Red text in the report template shall be replaced (e.g., square brackets [ ]) with project specific information, and reformatted to black text. Informational text to the EC can be deleted.

**[Project Name]**

Schematic Design Energy Report

Located at:

**[Project Address]**

**[City, State, Zip Code]**

Presented to:

**[Customer’s Name]**

IDAP Project # [Project # provided by program administrator]

**[Date e.g. January XX, 20XX]**

**Owner / Owner Representative**

[Customer Name]

[Company Name]

P: [Phone #]

E: [email address]

**Energy Consultant**

[Consultant Name]

[Company Name]

P: [Phone #]

E: [email address]

**Utilities IDAP Program Administrator**

[Administrator Name]

[Organization Name]

P: [Phone #]

E: [email address]

**Disclaimer**

The intent of this Schematic Design Energy Report (SDER) is to provide preliminary estimates of the modeled energy performance for design packages for [building name], evaluated in schematic design including a discussion/assessment of those packages. While the preliminary findings in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, the actual results may vary. As a result, Fort Collins Utilities (Utilities) and/or [consultant name] are not liable if estimated savings or economics are not realized. All savings and cost estimates in the report are for informational purposes, and are not to be construed as a design document or as guarantees.

In no event will Fort Collins Utilities and/or [consultant name] be liable for the failure of the project to achieve the modeled energy performance, the operation of the customer’s facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of evaluated measures.

Update TOC after writing report

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# Executive Summary

As a participant in Fort Collins Utilities Integrated Design Assistance Program (IDAP) a goal of the project is to achieve at least a 10% reduction from the current City of Fort Collins energy code. Other energy goals include … (e.g. net zero, number of energy points in LEED, renewable goals, etc.) …

This report contains details of the energy model simulation results, incentives and life cycle costs for each of the high performance building design packages discussed during schematic design, including the SD charrette.

The following is a description of the design packages considered and analyzed during schematic design. Optional: insert a table

1. Describe building orientation, shape, envelope, mechanical and electrical systems for Option A.
2. Describe building orientation, shape, envelope, mechanical and electrical systems for Option B.
3. …

The Code Baseline Building Performance energy cost (BBPCode) is $[BBPCode]. The Proposed Building Performance energy cost target (PBPt) is $[PBPt]. For each of the proposed design packages, Table 1 includes the energy cost, cost savings compared to the baseline, life cycle cost, and modeled peak building heating and cooling loads.

Table 1. Modeling Results Summary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Design Package** | **Proposed Building Energy Cost****PBPm ($/yr)** | **Energy Cost Savings ($/yr)****BBPCode-PBPm** | **Percent Below Code (%)1** | **Life Cycle Cost NPV** **($)2** | **Peak Design Cooling Load (tons)3** | **Peak Design Heating Load (kBTUh)3** |
| **A1: Package Name** |  |  |  |  |  |  |
| **A2: Package Name** |  |  |  |  |  |  |
| **A3: Package Name** |  |  |  |  |  |  |

1. Calculation is based on regulated costs only: 1-PBREC/(BPFCode x BBREC)
2. If the first cost for each package is available then report the NPV in this column based on the following inputs (calculation details are in Appendix A):
	1. Fuel Escalation Rate: [rate %]
	2. Labor & Materials Inflation Rate: [rate %]
	3. Discount Rate (excluding inflation): [rate %]
	4. Term: [years]
3. Peak coil loads; not the size of the HVAC equipment. The energy model peaks occur at outside air conditions of [°F drybulb] for heating, and [°F drybulb / °F wetbulb] for cooling.

Although it is understood that the energy models are not intended to generate loads used for equipment sizing, model load outputs can often be useful as a reference point for discussing design strategies and evaluating engineering design loads. Included in the table above are peak cooling and heating loads from the model (these represent building [coil] loads, and as such, do not take into account equipment efficiencies).

