposes of the adjustment calculation the measures which are changes in a conditioned space such as lighting controls, reduced lighting design, and reduced plug load. This treatment provides an incentive to the customer to pursue more energy savings on the gas side. Because the electric rebate to the customer is discounted by the net gas increase, a reduction in this net gas increase would result in less of a discount, or a net increase in the rebate. If the gas usage is less than 10% of the electric savings, the gas increase should be considered participant energy O&M costs.

3. A large scale project to replace the lighting in a building results in an increase in gas usage due to lost heat, that exceeds 10% of the electric savings on a source BTU basis. Because the increased usage is due to changes in a conditioned space, this project should treat the increased gas usage as a participant O&M cost and should not discount the electric savings or rebate. If the gas usage is less than 10% of the electric savings, the gas increase should be considered participant energy O&M costs.

4. An electric boiler is replaced by a gas boiler. This project is considered fuel-switching and is not allowed, even if it results in cost-effective source BTU savings, as the primary fuel being used changes as a result of the project.

5. A ground-source heat pump replaces a gas furnace. This project should go through cross-fuel analysis if the secondary fuel impacts are greater than 10% of the primary fuel impacts, and otherwise treat the secondary fuel impacts as participant energy O&M costs. This project is allowed in due to the exception made for fuel-switching involving renewable energy sources. (This situation usually doesn't apply in CO)

Also, when considering the revenue requirement impact of both fuels (avoided revenue requirements for saved fuel and increased revenue requirements for increased fuel) the project must be cost-effective.

Treatment of Achievements, Rebates and Other Utility Costs

For the fuel that is being conserved, the savings should be deducted by the fraction of the increased fuel's Source BTU Impact over the conserved fuel's Source BTU Impact. This percentage should then be applied to all aspects of the energy savings, including Marketing kW, Generator kW and Generator kWh on the electric side, and Dth on the gas side. This will result in a reduction of the rebate paid and the assumed other utility costs (administration and marketing costs). Net benefits are calculated from this reduced conservation of the rebated fuel, rather than from the net benefits of the two fuels.

> **Primary Fuel Savings Deduction = Source BTU Impact (Secondary Fuel Increase) / Source BTU Impact (Primary Fuel Savings)**

Treatment of Incremental Capital and O&M Costs or Savings

The full Incremental Capital and non-energy O&MN Costs or Savings shall be used in the cost-effectiveness test and payback calculations. Payback calculations should use the bill savings based on the savings of the primary fuel and the increase in the consumption of the secondary fuel.

Full Combo Project Policy (Reduced consumption for both fuels and Xcel Energy serves both fuels.)

Treatment of Achievements, Rebates and Other Utility Costs

Full achievement credit shall be taken for the savings of both fuels. The rebates and other utility costs should be based on these achievements for each fuel. The Participant Test and payback estimates should be based on the bill savings and rebates paid from both fuels.

Treatment of Incremental Capital and O&M Costs or Savings

For the Participant Test and payback calculations, the full participant cost and O&M costs or savings from both fuels should be used. For the other test, the fuel's portion of the project's total avoided revenue requirements should be applied to the Incremental Capital and non-energy O&M Costs or Savings to produce the fuel's share of those costs or savings. There should not be any energy O&M impacts, as the impact of both fuels are captured.

Partial Combo Project Policy (Reduced consumption for both fuels but Xcel Energy serves only the primary fuel)

Treatment of Achievements, Rebates and Other Utility Costs

Achievement credit shall be taken only for the savings of fuel served by Xcel Energy. Rebates paid and other utility costs should be based only on the achievements of the fuel served by Xcel.

Treatment of Incremental Capital and O&M Costs or Savings

Internal Xcel: For TRC tests, the savings of the fuel not served by Xcel should be translated into avoided revenue requirements, and the incremental capital cost and any participant non-energy O&M costs or benefits shall be reduced so that they represent just the share of the avoided revenue requirements of the fuel served by Xcel. For the participant test, the full participant cost and non-energy O&M costs or savings from both fuels should be used. The bill savings from the fuel not served by Xcel shall be treated as bill savings.

Appendix B – Load Shifting

Policy Overview
This document outlines the policy for EDA projects with load shifting measures within Xcel Energy's Colorado service territory. This policy will ensure that load shifting projects are analyzed and accepted or rejected using a consistent decision-making methodology.

Definition
Load shifting shall be defined as a measure that shifts electrical energy and demand to an off-peak period, without reducing the total load served over a defined time period (for example, one day or one week). Energy consumption to meet the loads of the affected end use will not be significantly reduced. Example load shifting measures include thermal energy storage and equipment rescheduling.

Peak shaving and demand control technologies (for example, lighting voltage reduction) shall not be classified as load shifting if they reduce the total load being served.

