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Governor

ENERGY-EFFICIENT COMMUNITY DEVELOPMENT IN CALIFORNIA: CHULA VISTA RESEARCH PROJECT

ATTACHMENT I: BUILDING ENERGY TECHNOLOGY MODELING ASSUMPTIONS AND RESULTS FOR SITE A

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End Use Solutions

Building Energy Technology Modeling Assumptions and Results for Site-A: The Chula Vista Research Project

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This research project is part of the California Energy Commission and U.S. Department of Energy sponsored program to promote energy efficiency in municipal facilities and operations and the community's residential and business sectors. The Gas Technology Institute partnered with the San Diego State University Center for Energy Studies to provide technical research and energy modeling for the project.



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Executive Summary

This report contains the findings of an engineering modeling study to determine the most cost-efficient means of reducing energy consumption and energy-related air emissions in new commercial, residential and mixed-use residential/commercial development project. This study was sponsored by the California Energy Commission and the U.S. Department of Energy to assist developers and builders in their efforts to construct more energy-efficient development projects.

The study examined a new community called Site-A (SITE-A) planned for development in the City of Chula Vista, CA. This new community will consist of 180 buildings with total of 6,600,719 square foot of floor space representing various configurations of 6 basic space-use types; restaurant, retail, hotel, office, library, and residential. Residential floor areas will represent approximately 41% of the total or 2,711,980 square foot.

For modeling purpose all SITE-A buildings are represented in this study by 15 distinct prototypical buildings¹. The prototypes geometry, floor plans as well as other building details were developed in collaboration and approved by the SITE-A builder.

The methodology employed in the study entailed detailed computer modeling and an examination of the energy consumption, costs and environmental impacts of both a **conventional approach** and a set of **alternative approaches** to the design of the buildings for the site. Specifically, the study modeled building envelope energy losses and internal energy loads for occupants and all fixtures, appliances and equipment, including space conditioning and ventilation systems.

The conventional approach, referred to in this report as the “**Builder Proposed Baseline**,” is defined as one in which the construction materials, lighting and operating equipment for each building structure are designed to meet the California Title-24, 2005 energy efficiency standard or to exceed it if specified as such in the builder’s provided structure-specific building plans.

The alternative energy efficiency approaches are;

- “**EE Package**” design approach incorporating advanced energy efficiency measures including alternative grades of wall and roof insulation, windows, doors, lighting, HVAC equipment including thermal storage, appliances, and implementation of solar thermal technology,
- “**EE Package with PV**” design approach supplements EE Package with the solar PV-based power generation and,
- “**EE Package with DG**”² design approach which supplements EE Package with the fossil fuel (natural gas) microturbine or IC-engine-based power generation with heat recovery in CHP configuration.

¹ See Appendix A section of this report

² The latest 2008 SGIP eliminated all DG rebates except for the wind and fuel cell applications. That makes SITE-A DG analysis more a "what if" case than a practical deployment target as the payback are may not be acceptable without the rebates. See footnote 5 of this report for additional explanations.

The results of the modeling study indicate that the use of the “EE Package” approach could reduce SITE-A community annual TDVI³ based energy consumption (kBtu/sf-year) by 12.3% below what would be expected if the buildings were built per builder specifications. Supplementing “EE Package” with the solar PV-based on-site power generation systems could further reduce the site TDVI to 30.0% below the builder’s baseline. Substituting solar PV power generation technology with the natural gas fired DG would result in 21.7% TDVI reduction.

Relative to natural gas, use of the “EE Package” approach would achieve a 16.6% reduction in annual consumption (MMBtu/year). Adding PV technology to EE packages for obvious reasons would not alter the site natural gas consumption. However, using DG technology instead of PV could result in a significant increase of the SITE-A natural gas consumption by 106.5% as compared with the baseline.

With regard to electric energy consumption (kWh) and peak demand (kW), implementation of the “EE Package” approach could reduce site annual kWh by 11% and demand by 16.8% below the builder’s baseline approach. Supplementing “EE Package” with the PV technology would result in a cumulative reduction of kWh by 34.3% and kW by 29.1%. Alternatively, using DG technology with the “EE Package” would reduce annual kWh by 31.2% which is close to the PV option impact. However, DG could be more effective in controlling electric peak demand and could reduce it by 45.2%.

Given the reduction in energy consumption resulting from the use of the energy-efficient “EE Package” approach, energy-related air emissions would be also significantly reduced. Specifically, Carbon Dioxide (CO₂) emissions would be reduced by 12.1%, Sulfur Dioxide (SO_x) emissions by 11%, and Nitrogen Oxide (NO_x) emissions by 12.6% as compared to the emissions expected from the builder’s baseline approach. Similar numbers for the “EE Package with PV” option show reduction of 30.8% (CO₂), 34.2% (SO_x), and 29.3% (NO_x). The “EE Package with DG” option is not as effective in reducing emissions as the “EE Package with PV”, however with the reductions of 6.7% (CO₂), 30.3% (SO_x), and 38.5% (NO_x) it is still better than the builder’s baseline approach.

Annual utility costs savings associated with the use of the energy-efficient “EE Package” approach are estimated at 11.3% when compared with the builder’s baseline approach. Simple payback for the “EE Package” is estimated to be 5.9 years with ROI of 16.9%. The “EE Package with PV” option utility cost savings are 32.3% with simple payback of

³ Calculated and reported in this report specific energy use TDVI accounts for all building energy uses including energy consumed by appliances, plug-in loads and lights. Such approach differs from the TDV calculations that are typically conducted for the Title 24 building compliance certification purpose where the energy used for cooling, heating and domestic hot water is used as indicator of residential building energy efficiency. Title 24 commercial building TDV method also accounts for lights and receptacles load. The modified TDVI approach applied to this study is one of the number of energy efficiency indications analyzed and discussed in this report and was used to show more realistic/complete impacts of EE measures on building energy consumption than that typically calculated by Title 24 certification software like Energy PRO 4.3 or Micropas7 v. 7.3.

12.4 years and ROI of 8.1%. Implementing “EE Package with DG” would result in annual utility cost savings of 16%, simple payback of 7 years, and ROI of 14.3%⁴

⁴ Assumes SGIP rebates of 600/kW. See footnotes 2 and 5 of this report for additional explanation.

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List of Acronyms

AER	Appliance Efficiency Regulations (California)
AFUE	Annual Fuel Utilization Efficiency (furnace)
AV	Adjusted Volume of Refrigerator Appliance (per CEC AER)
BEA	Building Energy Analyzer Modeling Software
BPB	Builder Proposed Baseline modeling option
BUR	Built Up Roof Assembly
Btu	British thermal unit
CEC	California Energy Commission
CEC AER	California Energy Commission Appliance Efficiency Regulations
CFL	Compact Fluorescent Light Bulb
CHP	Combined Heat and Power, on-site power generation with heat recovery
CVRP	Chula Vista Research Project
DHW	Domestic Hot Water
DG	Distributed Generation, on-site power generation
DOE2.1e	Building Energy Modeling Software
EE	Energy Efficiency and Energy Efficiency package modeling option
EE-PV	Energy Efficiency package supplemented with PV modeling option
EE-DG	Energy Efficiency package supplemented with DG modeling option
EEM	Energy Efficiency Measure
EER	Energy Efficiency Rating (air conditioning).
EF	Energy Efficiency Factor (furnace, water heater)
SITE-A	Site-A
kBtu	Thousand Btu
kW	Kilowatt or Thousand Watts
LCC	Life Cycle Cost
LPW	Lumens per Watt (lights)
MMBtu	Million Btu
MEF	Minimum Energy Factor of Dishwasher (per CEC AER)
MMEF	Minimum Modified Energy Factor of Clothes Washer (per CEC AER)
PV	Photo-Voltaic panels
R	A Measure of the Heat Conductivity of Material
RT	Refrigerating Ton (12,000 Btu/hour)
ROI	Return on Investment
SEER	Seasonal Energy Efficiency Rating (air conditioning)
SGIP	CA Self-Generation Initiative Program
sf	square foot
Title-24, T24	California Title-24 2005 Building Energy Efficiency Standard
TDV	Time Dependent Valuation of Building Specific Energy Consumption calculated per Title-25 2005 standard (considers different categories of energy uses for residential and non-residential structures)
TDVI	Time Dependent Valuation Inclusive (accounts for all building energy uses including appliances independent of building type)
U	Heat transfer coefficient of material

Project Background and Objective

The Chula Vista Research Project (CVRP) was sponsored by the California Energy Commission and the U.S. Department of Energy to assist developers and builders in their efforts to construct more energy-efficient development projects.

The overall objective of the CVRP is to determine which actions and technologies in the California building code can be combined with performance enabling community design options to increase the energy efficiency and air quality of California communities. The specific objective of the study presented in this report is to analyze the variable energy, economic and environmental impacts of the SITE-A planned development site relative to both a conventional and a set of alternative approaches to buildings design and construction. The analytical results of this study will be used by the CVRP team to conduct social science research to identify potential institutional (legislative and regulatory) and market barriers and solutions associated with energy-efficient community development. The CVRP project will conclude by translating this research into a set of practical transferable resources for California planning, design and building professionals.

Development Site Description

A specific component of the CVRP study presented in this report examines a commercial, residential and mixed-use residential/commercial development project called Site-A (SITE-A) planned for development in the City of Chula Vista, CA (see Figure 1). The project will consist of buildings representing various configurations of 6 basic space-use types; restaurant, retail, hotel, office, library, and residential.



Figure 1 – Chula Vista SITE-A Vicinity Map

The total number of SITE-A buildings structures will be 180. Buildings total floor area will be 6,600,719 with residential applications representing approximately 41% of the total or 2,711,980 square foot.

For modeling purpose they are represented in this study by 15 distinct prototypical buildings. The prototypes geometry, floor plans as well as other building details were developed in collaboration and approved by the SITE-A builder. Table 1 provides list of SITE-A prototypes and Table 9 on page 22 of this report as well as Appendix A provide details of the modeled building.

Table 1 – List of SITE-A Prototypical Buildings

1	Freestanding Full Service Restaurant	FSR
2	Multi-Tenant Retail Shop	MTR
3	Major Retailer Store	MRS
4	Office Building Low-Rise	LRO
5	Office Building Mid-Rise	MRO
6	Office Building High-Rise	HRO
7	Large Hotel	LGH
8	Small Hotel	SMH
9	Retail/Commercial Mixed Use	RCM
10	Retail/Residential Mixed Use Mid-Rise	RRM
11	Retail/Residential Mixed Use Low-Rise	RRL
12	Civic/Commercial Mixed Use	CCM
13	Residential Multi-Family Townhome	RTH
14	Residential Low-Rise	RLR
15	Residential Mid-Rise	RMR