For consultant reference – when evaluating the drybulb and wetbulb peak cooling and heating conditions, consider a 2013 study by the Colorado Climate Center at Colorado State University showing that the 99.6% and 99% heating temperatures are 0.4 and 6.6 degrees Fahrenheit, respectively. The 2%, 1% and 0.4% cooling temperatures are 86.9, 89.7 and 92.5 degrees Fahrenheit, respectively. The mean coincident wet-bulb temperatures associated with the 2%, 1% and 0.4% cooling temperatures are 61.3, 61.6 and 61.6 degrees Fahrenheit, respectively. These results are based on 23 years of data from 1990 – 2013 at the Fort Collins, CO weather station located at CSU (COOP#05-3005-4).

Additional individual energy efficiency measures (EEMs) were also considered. [Include if true and describe other EEMs]

The design team is challenged to weigh the value of each whole building design package contained in this report and work toward selecting a single high performance design package that meets the IDAP Proposed Building Performance energy cost target (PBPt), including owner and design team energy and economic goals. This package will be more fully developed in the Design Development Energy Report at the end of the design development (DD) phase, containing refined model results, incentives and costs of the selected design package.

# Introduction

## Project Description

The [building name] building is a new 110,420 SF educational facility including: classrooms, auditorium, cafeteria, gymnasium, kitchen, and administration offices. Other building characteristics can be found in the energy model spreadsheet in the Energy Model Input Details table later in this report. This building is being designed and constructed through a [e.g. design-build, CM/GC, design-bid-build] process. Key design team members include [list owner, architect, ME, EE, CxA, energy consultant, CM - if hired and other key design team members].

## Key Design Packages from Charrette

[# of design packages] potential design packages were investigated during the project design charrette and have since been refined as part of this SDER. Likely combinations of design package elements (energy efficiency measures - EEMs) were chosen providing the greatest systems-approach benefits, thus capturing the synergies between the EEMs included. Each package has inherent savings, and its value has been analyzed in the modeling software to quantify its energy performance. Table 2 lists the key components determined after the charrette, in concert with the design team and owner. Add columns if necessary

Table 2. Details of Each Design Package

|  |  |  |  |
| --- | --- | --- | --- |
|  | Package A: Package Name | Package B: Package Name | Package C: Package Name |
| Architectural Systems | * orientation
* building site
* window-to-wall ratio
* overhangs
* building shape
* daylighting
* landscaping
* other passive design strategies
* interactions with other systems (e.g. overhangs reduce cooling load)
 |  |  |
| Electrical Systems | * interior lighting
* interior lighting system controls
* exterior lighting
* exterior lighting system controls
* interactions with other systems (e.g. reduced lighting power density reduces cooling load)
 |  |  |
| Mechanical Systems | * major HVAC system equipment
* equipment efficiencies
* control system
* key control strategies to reduce energy
* design considerations to save energy (e.g. short duct runs used to reduce fan static pressure).
* interactions with other systems (e.g. direct evaporative cooling system will reduce the need for humidification)
 |  |  |
| On-site Renewable Systems  | * system summary
* interaction with other systems (e.g. solar thermal system eliminates the need for DHW systems)
 |  |  |
| Process Systems | * datacenter equipment
* plug loads
* manufacturing equipment
* laboratory systems
* etc.
 |  |  |
| Keys to Integrated Design | * e.g. integrated daylighting system is critical to allowing the packaged HVAC systems to be sized properly.
 |  |  |
|  |  |  |  |

## Design Incentive

Based on the project size in the Project Description, the Design Incentive is estimated to be $ [Design Incentive $] based on the following formula: $5,000 + $0.10/SF.

In order to receive the design incentive the following five milestones need to be met:

* 1. Hold a schematic design charrette,
	2. Submit a Schematic Design Energy Report,
	3. Hold a design development energy meeting,
	4. Submit a Design Development Energy Report, and
	5. Submit a Final Energy Report and Construction Documents (CDs) at the end of design.

Completion of all five milestones, with the CDs showing the modeled energy efficiency features that will achieve the IDAP PBPt are required to receive the Design Incentive.

## Construction Incentive

The Construction Incentive (CI) for each of the packages was calculated using the formulas below.

