EDAPT Example Project  
1123 W 3rd Ave, Denver, CO 80223

Xcel Energy’s Energy Design Assistance Program

Construction Documents Report

June 29, 2013

**Prepared for:**

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Energy Design Assistance Program Process & Timeline

Xcel Energy’s Energy Design Assistance (EDA) process is designed to assist the Owner and Design Team in making decisions concerning energy-efficiency measures for the project. The main steps of the process are as follows.

|  |  |  |
| --- | --- | --- |
| **Construction stage** | ENERGY DESIGN ASSISTANCE STATE | **DATE** |
| **aPPLICaTIon**  **Design phase** | Step 1: APPLICATION  Complete application  Xcel Energy accept/reject of application | **June 29, 2013** |
| **PRE/EARLY SCHEMATIC DESIGN PHASE** | Step 2: INTRODUCTION  Introductory meeting  EDA Program overview  Energy efficiency measure discussion  Begin collection of building and incremental cost data  Submit introductory report | **July 15, 2013** |
| **Schematic Design phase** | Step 3: PRELIMINARY ENERGY ANALYSIS (PEA)  Early massing, HVAC, daylighting (Enhanced Track only)  Preliminary energy analysis meeting  Review of analysis results in PEA report  Selection of measures to be included in final energy analysis  Submit PEA report | **June 29, 2013** |
| SD completion | |  |
| **Design Development phase** | Step 4: FINAL ENERGY ANALYSIS (FEA)  Final energy analysis meeting  Review of updated whole building analysis in FEA report  Review of program incentives  Introduction to verification process  Customer selects an energy design alternative, showing an intent to move forward with selected measures | **June 29, 2013** |
| DD completion | |  |
| **Construction Document phase** | Step 5: CONSTRUCTION DOCUMENT (CD)  Customer sends final design CDs to EDA Verification Consultant  **EDA Verification Consultant:**  Confirms measures included in final design documents. Sends to EDA  Modeling Consultant to update model  Submits CD report with updated model results and incentive  EDA consultant complete green certification docs (Enhanced Track only)  Design team completes documentation for fee reimbursement |  |
| **CD Completion** | |  |
| **Construction** | **Construction Occurs. Estimated construction completion date** |  |
| **Construction ends** | |  |
| **Post-Occupancy** | EDA Verification Consultant conducts:  On-site measurement and verification. Sends M&V results to EDA Modeling Consultant to update model  Submits M&V report with updated model results and incentive |  |
| **Incentive payment to customer is received approximately two months post-verification** | | |

Xcel Energy, through the Energy Design Assistance program, has qualified energy consultants to provide our customers with a service that includes an integrated design process. This integration includes using an energy model to predict energy savings. The energy model itself is an instrument to project results and review different energy efficiency opportunities. The results of these models belong to Xcel Energy and their customers as participants through the Energy Design Assistance program.

Xcel Energy customers participating in the Energy Design Assistance program may distribute the results of their model to anyone they choose.  Xcel Energy will not release this information unless written permission from the customer has been obtained.  As a result of this permission, two reports will be provided: the Preliminary Energy Analysis Report and the Final Energy Analysis Report. Xcel Energy also cautions the use of these reports; data is based on an analysis done for a specific time frame.  Buildings naturally adjust as occupancy reaches its full potential, causing variations from pre-construction data.

Project Summary

|  |  |
| --- | --- |
| Project Name | EDAPT Example Project |
| Xcel Energy Project # |  |
| Location | 1123 W 3rd Ave, Denver, CO 80223 |
| Building Type | Hotel |
| Conditioned Floor Area | 52,000 |
| Unconditioned Floor Area | 0 |
| Above-Grade Stories | 3 |
| Below-Grade Stories | 0 |
| Electricity Provided by Xcel | Yes |
| Natural Gas Provided by Xcel | Yes |
| District Heating **Gas Provided by Xcel** | Yes |
| District Cooling **Electricity Provided by Xcel** | Yes |
| EDA Baseline | ASHRAE 90.1-2007 |
| Track (Basic or Enhanced) | Basic |
| Certification (Enhanced Only) | USGBC LEED Silver |
| Early Analysis (Enhanced Only) |  |
| Estimated Savings (vs. baseline) |  |
| Demand (kW) | 20 |
| Energy (kWh) | 100,000 |
| Gas (Dth) | 200 |
| Estimated Construction Completion Date | June 29, 2313 |
| Estimated 80% Occupancy Date |  |
| Estimated Verification Date |  |

|  |  |
| --- | --- |
| Customer incentive calculations are based on the following dollar amounts | |
| Demand ($/kW) | $ 400 |
| Energy ($/kWh) | $ 0.04 |
| Gas ($/Dth) | $ 4 |