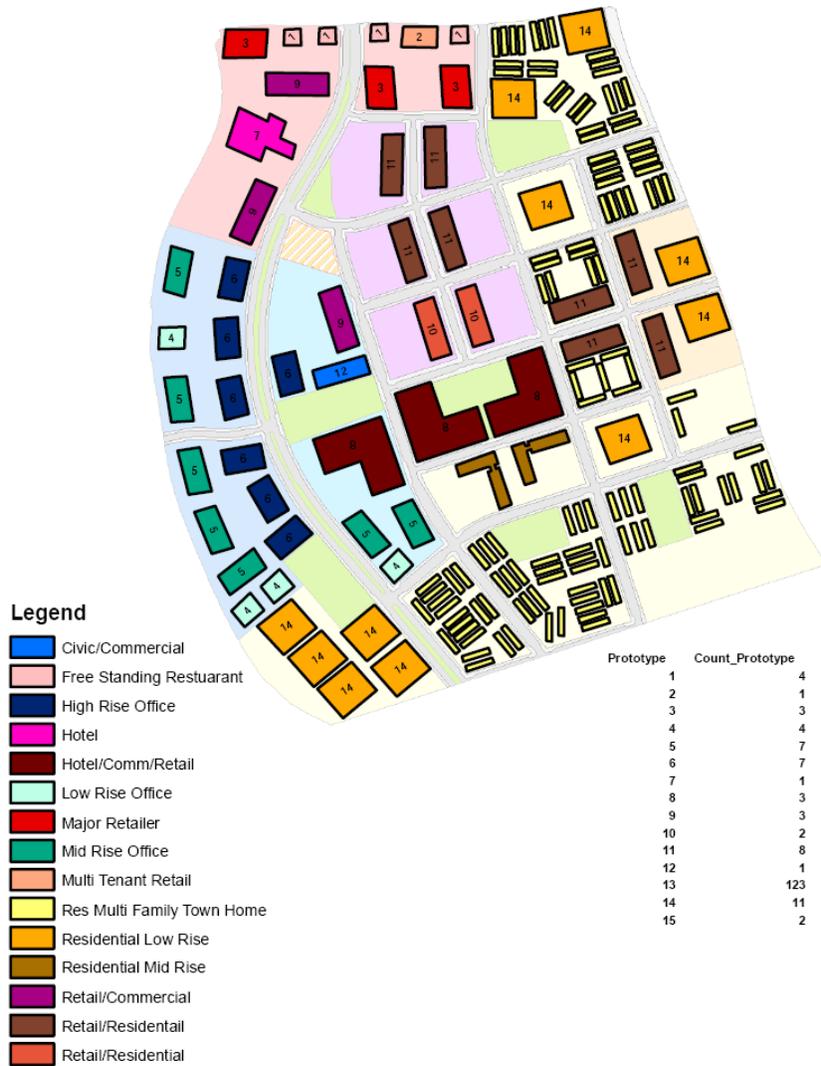


Figure 2 – Chula Vista SITE-A Land Use Plan Showing Placement of Prototypical Buildings

Approach

The research team led by the GTI and assisted by the SITE-A developer/builder and by the National Energy Center for Sustainable Communities at San Diego State University, initiated the project with the compilation of the technical building design, construction and equipment assumptions that was used to guide the modeling work. The “SITE-A Modeling Assumptions” section of this report (see Appendix A on page 117) provides details of modeled buildings’ geometry and materials specifications. The Modeling Assumptions section also contains specific details of the modeling approach and itemizes the Title-24 compliant mandatory and prescriptive features for the modeled buildings as well as all evaluated alternative energy-efficient (EE) materials, equipment and control measures and their assumed installed costs. The economic assumptions necessary to calculate EE measures paybacks, like applicable local utility rate structures as well as applicable rebates (e.g.: for the PV system), are also provided. The Assumptions Manual was reviewed by the SITE-A developer and other building industry professionals prior to use and was revised to ensure that a realistic set of assumptions was used as the basis for the SITE-A modeling.

GTI used sophisticated computer modeling to analyze the variable energy, economic and environmental impacts of the development site relative to both a conventional and a set of alternative EE approaches to buildings design and construction.

The alternative EE measures included:

- Energy-efficient glazing,
- Alternative framing and improved envelope insulation (roof, floors, walls and doors),
- Energy-efficient lighting,
- High efficiency space cooling equipment,
- High efficiency heating, domestic hot water equipment,
- EnergyStar appliances
- Thermal storage,
- Solar thermal heating,
- On-site power generation using solar photo-voltaic (PV) system and,
- On-site power generation with heat recovery using IC-engine or microturbine-based system.

The analysis entailed detailed analysis of buildings envelope energy losses and internal energy loads for occupants and all fixtures and equipment, including space conditioning and ventilation systems. Specifically, the modeling included 8,760, hour-by-hour consumption of five types of building energy uses including:

- Electricity,
- Natural Gas,
- Cooling,
- Heating,
- Domestic Hot Water.

The software tools used to conduct the analysis included:

- Building Energy AnalyzerTM (BEA), - a proprietary product of the Gas Technology Institute (GTI) that is based on the DOE2.1e computational engine; and
- Energy-10TM - a proprietary product of the Sustainable Building Industry Council.

BEA was used to model the energy, economic and environmental parameters for the commercial portions of the building structures. Energy-10TM was used to model details relating to the individual residential unit floor plans.

The modeling and EE analysis of SITE-A was conducted in four phases defined as;

Phase-I, a conventional approach called “**Builder Proposed Baseline**” (BPB) is defined as one in which the construction materials, lighting and operating equipment for each structure are designed to meet the California Title-24, 2005 energy efficiency standard or to exceed it if specified as such in the builder’s provided structure-specific building plans. Details of the conventional approach are described in the Modeling Assumptions – Appendix A to this report (see pages 134 to 184, Modeling Scenario tables’ columns with heading “Proposed Baseline”)

Phase-II, an alternative “**EE Package**” (EE) design approach that evaluates energy consumption, air emissions, and economic savings associated with the use of advanced energy efficiency measures including alternative grades of wall and roof insulation, windows, doors, lighting, HVAC equipment including thermal storage, appliances, and implementation of solar thermal technology. Details on these advanced energy efficiency measures are described in the Modeling Assumptions – Appendix A to his report (see pages 134 to 184, Modeling Scenario tables’ columns with headings “Alternative 1 to 3”, page 187 sections “Thermal Storage” and “Solar Thermal”).

Phase-III, an alternative “**EE Package with PV**” (EE-PV) design approach that evaluates impacts of combining preferred EE packages with the solar photovoltaic-based onsite power generation. Details of solar photovoltaic-based systems are described in the Modeling Assumptions – Appendix A to this report (see page 185, “On-Site Power Generation – Photovoltaics”).

Phase-IV, an alternative “**EE Package with DG**” (EE-DG⁵) design approach that evaluates impacts of combining preferred EE packages with a fossil fuel-based (natural

⁵ It should be noted that the economics component (simple payback and ROI analysis) of the EE-DG option analysis presented in this report may have at this point in time more hypothetical than practical value. At the time the CVRP study analysis was initiated (Spring of 2007) the DG analysis was based on applicable 2007 CA Self-Generation Initiative Program (SGIP) guidelines which provided rebate of \$600/kW for IC-engine based CHP system and \$800/kW for microturbine based CHP systems. Preliminary calculations showed a very long payback of 17 years for the microturbines based DG and consequently microturbines were not considered as a valid technology, even as they qualified from the emissions point of view. On the other hand, the paybacks for IC engines based DG system were acceptable 7.5 years and considering fact that the units were to be run in CHP configuration with heat recovery, an assumption was made to take advantage of SGIP permitted heat recovery credit to qualify IC installations from the emissions point of view. Unfortunately, the latest 2008 SGIP eliminated all DG rebates except for the wind and fuel cell

gas) onsite power generation with heat recovery. Details of this system are described in the Modeling Assumptions – Appendix A to this report (see page 186, “On-Site Combined Heat and Power” – “Microturbine CHP”).

applications. That makes SITE-A DG analysis more a "what if" case than a practical deployment target as the payback are not acceptable without the rebates. An option of eliminating EE-DG Scenario from the final report was discussed with the NECSC Project Manager; however in conclusion a decision was made to leave it in the report to provide benefits of illustrating to the readers potential for energy efficiency and environmental impacts of targeted CHP deployment.

Builder's Baseline vs. Alternative Energy Efficiency Approaches - Key Findings

This chapter provides review of composite results of energy efficiency, environmental, and economic impacts from all four modeling phases of the SITE-A project.

Energy - Gas and Electric Utility Use Impacts

Impacts of four different development scenarios on the annual consumption of utility provided energy (gas and electric) are shown in Figure 3 for all of the 188 SITE-A building structures.

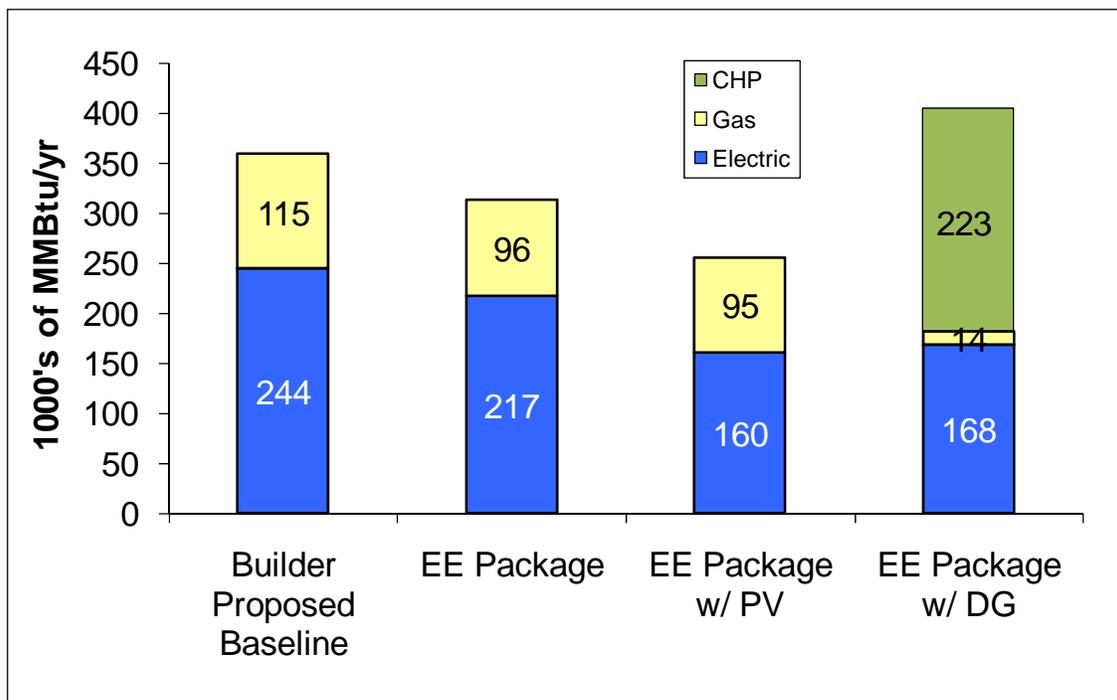


Figure 3. Total Annual Energy Consumption (all buildings)

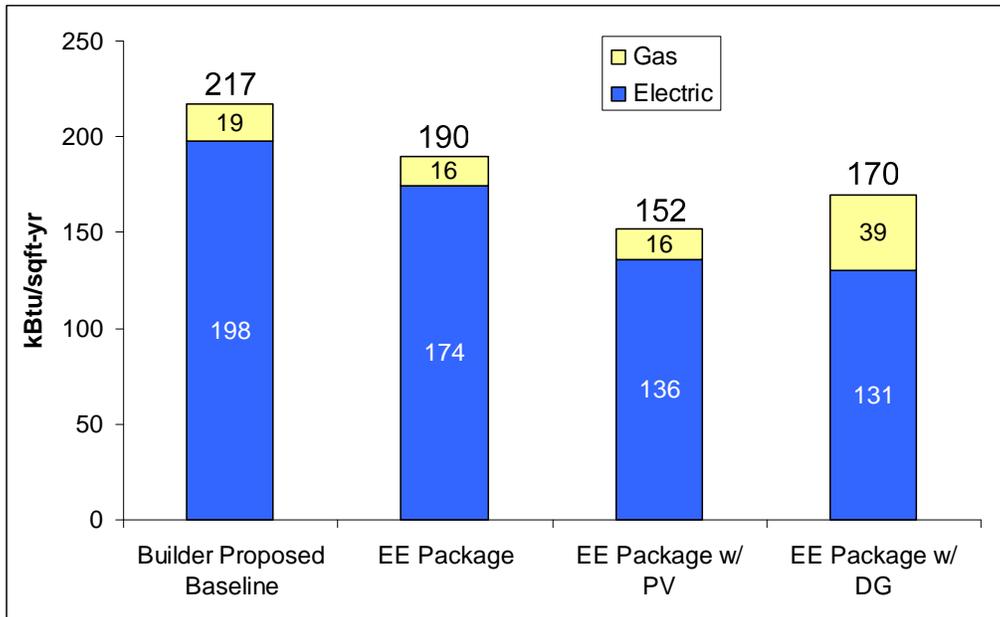
The analysis showed that implementing all applicable and economically feasible EE options can lower SITE-A annual energy consumption from the builder proposed baseline of 359,000 MMBtu to 313,000 MMBtu, or by 12.8%.