**BBPCode = BBUEC + (BPFCode x BBREC)**

**BBPCode** = Baseline Building Performance, the annual energy cost of the Baseline Building adjusted to current code.

**BBUEC** = Baseline Building Unregulated Energy Cost, from Baseline energy model.

**BPFCode** = Building Performance Factor (BPF), from Table 3, for a building meeting the current City building code (2015 IECC, represented by ASHRAE 90.1 – 2013).

**BBREC** = Baseline Building Regulated Energy Cost, from Baseline Appendix G model

**PBPt = BBUEC + (BPFIDAP x BBREC)**

**PBPt** = Proposed Building Performance energy cost target, the maximum total energy cost of Proposed Building (unregulated + regulated costs). Unregulated energy cost will be the same in the proposed and baseline energy models.

**BPFIDAP** = IDAP BPF, from Table 3. These factors represent a 10% savings from the current code.

Table 3. Building Performance Factors (bold row that applies to your project)

|  |  |  |
| --- | --- | --- |
| **Building Type** | **BPFCode\*** | **BPFIDAP\*\*** |
| Multifamily  | 0.80 | 0.72 |
| Healthcare/Hospital  | 0.52 | 0.47 |
| Hotel  | 0.61 | 0.55 |
| Office  | 0.61 | 0.55 |
| Restaurant  | 0.58 | 0.52 |
| Retail  | 0.59 | 0.53 |
| School  | 0.50 | 0.45 |
| Warehouse  | 0.61 | 0.55 |
| All Others  | 0.57 | 0.51 |

\*ASHRAE 90.1 – 2016

\*\* 10% savings from code

**Construction Incentive = 2 x (BBPCode – PBPm)**

**PBPm =** Proposed Building Performance, modeled energy cost (unregulated + regulated) of proposed building.

(Must be ≤ PBPt)

The Construction Incentive is two times the difference between the code baseline building and proposed building modeled energy cost.

From the Baseline model, the Baseline Building Unregulated Energy Cost (BBUEC) is $[BBUEC] and the Baseline Building Regulated Energy Cost (BBREC) is $[BBREC]. Based on a Code Building Performance Factor of [BPFCode], the annual energy cost of the **Code Baseline Building (BBPCode) is $[BBPCode]**. Using the IDAP Building Performance Factor, the Proposed **Building Performance target (PBPt) is [PBPt]**, which represents a 10% savings in regulated energy cost.

Table 4 summarizes the construction incentives for each of the packages and also includes modeled Proposed Building Performance (annual energy cost).

Table 4. Summary of Estimated Construction Incentive for each Package

|  |  |  |
| --- | --- | --- |
| **Package** | **PBPm**($/yr) | **Construction Incentive** ($) |
| **A** |  |  |
| **B** |  |  |
| **C** |  |  |

## Optional Performance Incentive

The owner may apply for an optional Performance Incentive, based on actual energy use, by the end of construction. The Performance Incentive amount is estimated at this stage, assuming the actual building regulated energy cost is the same as the modeled Proposed Building Performance Regulated Energy Cost (PBREC). Actual regulated energy cost may be more or less than PBREC, which will affect the incentive. Sub-metering of the building performance over a 12 consecutive month period is required in order to determine the actual regulated energy cost. The Performance Incentive is calculated using the following formula.

**Performance Incentive = (BPFCode x BBREC) – Actual Regulated Energy Cost**

The code baseline regulated energy cost (BPFCode x BBREC), used to estimate the Performance Incentive, is $[BPFCode x BBREC].

Table 5 summarizes the performance incentives for each of the packages and also includes modeled proposed building regulated energy cost (PBREC), used as a proxy for actual performance.

Table 5. Summary of Estimated Performance Incentive Calculation

|  |  |  |
| --- | --- | --- |
| **Package** | **PBREC\*** ($/yr) | **PI** ($) |
| **A** |  |  |
| **B** |  |  |
| **C** |  |  |

\*This is a proxy for Actual Regulated Energy Cost

Utilities can provide support to customers to ensure that sub-metering of regulated loads takes place. Regulated loads are associated with building equipment that is regulated by building energy codes (e.g., HVAC equipment, lighting, motors, etc.).