Project Participants

Project participants at the meeting included:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Company | Role | E-Mail | Phone | In Attendance |
| John Doe | The Best Architects | Architectural Firm | john.doe@arch.com | (252) 626-8842 | Yes |
| Jim Smith | The Best Mechanical Engineers | Mechanical Engineer | jim.smith@contractor.com | (252) 626-8842 | Yes |

CD Review Summary

Based on this review, the building is currently 16% better than the EDA Baseline on an EUI basis. As shown in the table below, we have been able to find 100% of the measures in the selected design alternative.

The list below details those items that are different from the selected design alternative:

1. The CDs only showed a 15% EPD reduction instead of a 20% EPD reduction because EnergyStar mini-fridges were spec’d but EnergyStar TVs were not. This can be corrected by purchasing and installing EnergyStar TVs.

2. The CDs only showed R-45 insulation in the roof. This could be remedied by increasing the insulation thickness in the roof slightly.

# Measures Included in the Final Design

The selected design alternative includes the following measures:

|  |  |  |
| --- | --- | --- |
| Measure | Description | Comments |
| 15% EPD Reduction in Guest Rooms Only | Reduce EPD in guest rooms with EnergyStar rated TVs (TVs not spec’d) and mini-fridges. | Found in CDs with difference. Model was changed accordingly. |
| 20% LPD Reduction in Guest Rooms Only | Reduce LPD in guest rooms with CFLs and vacancy sensors | Found in CDs as described |
| R-15 Exterior Wall Insulation Only | R-15 exterior walls | Found in CDs as described |
| R- 45 Roof Insulation Only | R-50 roof insulation (only R-45 spec’d) | Found in CDs with difference. Model was changed accordingly. |
| Rotate Building 90 Degrees Only | Building sited with long axis E-W | Found in CDs as described |

# As-Designed Results

Table 2‑1 EDA Baseline Annual Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Energy  Cost  ($) | EUI  (kBtu/ft2-yr) | Peak  Demand  (kW) | Electric  Consumption  (kWh) | Natural Gas  (Dth) |
| $146,465 | 102.21 | 136.340 | 645,181 | 1,567.366 |

Table 2‑2 As-Designed - Annual Savings vs. EDA Baseline

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Design Alternative | Energy Cost Savings  ($) | EUI Reduction  (kBtu/ft2-yr) | Peak  Demand Savings  (kW) | Electric  Consumption Savings  (kWh) | Natural Gas Savings  (Dth) | Incremental Capital Cost  ($) | Estimated Incentive\*\*  ($) | Simple Payback\*  (years) |
| Design-Team and Customer Agreed-Upon Alternative | $21,261 | 13.74 (16%) | 23.297 (17%) | 93,739 (15%) | 203.261 (13%) | $70,299 | $20,103 | 3 |

\*Simple payback includes reduction of incremental capital cost by estimated Xcel incentive

\*\*This incentive is calculated using un-rounded energy modeling results.  Because of rounding error, hand-calculation may be off by up to $1.

# Results by Individual Measure

Table 3‑4 EDA Baseline Annual Energy Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Energy  Cost  ($) | EUI  (kBtu/ft2-yr) | Peak  Demand  (kW) | Electric  Consumption  (kWh) | Natural Gas  (Dth) |
| $146,465 | 102.21 | 136.340 | 645,181 | 1,567.366 |

Table 3‑5 Measures - Annual Savings vs. EDA Baseline

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Measure | Energy  Cost  Savings  ($) | EUI  Reduction  (kBtu/ft2-yr) | Peak  Demand Savings  (kW) | Electric  Consumption Savings  (kWh) | Natural Gas Savings  (Dth) | Incremental Capital Cost  ($) | Simple Payback  (years) |
| 15% EPD Reduction in Guest Rooms Only | $6805 | 1.85 (2%) | 8.623 (6%) | 32,150 (5%) | -17.841 (-1%) | $19,899 | 3 |
| 20% LPD Reduction in Guest Rooms Only | $7366 | 2.06 (2%) | 11.649 (9%) | 33,925 (5%) | -13.936 (-1%) | $39,798 | 5 |
| R-15 Exterior Wall Insulation Only | $607 | 1.12 (1%) | 2.664 (2%) | 1,531 (0%) | 51.931 (3%) | $1,851 | 3 |
| R- 45 Roof Insulation Only | $4237 | 3.17 (3%) | 0.418 (0%) | 17,272 (3%) | 105.493 (7%) | $8,750 | 2 |
| Rotate Building 90 Degrees Only | $2703 | 5.52 (6%) | 1.043 (1%) | 11,108 (2%) | 74.901 (5%) | $0 | 0 |