Implementing EE-PV option could further reduce electric grid and natural gas utility consumption to 255,000 MMBtu or by 27.8% compared to builder's baseline option.

Deploying EE-DG option would not be as effective in reducing SITE-A consumption of the grid provided electric energy as the EE-PV option, however it can still lower it to 168,000 MMBtu from 217,000 MMBtu for EE only option. On the other hand the natural

gas consumption will increase significantly reaching 237,000 MMBtu as compared with 95,000 MMBtu for the EE option. Increased natural gas consumption would result in the highest requirements for the combined gas and electric utility provided energy than any other option, including builder proposed baseline.

It should be noted that the Figure 3 shows consumed electric and natural gas energy expressed as a Btu or heat content of equivalent utilities. As such, although often used, the analysis may be missing other important factors associated with the value of energy imported/consumed by the community at different time of the day and year. Therefore, the results of the SITE-A energy efficiency analysis are also presented using the Title-24 prescribed Time Dependant Valuation (TDV⁶) approach. However, to provide a more complete assessment of buildings total energy uses the TDV approach was here further enhanced to include appliances and other internal loads not accounted for by a standard TDV approach. This modified methodology used in the SITE-A study is called Time Dependant Valuation Inclusive (TDVI⁷).



⁶ Time Dependent Valuation of Building Specific Energy Consumption calculated per Title-25 2005 standard. TDV value of electricity differs depending on time-of-use (hourly, daily, seasonal), and the value of natural gas differs depending on season. TDV better reflects value of building energy as it reflects varying cost to provide the energy at different times.

⁷ Calculated and reported in this report specific energy use TDVI accounts for all building energy uses including energy consumed by appliances, plug-in loads and lights. Such approach differs from the TDV calculations that are typically conducted for the Title 24 building compliance certification purpose where the energy used for cooling, heating and domestic hot water is used as indicator of residential building energy efficiency. Title 24 commercial building TDV method also accounts for lights and receptacles load. The modified TDVI approach applied to this study is one of the number of energy efficiency indications analyzed and discussed in this report and was used to show more realistic/complete impacts of EE measures on building energy consumption than that typically calculated by Title 24 certification software like Energy PRO 4.3 or Micropas7 v. 7.3.

Figure 4. TDVI Energy Consumption (all buildings)

Figure 4 shows that implementing EE options can lower SITE-A TDVI specific energy consumption from the builder proposed baseline of 217 kBtu/sf-year to 190 kBtu/sf-year, or by 12.1%.

Implementing EE-PV option could further reduce TDVI to 152 kBtu/sf-year or by total of 31.3% compared with the builder proposed baseline.

Similar to the results shown in Figure 3, deploying EE-DG option would not be as effective in reducing SITE-A TDVI specific energy consumption as the EE-PV option. However in contrast to Figure 3, where the energy is expressed in Btu and EE-DG shows its highest use, at TDVI of 170 kBtu/sf-year the EE-DG option is 33.8% better than the builder proposed baseline TDVI. This shows benefits of DG technology which while increasing consumption of a low TDVI valued fuel like natural gas can significantly decrease grid import of high TDVI valued electricity.

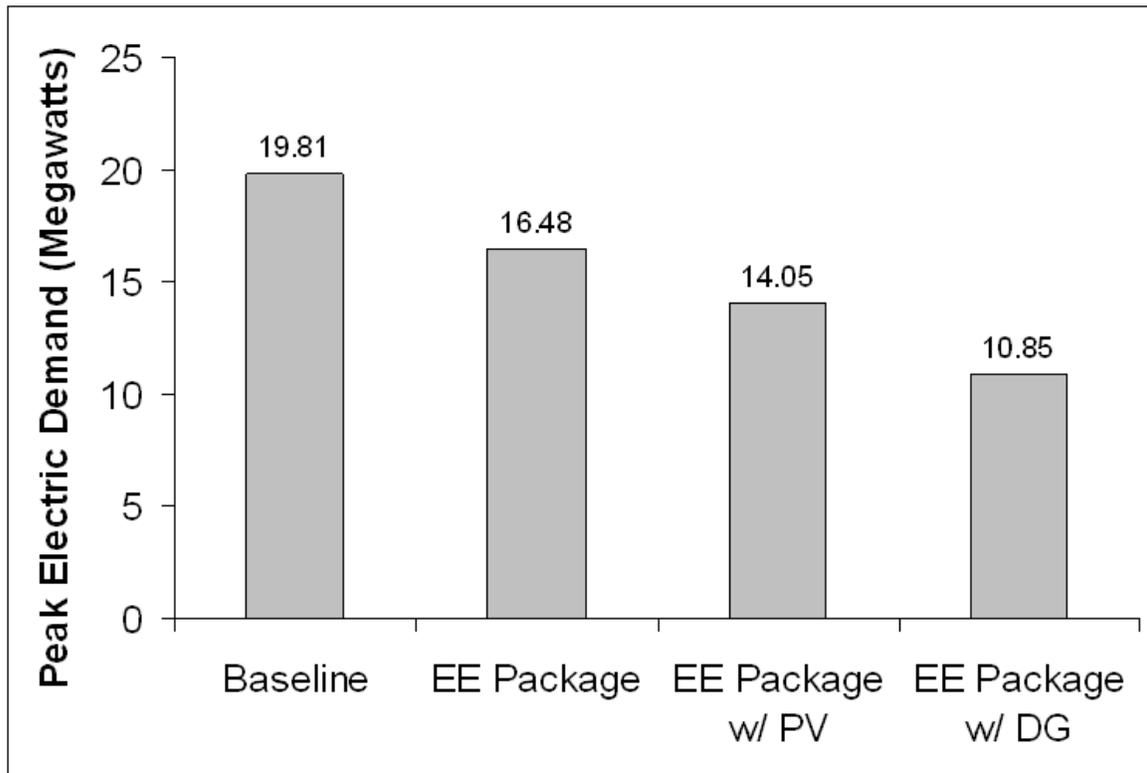


Figure 5. Peak Electric Demand (all buildings contributions)

Table 2 – Specific Cost of Electric Peak Demand Reduction

	Peak MW	Total Cost	\$/kW for Reduced Peak Demand
Baseline	19.809	-	-
EE Package	16.478	\$10,068,880	\$3,023
EE Package w/ PV	14.045	\$55,372,374	\$9,607
EE Package w/ DG	10.851	\$15,795,566	\$1,763

Another important measure of implemented community energy efficiency options is their impact on the grid peak electric demand kW. Figure 5 shows SITE-A peak demand for four analyzed alternatives and Table 2 lists specific cost of implementing them.

Implementing EE options would result in lowering SITE-A electric peak demand from the builder proposed baseline of 19.81 MW to 16.48 MW, or by 16.8%. As see in Table 2, at \$3,023 / kW this is also the second least expensive of the three analyzed options to lower peak demand.

Implementing EE-PV option could further reduce electric peak demand to 14.05 MW or by total of 29.1% compared with the builder proposed baseline. At \$9,607 / kW this is the most expensive of the three analyzed options to lower peak demand.

Implementing EE-DG option could reduce SITE-A electric peak demand to 10.85 MW which is better than EE_PV option and 45.2% less compared with the builder proposed baseline. Specific cost of implementing it would be \$1,763 / kW reduced⁸.

Environmental Impacts

Impacts of different development scenarios on the cumulative annual emissions associated with SITE-A electricity and natural gas consumption are shown in Figures 6 to 8. The calculations are based using conversion factors (see Appendix A, page 190 of this report) and assume end use delivery efficiency of 92% for electricity and 98.4% for natural gas.

Figure 6 shows that implementing EE options can lower SITE-A annual CO2 emissions from the builder proposed baseline of 30,924 metric tons/ year to 27,174 metric tons/ year, or by 12.1%.

Implementing EE-PV option could further reduce CO2 emissions to 21,403 metric tons/ year, or by 30.8%.

Deploying EE-DG option would be less effective in reducing SITE-A CO2 emissions as the EE-PV option, however at 28,865 metric tons/ year it is still 6.7% lower than the builder proposed baseline CO2 emissions.

⁸ Based on incentives of \$600/kW of installed DG. See footnote 5 on page 6 of this report for additional explanation.

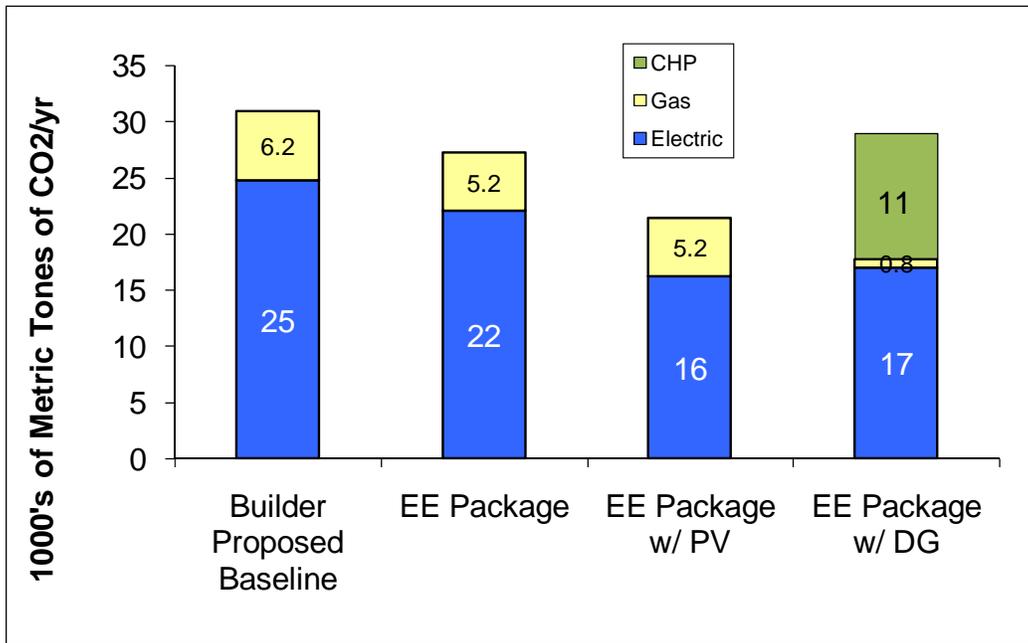
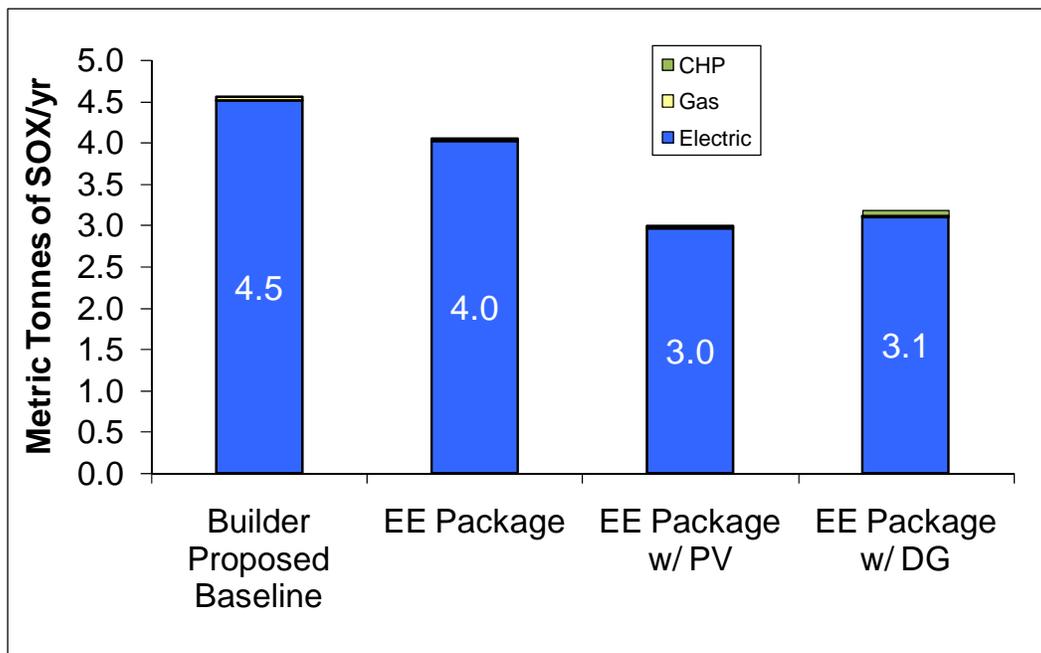


Figure 6. Total Annual CO2 Emissions (all buildings contributions)

Figures 7 and 8 show SOx and NOx emissions impacts. The EE options can lower SITE-A annual SOx emissions to 4.05 metric tons/ year from the builder proposed baseline of 4.55 metric tons/ year, or by 11%. NOx emissions would be 14.79 metric tons/ year with EE option implemented vs. 16.93 metric tons/ year for the builder proposed baseline, a reduction of 12.6%.