# Energy Model Documentation

## Energy Model

The tool used to perform this analysis is eQUEST (A Quick Energy Simulation Tool). This is a robust program that allows one to perform an hourly simulation of the building’s energy use based on local weather data, geometry and envelope characteristics, internal gains, system size and performances, schedules, and utility rates. The information used to assemble this model is based on design documents, energy code values, and feedback from the project team. The design team and energy modeling consultant are encouraged to collaborate on this effort to ensure model inputs and assumptions are consistent with the design team’s schematic design.

Figure 1 shows a 3D picture of the facility as generated by eQUEST.



**Figure 1: Building Perspective**

## Utility Rates

State the blended utility rates provided by Utilities for all fuel types and ensure that they are up to date at the time of submitting this report.

## Energy Model Input Details

The following energy model takeoff sheet summarizes the technical inputs to the models for the baseline and each design package as determined from the design team. The EC should copy and paste their inputs from their internal inputs tracker into this table. The inputs listed are what the IDAP program typically expects to see for each package. It is only necessary to list package inputs that differ from the baseline. As such, it will be assumed that a blank cell for a package input is the same as the value listed in the column before it.

|  | **BASELINE** | **Package A** | **Package B** | **Package C** |
| --- | --- | --- | --- | --- |
| Model file name |  |  |  |  |
| Total Building gross SF |  |  |  |  |
| Conditioned Area (SF) |  |  |  |  |
| Number of Floors (including basement) |  |  |  |  |
| Weather file used for computer model |  |  |  |  |
| Internal Loads |  |  |  |  |
|  Occupancy (sf/person) |  |  |  |  |
|  Ambient Lighting (W/sf) |  |  |  |  |
|  Daylighting (% Ltg. Controlled) |  |  |  |  |
|  Task Lighting (W/sf) |  |  |  |  |
|  Plug Loads (W/sf) |  |  |  |  |
|  Other equipment (W/sf) |  |  |  |  |
| Envelope |  |  |  |  |
|  Exterior wall construction |  |  |  |  |
|  Overall wall R-value |  |  |  |  |
|  Roof construction |  |  |  |  |
|  Overall roof R-value |  |  |  |  |
|  Glazing SHGCs & U-values for North, South, East & West |  |  |  |  |
|  Window/Wall ratio |  |  |  |  |
|  Infiltration (e.g. cfm/sf² of wall & roof area) |  |  |  |  |
|  Exterior door type/R-value |  |  |  |  |
| HVAC – Primary Systems (Central Plant) |  |  |  |  |
|  Primary cooling system type (centrifugal chiller, DX, HP, etc.) |  |  |  |  |
|  Condenser type (air cooled, water cooled, evaporatively cooled) |  |  |  |  |
|  Cooling Plant fuel type (electric, gas, etc.) |  |  |  |  |
|  Primary Cooling efficiency (kW/ton) |  |  |  |  |
|  CHW pumping arrangement and controls |  |  |  |  |
|  CHW pumps HP, GPM, ft head |  |  |  |  |
|  CHWST setpoint and reset schedule (end points) |  |  |  |  |
|  CW pumping controls |  |  |  |  |
|  CW pumps HP, GPM, ft head |  |  |  |  |
|  Condenser fan controls (cycle, VFD) |  |  |  |  |
|  CWST setpoint and reset schedule (end points) |  |  |  |  |
|  DX EER including fan energy (packaged equipment) |  |  |  |  |
|  DX EER excluding fan energy (packaged equipment) |  |  |  |  |
|  Thermal storage (Y/N), type, capacity |  |  |  |  |
|  Primary heating system type (condensing boiler, furnace, HP, etc.) |  |  |  |  |
|  Heating plant fuel type (gas, electric, etc.) |  |  |  |  |
|  Heating plant efficiency |  |  |  |  |
|  HW pumping arrangement and controls |  |  |  |  |
|  HW pumps HP, GPM, ft head |  |  |  |  |
|  HWST setpoint and reset schedule (end points) |  |  |  |  |
| HVAC – Secondary Systems |  |  |  |  |
|  Secondary system type (VAV w/ electric reheat, constant volume, etc.) |  |  |  |  |
|  Total supply fan BHP or kW & kW/CFM |  |  |  |  |
|  Total supply fan CFM & CFM/SF |  |  |  |  |
|  Supply fan control (inlet vanes, VFD, etc.) |  |  |  |  |
|  Total return fan BHP or kW & kW/CFM |  |  |  |  |
|  Total return fan CFM |  |  |  |  |
|  Return fan control |  |  |  |  |
|  Supply air temperature setpoint and reset schedule (end points) |  |  |  |  |
|  Terminal unit reheat temperature or delta T |  |  |  |  |
|  Minimum zone airflow ratio (CFM/SF) |  |  |  |  |
|  Occupied Setpoints (Htg./Clg.) |  |  |  |  |
|  Unoccupied Setpoints |  |  |  |  |
|  Night setback controls (zone, AHU, or building level) |  |  |  |  |
|  Min and Max outside air (%) |  |  |  |  |
|  Outside air control (fixed, airside economizer and control type, DCV) |  |  |  |  |
|  Total exhaust air BHP and CFM |  |  |  |  |
|  Heat recovery used (Y/N) |  |  |  |  |
| Other Loads |  |  |  |  |
|  External lighting (kW) |  |  |  |  |
|  Elevator (kW) |  |  |  |  |
|  Domestic hot water (occupied gpm) and pump HP |  |  |  |  |
|  DHW source (gas/electric) |  |  |  |  |
|  Server Room loads (kW) & diversity |  |  |  |  |
| Utility Rate Schedule |  |  |  |  |
| Operating Schedules/Controls |  |  |  |  |
|  Occupancy Schedule |  |  |  |  |
|  Interior Lighting Schedule |  |  |  |  |
|  Task Lighting Schedule |  |  |  |  |
|  Exterior Lighting Schedule |  |  |  |  |
|  Equipment/Plug Loads Schedule |  |  |  |  |
|  Heating Setpoints/Schedule |  |  |  |  |
|  Cooling Setpoints/Schedule |  |  |  |  |
|  Infiltration Schedule |  |  |  |  |
|  HVAC Fans Schedule |  |  |  |  |
|  DHW Schedule |  |  |  |  |
|  Chiller Schedule |  |  |  |  |
|  Boiler Loop Schedule |  |  |  |  |
|  Add additional rows as necessary |  |  |  |  |
|  |  |  |  |  |