# Verification of Measure Implementation

The verification for this project will be done by John Doe, M&V Consultant. John Doe will contact the owner to schedule M&V tasks about 2 months after occupancy, and will wait until the building is 80% occupied to carry out the verification process.

The objective of the final measurement and verification is to confirm the installation and proper functioning of the energy efficiency measures. Verification entails collection of contractor submittals and site inspections. The site inspection will occur two months after occupancy when possible. If monitoring or trending is required, it will generally be completed within two weeks of the site inspection. The remaining incentive payment will be paid within 3-4 months of occupancy.

The various efficiency measures require different verification methods. The verification method is dependent on whether the measure is “static” (Architectural Measures), or dependent on operation or schedules (HVAC, & Lighting). These measures will be verified as follows:

* Static measures
  + Architectural measures, such as insulation and windows, will be verified from contractor submittals and site inspection.
* Measures dependent on operation or schedules
  + Reduced lighting power density (LPD) will be verified with lighting fixture counts and selected field electric power measurements of representative lighting circuits.
  + Lighting occupancy sensors are checked manually for operation including the time delay function.
  + Daylighting control operation can be verified by trending lighting power for comparison with hourly reports from the energy model and from illumination spot measurements.
  + Installation of high-efficiency HVAC equipment will be verified by recording nameplate data and reviewing contractor submittals.
  + Advanced control features of HVAC systems require trending of performance parameters.

Short-term data-logging and monitoring will be completed for a two-week period. Long-Term data-logging and monitoring will be completed for a four-week period for measures predicted to save more than 1GWh or 20,000 Dth.

The implemented measures for this project and their planned verification approach are detailed below:

## CD Review Results, Verification Plan and Field Verified Results

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | CD Review Results | | Verification Plan | | | Field Verification Results | |
| Measure | Description | CD Review | Verification Approach | Short-Term Data Logging | Long-Term Data Logging | Verification Status | Notes |
| 20% EPD Reduction in Guest Rooms Only | Reduce EPD in guest rooms with EnergyStar rated TVs and mini-fridges. | Only a 15% EPD reduction was found in guest rooms. Mini-fridges were EnergyStar rated but not TVs | Determine EPD in guest rooms by sampling rooms and counting equipment power | None | None | By M&V Consultant | By M&V Consultant |
| 20% LPD Reduction in Guest Rooms Only | Reduce LPD in guest rooms with CFLs and vacancy sensors | Found as modeled | Count fixtures and inspect lamp and ballast ratings. | Put data logger in guest rooms to verify vacancy sensor operation | None | By M&V Consultant | By M&V Consultant |
| R-15 Exterior Wall Insulation Only | R-15 exterior walls | Found as modeled | Review installation | None | None | By M&V Consultant | By M&V Consultant |
| R-50 Roof Insulation Only | R-50 roof insulation | Only R-45 insulation was found in the roof construction. | Review installation | None | None | By M&V Consultant | By M&V Consultant |
| Rotate Building 90 Degrees Only | Building sited with long axis E-W | Found as modeled | Visit building site ☺ | None | None | By M&V Consultant | By M&V Consultant |

## Verification of Hours Used Within the Model

The verification team will document the current hours of operation for each system affected by an energy efficiency measure. This will be accomplished with a combination of data-loggers, investigation of the building automation system (where applicable), and an interview with the building owner/operator. The actual hours of operation for each effected system will be compared to the originally assume schedules used in the energy model. If significant discrepancies exist from CD review modeling assumptions, Xcel will be notified to discuss potential adjustments.

## Final Savings Verification and Incentive Amounts

If any discrepancies from the CD review are found during verification, energy savings for the selected bundle of measures will be re-calculated by creating an as-verified model with as-verified conditions and schedules. Incentive amounts will be adjusted according to the as-verified energy savings calculations.