Note; Gas and CHP contributions to SOx emissions are too small to clearly show on this chart

Figure 7. Total Annual SOx Emissions (all buildings contributions)

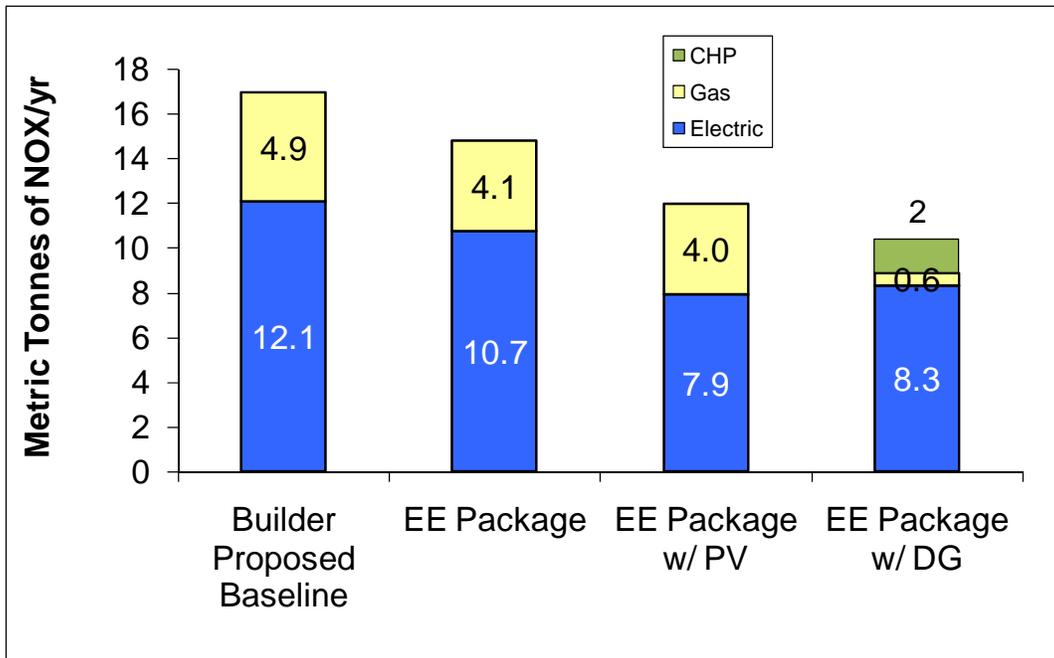


Figure 8. Total Annual NOx Emissions (all buildings contributions)

Implementing EE-PV option could further reduce SOx emissions to 2.99 metric tons/year or by 34.2%, and NOx emissions to 12 metric tons/year or by 29.3% as compared to the builder proposed baseline.

Implementing EE-DG option could reduce SITE-A SOx emissions to 3.17 metric tons/year or by 30.3% and NOx emissions to 10.40 metric tons/year or by 38.5% as compared to the builder proposed baseline.

TDVI Impacts by Building Prototype

To help reader better understand which prototype buildings are the most energy intensive and to what degree the total number them contribute to the SITE-A annual energy consumption a number of charts was prepared. The charts shown in Figures 9 to 12 provide TDVI specific energy density for each of the 15 single prototype buildings as well as the total annual TDVI – based energy consumption for all the buildings of the same type (shown as a smaller chart insert).

Table 3 provides tabularized data showing percentage of each prototype building TDVI as that of the SITE-A total TDVI. The results are given as a utility specific percentage per utility (electric and gas) as well as a utility specific percentage per site total TDVI.

In the builder proposed baseline configuration the freestanding Full Service Restaurant (FSR) prototype has the highest TDVI of 1,126 kBtu/sf-year (Figure 9) however all FSR buildings contribute to only 2.4% of the SITE-A TDVI (Table 3).

As shown in Figures 10 to 12 and in Table 3, the High Rise Office (HRO) buildings contribute the most to the SITE-A TDVI energy consumption, therefore this prototype could be considered a prime target when selecting most attractive target for uniform implementation of selected Energy Efficiency measures.

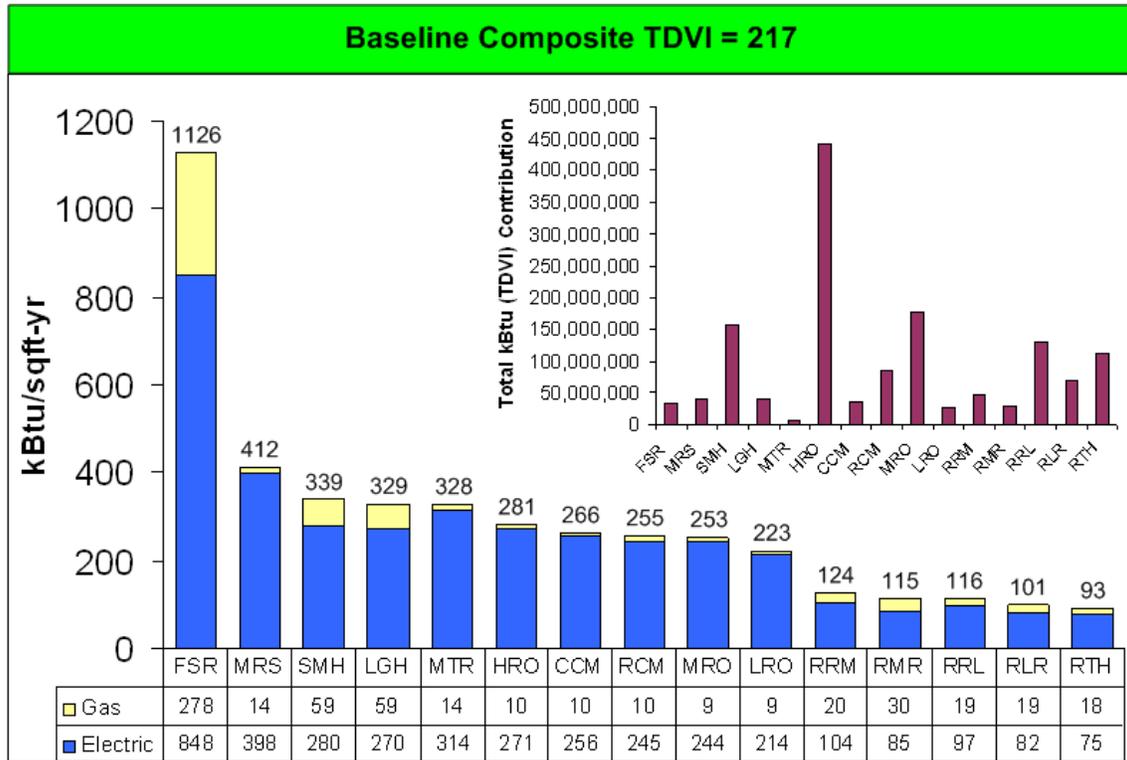


Figure 9. Builder Baseline - TDVI per Building Type

Table 3 – TDVI per Building Type (composite for prototype all end-use areas)

	Baseline	Elec. TDVI as % of Total Elec. TDVI	Gas TDVI as % of Total Gas TDVI	Elec. TDVI as % of Total Site TDVI	Gas TDVI as % of Total Site TDVI
1	Freestanding Full Service Restaurant	1.9%	6.6%	1.8%	0.6%
2	Multi-Tenant Retail Shop	0.5%	0.2%	0.4%	0.0%
3	Major Retailer	3.0%	1.1%	2.7%	0.1%
4	Office Building Low-Rise	2.0%	0.9%	1.8%	0.1%
5	Office Building Mid-Rise	13.1%	5.1%	11.9%	0.4%
6	Office Building High-Rise	32.6%	12.7%	29.8%	1.1%
7	Hotel - Large	2.5%	5.8%	2.3%	0.5%
8	Hotel - Small	10.3%	16.7%	9.4%	1.4%
9	Retail/Commercial Mixed Use	6.3%	2.8%	5.8%	0.2%
10	Retail/Residential Mixed Use Mid-Rise	3.3%	4.1%	3.0%	0.4%
11	Retail/Residential Mixed Use Low-Rise	9.1%	8.5%	8.3%	0.7%
12	Civic/Commercial Mixed Use	2.6%	1.0%	2.4%	0.1%
13	Residential Multi-Family Townhome	6.9%	17.5%	6.3%	1.5%
14	Residential Low-Rise	4.3%	10.6%	3.9%	0.9%
15	Residential Mid-Rise	1.7%	6.3%	1.5%	0.5%