Eligibility
Potential load shifting projects would have to meet all existing eligibility requirements of the applicable program (e.g. cost effectiveness requirements, payback criteria, customer eligibility, etc.). To address potential persistence issues surrounding load shifting measures, additional eligibility requirements include:
- A required capital investment in equipment - measures that are solely a function of change in behavior are ineligible (e.g. rescheduling manufacturing shifts), and
- Reasonable demonstration that savings persistence of at least 10 years is likely.

Load shifting projects will need to demonstrate persistence by meeting one or more of the following criteria:
- A minimum 3 year simple payback requirement - intent is to show the savings are significant enough that the customer would be motivated to continue the measure.
- A minimum estimated annual energy cost savings of $5,000. Supporting calculations should be provided during the application and pre-approval process.
- Customer shall provide written documentation stating the measure will be in place for at least 10 years.
- For unique technologies and situations, a demonstrated customer commitment to and adoption of the technology into current practices, as determined by Xcel Energy's project manager.

Appendix C - Occupancy Sensor Savings Tables

Dual level Occupancy Sensor Controls – to implement increase the reduction factors in the table below by 5%.

Building Type	Space Type	on-peak	off-peak
Housing/ Hotel			
	Apartment/ Guest Room/ Bedroom w/study	NA	NA
	Laundry	25%	40%
	Common Room	25%	29%
	Corridor	20%	30%
	Exercise	25%	40%
	Lounge	25%	40%
	Guest Room Toilet	30%	60%
Hospital			
	Pharmacy	NA	NA
	Nursery	NA	NA
	Corridor	0%	30%
	Exam	25%	40%
	Lounge/ Waiting Room	15%	40%
	Patient Room / Operating Room / Emergency OR / Radiology	20%	30%
	Prep/Work	20%	30%
	Laboratory	20%	30%
	OR Recovery	15%	30%
	Storage/ Medical Supplies	25%	40%
	Nursing Station	20%	40%
	Occu/Physical Therapy	20%	30%
	Procedure	25%	40%
Clinic			
	Waiting	15%	24%
	Prep/Work	20%	35%
	Storage/ Medical Supplies	25%	40%
	Exam	25%	40%
	Nurse Station	15%	15%
	Corridor	0%	10%
	Procedure	25%	40%
	Physical Therapy	20%	30%
	Radiology	20%	30%
Manufacturing / Warehouse			
	Warehouse	20%	35%
	Manufacturing	0%	20%
Office			
	Conference[8]	25%	25%
	Corridor / Atrium	5%	3%
	Laboratory	20%	35%
	Lobby	5%	13%
	Storage	25%	22%
	Data center	25%	23%
	Dining[9] / Serving	5%	19%
	Kitchen	10%	20%
	Private office	15%	23%
	Open office	0%	9%

Building Type	Space Type	on-peak	off-peak
Religious			
	Audience / Seating / Pulpit / Choir	15%	35%
Retail			
	Sales Floor/ 24 hr Retail/ 9 hr Retail	NA	NA
	Pharmacy	NA	NA
	Check Lanes	NA	NA
	Vestibule	NA	NA
	Kitchen	NA	NA
	Grocery	0%	15%
	Corridor	25%	32%
	Storage	25%	27%
	Stock	25%	40%
	Restroom	35%	45%
	Office	25%	26%
	Dining/ Serving	5%	23%
	Loading Dock	25%	25%
	Mech/Elec	25%	40%
	Walk in Cooler/Freezer	25%	40%
School (Primary)			
	Classroom	10%	13%
	Coridor	20%	18%
	Laboratory	10%	12%
School (Secondary)			
	Classroom	15%	23%
	Corridor	20%	19%
	Laboratory	15%	30%
School (Post Secondary)			
	Classroom[10]	25%	34%
	Computer Lab	15%	21%
	Corridor	15%	22%
	Laboratory	20%	30%
	Faculty Office	25%	34%
	Library/ Media Center	20%	32%

Building Type	Space Type	on-peak	off-peak
School (Generic)			
	Computer Classroom	15%	19%
	Shop	15%	20%
	Gym	15%	23%
	Locker Room & Shower	30%	46%
	Library/ Media Center	15%	9%
	Auditorium	25%	26%
	Cafeteria/ Serving	5%	19%
	Kitchen	5%	25%
	Community Room	20%	28%
Generic/ All Other			
	Gym/ Fitness	15%	23%
	Storage	50%	54%
	Day Care	10%	15%
	Garage/ Open Garage	25%	6%
	Mech/elec	50%	70%
	Pool	20%	30%
	Conference[8]	25%	25%
	Open Office	0%	9%
	Private Office	15%	20%
	Corridor	20%	30%
	Kitchen	10%	20%
	Dining[9]/ Serving	5%	20%
	Vestibule	NA	NA
	Restroom	35%	42%

8 –Required unless multi-scene controls for all conference space type

9 – Required unless multi-scene controls for all employee lunch and break rooms

10 – Required unless multi scene controls in non K-12 classrooms and laboratories