# Appendix A – Life Cycle Cost Analysis

Provide detail of life cycle cost analysis, including, end of equipment useful life, maintenance costs, utility escalation rate and discount factor.

# Appendix B – Summary Of IDAP Process

The following is a summary of the IDAPprocess (see IDAP Program Manual for details regarding energy consultant and owner responsibilities):

* Schematic Design Charrette ([Insert Date])
	+ Establish 3 or more high performance building design packages to be modeled.
	+ Schedule for the design team to provide costs for each design package to the consultant.
	+ Discuss anticipated integrated design assistance schedule and future meeting date
* Schematic Design Report
	+ Analyze the interactive system effects and summarize the results at the whole building level for 3 or more design packages.
* Design Development Meeting
	+ Review impacts of the analyzed design packages and select one to use as the proposed design
	+ Review changes or updates to the building design.
* Design Development Energy Report (DDER)
	+ Revise the energy calculations and costs based on the proposed design package
* Final Energy Report
	+ Confirm the selected design package and associated individual measures are incorporated in the construction documents and refine model (if necessary).
* Final Energy Report Approval
	+ Following completion of the FER the utility will perform a review. Owner submits signed Final Energy Report Approval Form to Utilities
	+ Design team submits application for Design Incentive
* Commissioning and air barrier testing conducted by the owner
	+ Owner submits electronic versions of commissioning and air barrier test reports to Utilities
* Final Inspection
* Confirm design operation and energy savings post occupancy: Construction Incentive is paid to Owner
* Optional Performance Incentive
	+ Request for Performance Incentive is submitted to Utilities within 6 months of construction completion date. Customer submeters regulated energy loads consistent with the FER energy model. IDAP program manager provides assistance to improve building performance if requested.
	+ Performance Incentive is paid if the energy consumption is at or below the target IDAP regulated energy cost **(**BPFIDAP x BBREC)