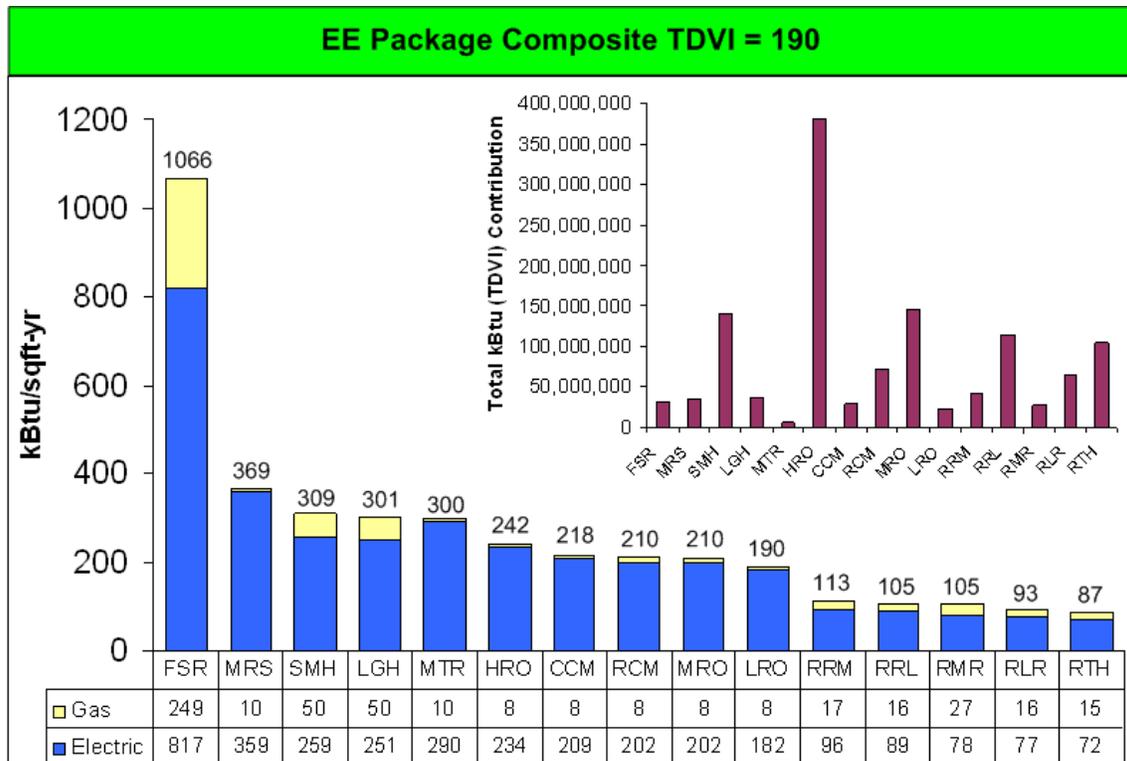


Figure 10. EE Packages Only Option - TDVI per Building Type

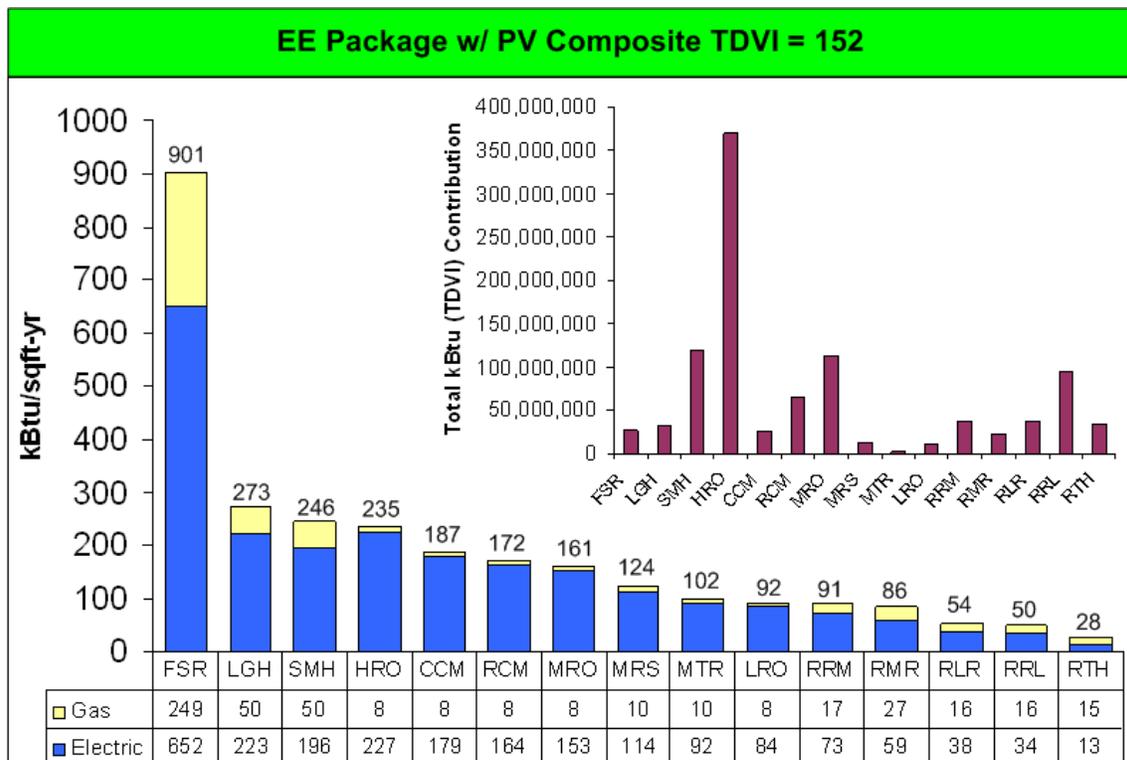


Figure 11. EE Package with PV Option - TDVI per Building Type

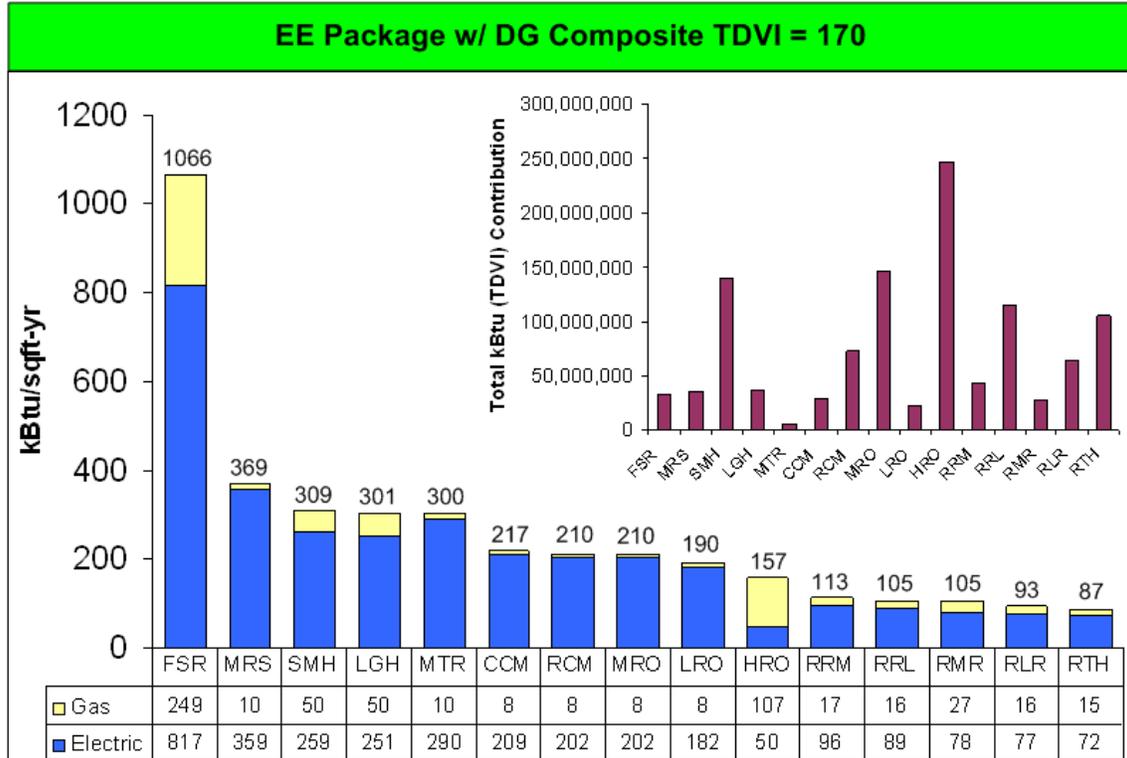


Figure 12. EE Package with DG Option - TDVI per Building Type

TDVI Impacts by Space-Use Type

To illustrate which of the building 6 major end-use spaces are the most energy intensive and to what degree the total square footage they represent contribute to the SITE-A annual energy consumption charts shown in Figures 13 to 16 was prepared. The charts provide TDVI specific energy density for various end-use spaces/floor plans as well as the total annual TDVI – based energy consumption for all the buildings end-use spaces of the same type (shown as a smaller chart insert).

Table 4 provides tabularized data showing percentage of each end-use space type TDVI as that of the SITE-A total TDVI. The results are given as a utility specific percentage per total utility use (separate for electric and gas) as well as a utility specific percentage per site total TDVI.

As seen in Figure 9 (the builder proposed baseline) the restaurants have the highest TDVI of 1,122 kBTU/sf-year. However because the SITE-A office space square footage will greatly exceed any other of the 5 remaining end-use space footages, the office spaces will contribute to more than 51% of the SITE-A total TDVI (Table 4).

Figures 13 to 16 and Table 4 show consistently that in all energy efficiency options the office spaces / floor plans contribute most to the SITE-A TDVI energy consumption, therefore they could be considered a good target when selecting end-use areas most attractive for uniform implementation of selected Energy Efficiency measures.

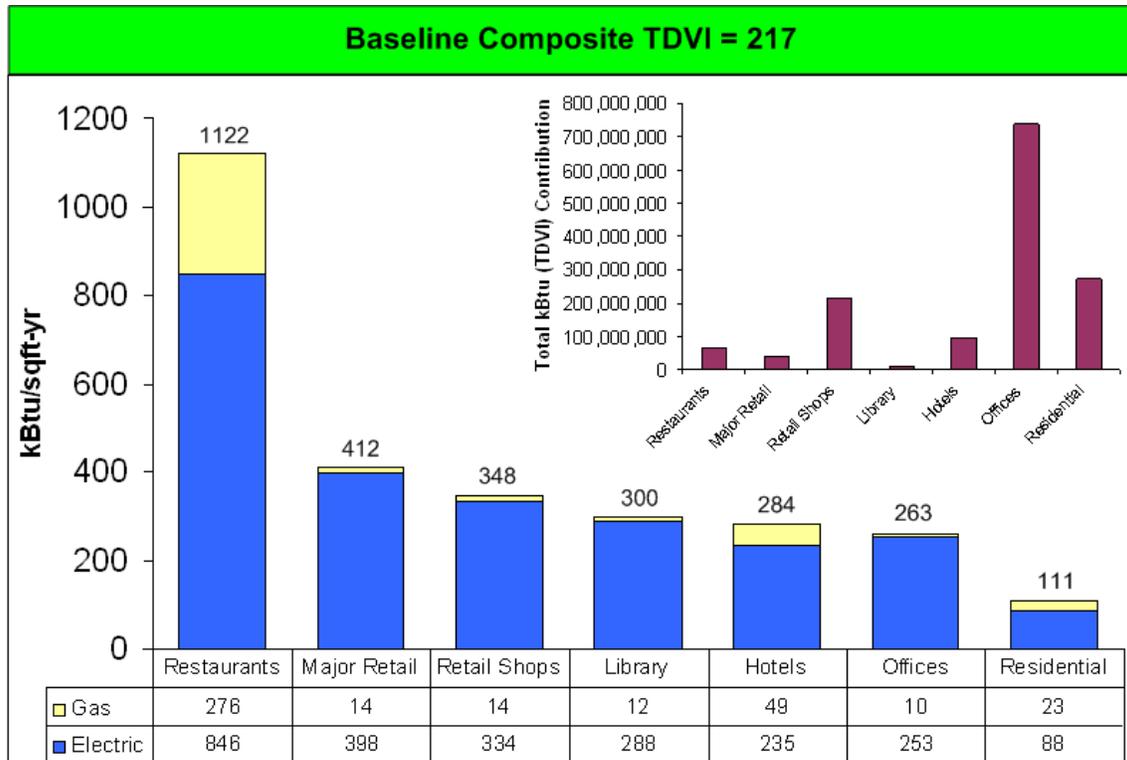


Figure 13. EE Builder Baseline - TDVI per Space-Use Type

Table 4 – TDVI per End-Use Area (composite for all buildings types)

Baseline	Elec. TDVI as % of Total Elec. TDVI	Gas TDVI as % of Total Gas TDVI	Elec. TDVI as % of Total Site TDVI	Gas TDVI as % of Total Site TDVI
Restaurants	3.8%	13.2%	3.5%	1.1%
Retail Shops	15.7%	7.0%	14.3%	0.6%
Major Retail	3.0%	1.1%	2.7%	0.1%
Offices	54.3%	21.5%	49.6%	1.9%
Hotels	6.0%	13.8%	5.5%	1.2%
Library	0.6%	0.3%	0.5%	0.0%
Residential	16.7%	43.2%	15.2%	3.7%

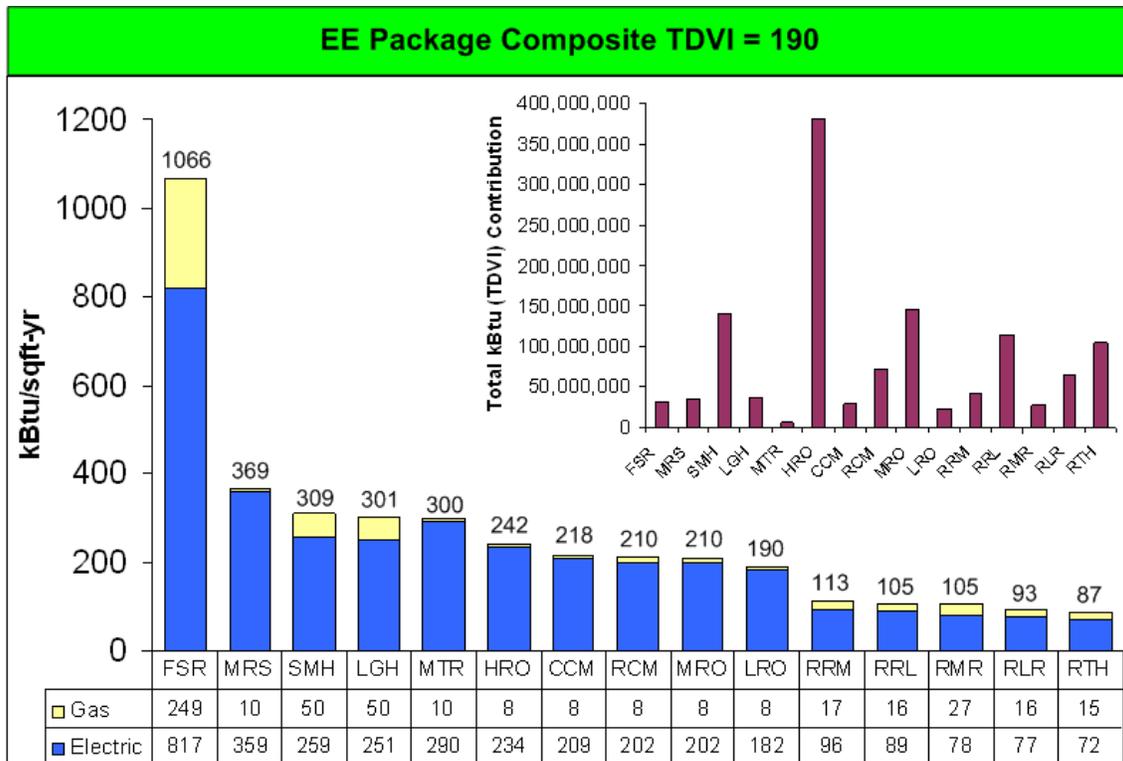


Figure 14. EE Package Option - TDVI per Space-Use Type

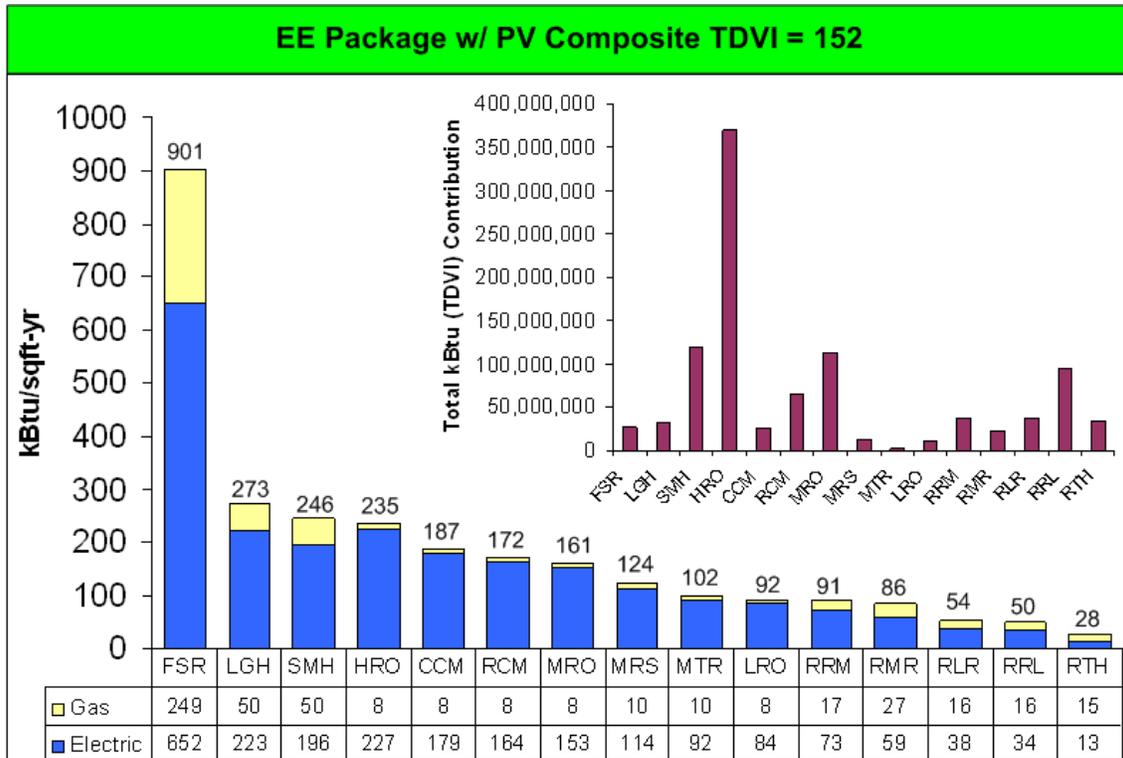


Figure 15. EE Package with PV Option - TDVI per Space-Use Type

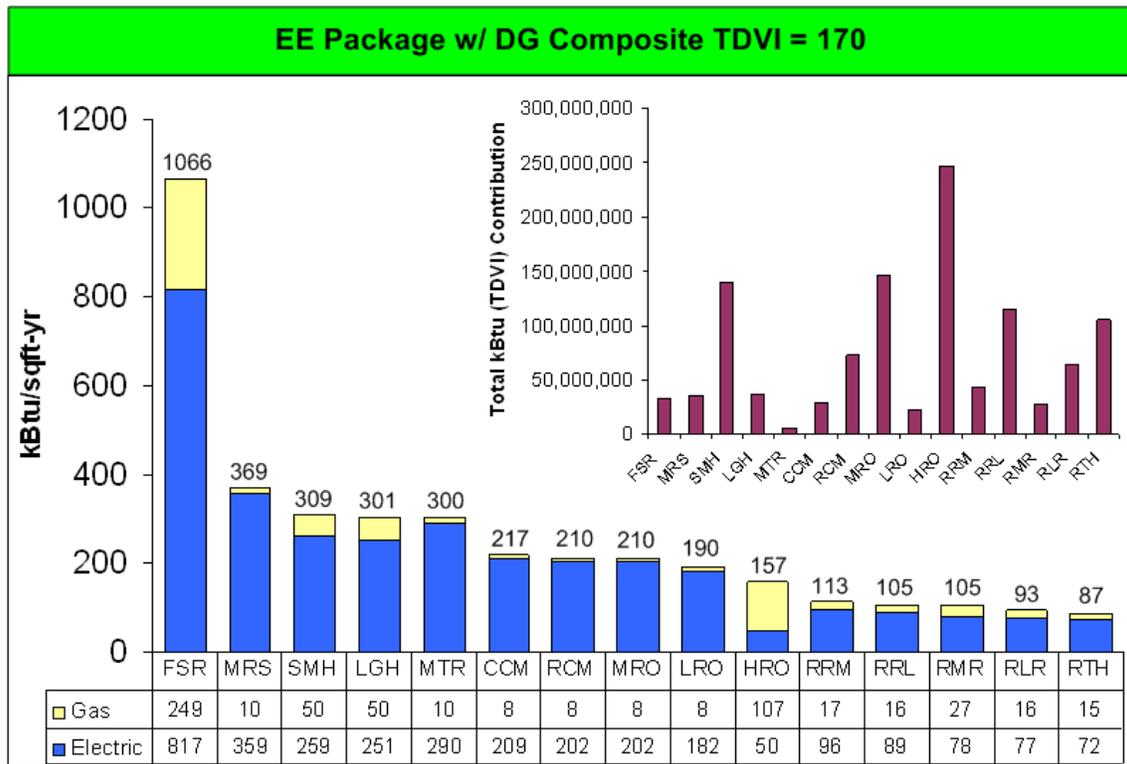


Figure 16. EE Package with DG Option - TDVI per Space-Use Type

Composite Results - Economics and Summary Tables

To help reader in direct comparison of the tree analyzed energy efficiency options with the builder proposed baseline a number of summary tables showing eleven different parameters related to the SITE-A energy, emissions, and economics were compiled and are provided below in Tables 5 to 7. The first nine of the listed parameters were already discussed in the previous sections of this report therefore only the economic aspects of the analysis will be highlighted in this section.

Table 5 – Impacts of EE Package vs. Builder Baseline

Parameter	Baseline	EE Package	% Savings
TDVI (kBtu/sqft-yr)	217	190	12.3%
Electricity (kWh/yr)	71,575,322	63,706,917	11.0%
Electric Demand (Max MW)	19.809	16.478	16.8%
Gas (MMBtu/yr)	114,606	95,542	16.6%
Total Energy (MMBtu/yr)	358,821	312,910	12.8%
Emissions - CO ₂ (tonnes/yr)	30,924	27,174	12.1%
Emissions - SO _x (tonnes/yr)	4.55	4.05	11.0%
Emissions - NO _x (tonnes/yr)	16.93	14.79	12.6%
Energy Cost (\$/yr)	\$15,110,206	\$13,405,617	11.3%
Simple Payback (years)	n/a	5.9	n/a
ROI (%)	n/a	16.9	n/a

Table 5 shows that installing all recommended economically feasible EE options could lower SITE-A annual utility costs by \$1,704,589 or by 11.3%. The simple payback of the investment necessary to implement EE options would be 5.9 years with ROI of 16.9%.

Supplementing EE option with PV (see Table 6) could reduce SITE-A electric and natural gas annual utility costs by \$4,879,683 or by 32.3% compared to the builder proposed baseline option. The simple payback of the EE-PV option would be 12.4 years with the ROI of 8.1%⁹.

Table 6 – Impacts of EE Package + PV vs. Builder Baseline

Parameter	Baseline	EE Package w/ PV	% Savings
TDVI (kBtu/sqft-yr)	217	152	30.0%
Electricity (kWh/yr)	71,575,322	47,003,474	34.3%
Electric Demand (Max kW)	19.809	14.045	29.1%
Gas (MMBtu/yr)	114,606	95,462	16.7%
Total Energy (MMBtu/yr)	358,821	255,838	28.7%
Emissions - CO ₂ (tonnes/yr)	30,924	21,403	30.8%
Emissions - SO _x (tonnes/yr)	4.55	2.99	34.2%
Emissions - NO _x (tonnes/yr)	16.93	12	29.3%
Energy Cost (\$/yr)	\$15,110,206	\$10,230,523	32.3%
Simple Payback (years)	n/a	12.4	n/a
ROI (%)	n/a	8.1	n/a

⁹ Assumes that excess electricity generated by PV qualifies for net metering based utility credits. PV installation incentive of \$2550/kW is applied.

Table 7 – Impacts of EE Package + DG vs. Builder Baseline

Parameter	Baseline	EE Package w/ DG	% Savings
TDVI (kBtu/sqft-yr)	217	170	21.7%
Electricity (kWh/yr)	71,575,322	49,239,156	31.2%
Electric Demand (Max kW)	19.809	10.851	45.2%
Gas (MMBtu/yr)	114,606	236,634	-106.5%
Total Energy (MMBtu/yr)	358,821	404,638	-12.8%
Emissions - CO ₂ (tonnes/yr)	30,924	28,865	6.7%
Emissions - SO _x (tonnes/yr)	4.55	3.17	30.3%
Emissions - NO _x (tonnes/yr)	16.93	10.40	38.5%
Energy Cost (\$/yr)	\$15,110,206	\$12,698,141	16.0%
Simple Payback (years)	n/a	7.0	n/a
ROI (%)	n/a	14.3	n/a

Finally, Table 7 shows that deploying EE-DG option could reduce SITE-A combined electric and natural gas annual utility costs by \$2,412,065 or by 16% as compared to the builder proposed baseline option. The simple payback of the EE-DG option would be 7 years with the ROI of 14.3%. However, as previously noted on page 6 of this report, the economic calculations of the DG option were based on, applicable at the time the CVRP analysis was conducted, 2007 CA SGIP guidelines which provided rebate of \$600/kW for IC-engine based CHP systems and \$800/kW for microturbine based CHP systems. Unfortunately, the latest 2008 SGIP eliminated all DG rebates except for the wind and fuel cell applications. That makes SITE-A DG analysis presented in this report more a "what if" analytical case than a valid energy efficiency option as the DG technology becomes economically not feasible without the rebates. Nevertheless, the analysis of DG energy efficiency impacts on SITE-A development remains valid while the economics could potentially become more favorable over time (lower cost, incentives.)

Due to a significant energy saving potential for PV technology a separate Table 8 was prepared to illustrate details of the SITE-A PV system¹⁰ economics. The evaluated PV installations would total ~1,140 kW (dc) of installed capacity. The installation will reduce SITE-A annual electric utility cost by \$3,073,567 which includes \$336,520 in electricity exported back to the grid. The simple payback for PV option alone (no other EE measures included) would be 14.8 years with the ROI of 6.83%.

¹⁰ See page 185 of this report (Appendix A) to review technical details / modeling assumption for PV based on-site power

Table 8 – Details of PV* Economic Calculation

Standalone PV Economics		
Excess PV generated electricity	Exported Electricity (kWh/yr)	2,949,340
exported to the utility grid	Net Metering Credits (\$/yr)	\$336,520
	Net Value of PV Generated Electricity (\$/yr)	\$3,073,567
Economics of PV system (net value)	Raw PV installed cost	\$73,309,641
includes value of net metering utility	Incentive @ \$2.55/watt	\$29,136,469
credits and direct savings from	PV cost after Subsidy	\$44,173,172
displacing grid supplied electricity	PV O&M (\$/yr)	\$87,972
	Simple Payback	14.8
	ROI	6.8%

Total of ~1,140 kW (dc) of PV systems installed. Roof area available for PV varies from 25% to 60% depending on building prototype. Photovoltaic installed costs as shown include metering and switchgear.

Recommendation and Conclusions

Significant energy savings and reduction in environmental impacts can be achieved by selective application of specific Energy Efficiency measures in the Chula Vista SITE-A development buildings.

The recommended Energy Efficiency measures include building envelope materials, high efficiency HVAC equipment and selective deployment of DG and PV technologies. However, as expected, each building and space-use type will have different combination and type of measures constituting a recommended/optimal Energy Efficiency package.

Details of the recommended space-use type specific EE packages are provided in the “SITE-A Modeling - Detailed Results Tables” of this report. Tables 10 to 123 list recommended measures and shows energy savings and environmental and economic impacts for each of the fifteen SITE-A prototypical buildings and their six analyzed space-use types.

The conducted study and detailed results listed on pages 23 to 117 of this report provide wealth of information that can be further used by the developer/builder for in-depth/ and building-specific analysis of implementing various economically feasible Energy Efficiency options in the SITE-A development.

Potentially even more important may be the fact that the study also identifies Energy Efficiency measures commonly considered as valuable that in the SITE-A application showed limited benefits and are not advised for implementation.

SITE-A Buildings Modeling - Detailed Results, Tables

Table 9 - Prototype Buildings Count and Orientations

Prototype #	Prototype	Qty	Deg From North	Avg Deg from North
1	Freestanding Full-Service Restaurant	4	180	180
2	Multi-Tenant Retail Shop	1	180	180
3	Major Retailer	1	180	
3	Major Retailer	1	90	
3	Major Retailer	1	270	180
4	Office Building - Low-Rise	1	0	
4	Office Building - Low-Rise	3	45	30
5	Office Building - Mid-Rise	2	90	
5	Office Building - Mid-Rise	4	115	
5	Office Building - Mid-Rise	1	45	100
6	Office Building - High-Rise	4	90	
6	Office Building - High-Rise	1	0	
6	Office Building - High-Rise	1	115	
6	Office Building - High-Rise	1	45	70
7	Hotel - Large	1	75	80
8	Hotel - Small	2	25	
8	Hotel - Small	1	205	90
9	Retail/Commercial Mixed Use	1	0	
9	Retail/Commercial Mixed Use	1	75	
9	Retail/Commercial Mixed Use	1	115	60
10	Retail/Residential Mixed Use Mid-Rise	2	25	30
11	Retail/Residential Mixed Use Low-Rise	2	0	
11	Retail/Residential Mixed Use Low-Rise	4	25	
11	Retail/Residential Mixed Use Low-Rise	2	115	40
12	Civic/Commercial Mixed Use	1	25	30
13	Residential Multi-Family/Town Homes	39	25	
13	Residential Multi-Family/Town Homes	2	0	
13	Residential Multi-Family/Town Homes	5	5	
13	Residential Multi-Family/Town Homes	4	90	
13	Residential Multi-Family/Town Homes	44	115	
13	Residential Multi-Family/Town Homes	12	135	
13	Residential Multi-Family/Town Homes	17	45	70
14	Residential Low-Rise	5	225	
14	Residential Low-Rise	6	195	210
15	Residential High Rise	1	25	30
15	Residential High Rise	1	115	120
Total Buildings		180	-	-

Detailed Modeling Results - Prototype 1 - Freestanding Full-Service Restaurant

Table 10 - Freestanding Full-Service Restaurant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=80%	Heating - AFUE=94%	None	None	Alternative 1
Space Cooling	HVAC - EER 9.5	HVAC - EER 10.5	HVAC - EER 11.5	HVAC - EER 12.5	Alternative 3
Photovoltaics	No PV	PV - 3698 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 1
DG	No DG	DG - 30kW microturbine	None	None	No Alternative

Table 11 - Freestanding Full-Service Restaurant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #1 Freestanding Full-Service Restaurant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$48,946	\$25,480	\$74,426	-	-
Package - Optimum EE	\$46,975	\$23,286	\$70,260	\$23,084	5.5
Package - Optimum EE + PV	\$39,858	\$23,286	\$63,144	\$206,937	19.0
CoolRoof - Abs=0.25	\$48,812	\$25,542	\$74,354	\$2,441	33.9
DHW - EF=0.640	\$48,946	\$24,362	\$73,308	\$620	0.6
DHW - EF=0.823	\$48,946	\$23,936	\$72,882	\$741	0.5
Heating - AFUE=94%	\$48,946	\$24,856	\$73,802	\$1,000	1.6
HVAC - EER 10.5	\$48,195	\$25,480	\$73,675	\$16,098	21.4
HVAC - EER 11.5	\$47,578	\$25,480	\$73,058	\$18,007	13.2
HVAC - EER 12.5	\$47,063	\$25,480	\$72,543	\$19,178	10.2
PV - 3698 sqft	\$41,793	\$25,480	\$67,272	\$183,853	25.7
Roof - U=R15 rigid	\$48,943	\$25,429	\$74,372	\$1,849	34.2
Roof - U=R20 rigid	\$48,940	\$25,419	\$74,359	\$3,328	49.7
Walls - R19 batt	\$48,916	\$25,488	\$74,403	\$394	17.1
Walls - R21 batt	\$48,908	\$25,485	\$74,393	\$537	16.3
Walls - R21 batt + R5 rigid	\$48,881	\$25,477	\$74,358	\$1,431	21.0
Windows - U=0.43, SHGC=0.39	\$48,928	\$25,463	\$74,390	\$733	20.4
Windows - U=0.26, SHGC=0.37	\$48,911	\$25,424	\$74,335	\$2,191	24.1
Windows - U=0.22, SHGC=0.22	\$48,788	\$25,504	\$74,293	\$6,690	50.3
DG - 30kW microturbine	\$43,966	\$29,033	\$73,336	\$44,709	59.4

Table 12 - Freestanding Full-Service Restaurant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #1 Freestanding Full-Service Restaurant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	334,010	1,140	1,875	3,015	-
Package - Optimum EE	323,160	1,103	1,679	2,782	233
Package - Optimum EE + PV	262,936	897	1,679	2,577	438
CoolRoof - Abs=0.25	333,244	1,137	1,880	3,017	-2
DHW - EF=0.640	334,010	1,140	1,775	2,915	100
DHW - EF=0.823	334,010	1,140	1,737	2,877	138
Heating - AFUE=94%	334,010	1,140	1,819	2,959	56
HVAC - EER 10.5	329,874	1,126	1,875	3,000	15
HVAC - EER 11.5	326,458	1,114	1,875	2,989	26
HVAC - EER 12.5	323,588	1,104	1,875	2,979	36
PV - 3698 sqft	273,785	934	1,875	2,809	206
Roof - U=R15 rigid	334,140	1,140	1,871	3,011	4
Roof - U=R20 rigid	334,226	1,140	1,870	3,010	5
Walls - R19 batt	333,900	1,139	1,876	3,015	0
Walls - R21 batt	333,879	1,139	1,876	3,015	0
Walls - R21 batt + R5 rigid	333,742	1,139	1,875	3,013	2
Windows - U=0.43, SHGC=0.39	333,853	1,139	1,873	3,013	2
Windows - U=0.26, SHGC=0.37	333,685	1,139	1,870	3,008	7
Windows - U=0.22, SHGC=0.22	333,202	1,137	1,877	3,014	1
DG - 30kW microturbine	300,342	1,025	2,192	3,217	-202

Table 13 - Freestanding Full-Service Restaurant EE Package and Single EE Measures Impacts on TDVI

Prototype #1 Freestanding Full-Service Restaurant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	7,396	848	278	1,126	-
Package - Optimum EE	7,396	817	249	1,066	60
Package - Optimum EE + PV	7,396	652	249	901	225
CoolRoof - Abs=0.25	7,396	847	279	1,126	0
DHW - EF=0.640	7,396	848	263	1,112	14
DHW - EF=0.823	7,396	848	258	1,106	20
Heating - AFUE=94%	7,396	848	270	1,118	8
HVAC - EER 10.5	7,396	836	278	1,114	12
HVAC - EER 11.5	7,396	826	278	1,104	22
HVAC - EER 12.5	7,396	818	278	1,096	30
PV - 3698 sqft	7,396	683	278	961	165
Roof - U=R15 rigid	7,396	849	277	1,126	0
Roof - U=R20 rigid	7,396	849	277	1,126	0
Walls - R19 batt	7,396	848	278	1,126	0
Walls - R21 batt	7,396	848	278	1,126	0
Walls - R21 batt + R5 rigid	7,396	848	278	1,126	0
Windows - U=0.43, SHGC=0.39	7,396	848	278	1,126	0
Windows - U=0.26, SHGC=0.37	7,396	848	277	1,125	1
Windows - U=0.22, SHGC=0.22	7,396	846	278	1,125	1
DG - 30kW microturbine	7,396	747	326	1,073	53

Detailed Modeling Results - Prototype 2 - Multi-Tenant Retail Shop - Corner Tenant

Table 14 - Multi-Tenant Retail Shop - Corner Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 1
Photovoltaics	No PV	PV - 842 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 2
DG	None	None	None	None	No Alternative

Table 15 - Multi-Tenant Retail Shop - Corner Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #2 Multi-Tenant Retail Shop - Corner Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,081	\$1,698	\$5,779	-	-
Package - Optimum EE	\$3,912	\$1,629	\$5,541	\$2,984	12.5
Package - Optimum EE + PV	\$2,165	\$1,629	\$3,794	\$44,402	22.9
CoolRoof - Abs=0.25	\$4,061	\$1,698	\$5,759	\$463	23.2
DHW - EF=0.640	\$4,081	\$1,678	\$5,759	\$310	15.5
DHW - EF=0.823	\$4,081	\$1,629	\$5,710	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$4,002	\$1,698	\$5,700	\$443	5.6
HVAC - EER 12.06, COP 3.48	\$4,021	\$1,698	\$5,719	\$1,328	22.1
HVAC - EER 12.80, COP 3.66	\$3,980	\$1,698	\$5,678	\$2,213	21.9
PV - 842 sqft	\$2,371	\$1,698	\$4,069	\$41,881	21.4
Roof - U=R15 rigid	\$4,070	\$1,698	\$5,768	\$351	31.9
Roof - U=R20 rigid	\$4,063	\$1,698	\$5,761	\$632	35.1
Walls - R19 batt	\$4,072	\$1,698	\$5,770	\$192	21.4
Walls - R21 batt	\$4,071	\$1,698	\$5,769	\$262	26.2
Walls - R21 batt + R5 rigid	\$4,067	\$1,698	\$5,765	\$699	49.9
Windows - U=0.43, SHGC=0.39	\$4,041	\$1,698	\$5,739	\$272	6.8
Windows - U=0.26, SHGC=0.37	\$4,040	\$1,698	\$5,738	\$813	19.8
Windows - U=0.22, SHGC=0.22	\$3,989	\$1,698	\$5,687	\$2,483	27.0

Table 16 - Multi-Tenant Retail Shop - Corner Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #2 Multi-Tenant Retail Shop - Corner Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	23,388	80	18	98	-
Package - Optimum EE	22,531	77	13	90	8
Package - Optimum EE + PV	8,282	28	13	41	57
CoolRoof - Abs=0.25	23,227	79	18	98	0
DHW - EF=0.640	23,388	80	17	97	1
DHW - EF=0.823	23,388	80	13	93	5
HVAC - EER 12.19, COP 3.52	23,028	79	18	97	1
HVAC - EER 12.06, COP 3.48	23,069	79	18	97	1
HVAC - EER 12.80, COP 3.66	22,863	78	18	96	2
PV - 842 sqft	9,517	32	18	51	47
Roof - U=R15 rigid	23,356	80	18	98	0
Roof - U=R20 rigid	23,331	80	18	98	0
Walls - R19 batt	23,342	80	18	98	0
Walls - R21 batt	23,328	80	18	98	0
Walls - R21 batt + R5 rigid	23,317	80	18	98	0
Windows - U=0.43, SHGC=0.39	23,076	79	18	97	1
Windows - U=0.26, SHGC=0.37	23,130	79	18	97	1
Windows - U=0.22, SHGC=0.22	22,790	78	18	96	2

Table 17 - Multi-Tenant Retail Shop - Corner Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #2 Multi-Tenant Retail Shop - Corner Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	317	14	331	-
Package - Optimum EE	1,404	302	10	312	19
Package - Optimum EE + PV	1,404	98	10	109	222
CoolRoof - Abs=0.25	1,404	314	14	329	2
DHW - EF=0.640	1,404	317	13	330	1
DHW - EF=0.823	1,404	317	10	327	4
HVAC - EER 12.19, COP 3.52	1,404	310	14	325	6
HVAC - EER 12.06, COP 3.48	1,404	311	14	325	6
HVAC - EER 12.80, COP 3.66	1,404	307	14	322	9
PV - 842 sqft	1,404	117	14	131	200
Roof - U=R15 rigid	1,404	316	14	330	1
Roof - U=R20 rigid	1,404	316	14	330	1
Walls - R19 batt	1,404	316	14	330	1
Walls - R21 batt	1,404	316	14	330	1
Walls - R21 batt + R5 rigid	1,404	316	14	330	1
Windows - U=0.43, SHGC=0.39	1,404	312	14	326	5
Windows - U=0.26, SHGC=0.37	1,404	313	14	327	4
Windows - U=0.22, SHGC=0.22	1,404	307	14	322	9

Detailed Modeling Results - Prototype 2 - Multi-Tenant Retail Shop - Internal Tenant

Table 18 - Multi-Tenant Retail Shop - Internal Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Photovoltaics	No PV	PV - 842 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3
DG	None	None	None	None	No Alternative

Table 19 - Multi-Tenant Retail Shop - Internal Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #2 Multi-Tenant Retail Shop - Internal Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,025	\$1,698	\$23,018	-	-
Package - Optimum EE	\$3,632	\$1,629	\$20,580	\$5,241	11.3
Package - Optimum EE + PV	\$1,982	\$1,629	\$7,379	\$46,659	19.8
CoolRoof - Abs=0.25	\$3,983	\$1,698	\$22,740	\$463	11.0
DHW - EF=0.640	\$4,025	\$1,678	\$23,018	\$310	15.5
DHW - EF=0.823	\$4,025	\$1,629	\$23,018	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$3,935	\$1,698	\$22,654	\$388	4.3
HVAC - EER 12.06, COP 3.48	\$3,940	\$1,698	\$22,691	\$1,163	13.7
HVAC - EER 12.80, COP 3.66	\$3,904	\$1,698	\$22,420	\$1,939	16.0
PV - 842 sqft	\$2,378	\$1,698	\$9,700	\$41,881	22.1
Roof - U=R15 rigid	\$3,999	\$1,698	\$22,922	\$351	13.5
Roof - U=R20 rigid	\$3,972	\$1,698	\$22,759	\$632	11.9
Walls - R19 batt	\$4,006	\$1,698	\$22,950	\$206	10.8
Walls - R21 batt	\$4,005	\$1,698	\$22,940	\$281	14.0
Walls - R21 batt + R5 rigid	\$4,004	\$1,698	\$22,943	\$748	35.6
Windows - U=0.43, SHGC=0.39	\$3,982	\$1,698	\$22,746	\$171	4.0
Windows - U=0.26, SHGC=0.37	\$3,964	\$1,698	\$22,652	\$510	8.4
Windows - U=0.22, SHGC=0.22	\$3,928	\$1,698	\$22,474	\$1,556	16.0

Table 20 - Multi-Tenant Retail Shop - Internal Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #2 Multi-Tenant Retail Shop - Internal Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	23,018	79	18	97	-
Package - Optimum EE	20,580	70	13	83	14
Package - Optimum EE + PV	7,379	25	13	38	59
CoolRoof - Abs=0.25	22,740	78	18	96	1
DHW - EF=0.640	23,018	79	17	95	2
DHW - EF=0.823	23,018	79	13	92	5
HVAC - EER 12.19, COP 3.52	22,654	77	18	96	1
HVAC - EER 12.06, COP 3.48	22,691	77	18	96	1
HVAC - EER 12.80, COP 3.66	22,420	76	18	95	2
PV - 842 sqft	9,700	33	18	51	46
Roof - U=R15 rigid	22,922	78	18	96	1
Roof - U=R20 rigid	22,759	78	18	96	1
Walls - R19 batt	22,950	78	18	97	0
Walls - R21 batt	22,940	78	18	97	0
Walls - R21 batt + R5 rigid	22,943	78	18	97	0
Windows - U=0.43, SHGC=0.39	22,746	78	18	96	1
Windows - U=0.26, SHGC=0.37	22,652	77	18	96	1
Windows - U=0.22, SHGC=0.22	22,474	77	18	95	2

Table 21 - Multi-Tenant Retail Shop - Internal Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #2 Multi-Tenant Retail Shop - Internal Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	311	14	325	-
Package - Optimum EE	1,404	278	10	288	37
Package - Optimum EE + PV	1,404	85	10	96	229
CoolRoof - Abs=0.25	1,404	306	14	321	4
DHW - EF=0.640	1,404	311	13	324	1
DHW - EF=0.823	1,404	311	10	321	4
HVAC - EER 12.19, COP 3.52	1,404	304	14	318	7
HVAC - EER 12.06, COP 3.48	1,404	305	14	319	6
HVAC - EER 12.80, COP 3.66	1,404	300	14	315	10
PV - 842 sqft	1,404	117	14	132	193
Roof - U=R15 rigid	1,404	309	14	323	2
Roof - U=R20 rigid	1,404	307	14	321	4
Walls - R19 batt	1,404	310	14	324	1
Walls - R21 batt	1,404	310	14	324	1
Walls - R21 batt + R5 rigid	1,404	310	14	324	1
Windows - U=0.43, SHGC=0.39	1,404	306	14	321	4
Windows - U=0.26, SHGC=0.37	1,404	305	14	319	6
Windows - U=0.22, SHGC=0.22	1,404	302	14	317	8

Detailed Modeling Results - Prototype 3 - Major Retailer

Table 22 - Major Retailer EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 4.90	HVAC - COP 6.13	None	None	Alternative 1
Photovoltaics	No PV	PV - 24300 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3
DG	None	DG - 60kW MT w/ 32 ton absorb	None	None	No Alternative
Thermal Strg	None	TS - 70% of max daily cooling load	None	None	No Alternative

Table 23 - Major Retailer EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #3 Major Retailer					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$101,893	\$7,292	\$109,184	-	-
Package - Optimum EE	\$91,124	\$5,668	\$96,793	\$50,415	4.1
Package - Optimum EE + PV	\$51,555	\$5,663	\$57,218	\$1,247,840	21.9
CoolRoof - Abs=0.25	\$99,992	\$7,289	\$107,281	\$10,692	5.6
DHW - EF=0.640	\$101,893	\$6,876	\$108,769	\$310	0.7
DHW - EF=0.823	\$101,893	\$5,680	\$107,572	\$371	0.2
Heating - AFUE=85%	\$101,893	\$7,285	\$109,178	\$482	80.3
HVAC - COP 6.13	\$96,201	\$7,292	\$103,493	\$4,496	0.8
PV - 24300 sqft	\$57,935	\$7,299	\$65,234	\$1,208,117	24.6
Roof - U=R15 rigid	\$101,264	\$7,307	\$108,572	\$8,100	13.2
Roof - U=R20 rigid	\$100,889	\$7,306	\$108,195	\$14,580	14.7
Walls - R19 batt	\$101,694	\$7,295	\$108,989	\$1,812	9.3
Walls - R21 batt	\$101,645	\$7,295	\$108,940	\$2,471	10.1
Walls - R21 batt + R5 rigid	\$101,384	\$7,302	\$108,686	\$6,588	13.2
Windows - U=0.43, SHGC=0.39	\$101,045	\$7,293	\$108,338	\$1,501	1.8
Windows - U=0.26, SHGC=0.37	\$101,140	\$7,298	\$108,438	\$4,484	6.0
Windows - U=0.22, SHGC=0.22	\$100,417	\$7,298	\$107,715	\$13,688	9.3
DG - 60kW MT w/ 32 ton absorb	\$83,776	\$20,102	\$104,551	\$106,237	26.8
TS - 70% of max daily cooling load	-	-	\$104,542	\$62,878	13.5

Table 24 - Major Retailer EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #3 Major Retailer					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	669,102	2,283	426	2,709	-
Package - Optimum EE	608,177	2,075	308	2,383	326
Package - Optimum EE + PV	282,626	964	308	1,272	1,437
CoolRoof - Abs=0.25	657,589	2,244	426	2,670	39
DHW - EF=0.640	669,102	2,283	396	2,679	30
DHW - EF=0.823	669,102	2,283	309	2,592	117
Heating - AFUE=85%	669,102	2,283	426	2,709	0
HVAC - COP 6.13	635,823	2,169	426	2,596	113
PV - 24300 sqft	317,321	1,083	427	1,510	1,199
Roof - U=R15 rigid	666,808	2,275	427	2,702	7
Roof - U=R20 rigid	665,328	2,270	427	2,697	12
Walls - R19 batt	668,316	2,280	426	2,707	2
Walls - R21 batt	668,131	2,280	427	2,706	3
Walls - R21 batt + R5 rigid	666,985	2,276	427	2,703	6
Windows - U=0.43, SHGC=0.39	663,956	2,265	426	2,692	17
Windows - U=0.26, SHGC=0.37	664,780	2,268	427	2,695	14
Windows - U=0.22, SHGC=0.22	660,277	2,253	427	2,680	29
DG - 60kW MT w/ 32 ton absorb	556,236	1,898	1,421	3,319	-610
TS - 70% of max daily cooling load	Not Reported				

Table 25 - Major Retailer EE Package and Single EE Measures Impacts on TDVI

Prototype #3 Major Retailer					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	32,400	398	14	412	-
Package - Optimum EE	32,400	359	10	369	43
Package - Optimum EE + PV	32,400	114	10	124	288
CoolRoof - Abs=0.25	32,400	391	14	405	7
DHW - EF=0.640	32,400	398	13	411	1
DHW - EF=0.823	32,400	398	10	408	4
Heating - AFUE=85%	32,400	398	14	412	0
HVAC - COP 6.13	32,400	377	14	391	21
PV - 24300 sqft	32,400	149	14	164	248
Roof - U=R15 rigid	32,400	396	14	411	1
Roof - U=R20 rigid	32,400	395	14	410	2
Walls - R19 batt	32,400	397	14	412	0
Walls - R21 batt	32,400	397	14	412	0
Walls - R21 batt + R5 rigid	32,400	396	14	411	1
Windows - U=0.43, SHGC=0.39	32,400	395	14	409	3
Windows - U=0.26, SHGC=0.37	32,400	395	14	410	2
Windows - U=0.22, SHGC=0.22	32,400	392	14	407	5
DG - 60kW MT w/ 32 ton absorb	32,400	322	49	371	41
TS - 70% of max daily cooling load			Not Reported		

Detailed Modeling Results - Prototype 4 - Office Building - Low-Rise

Table 26 - Office Building - Low-Rise EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 8976 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 27 - Office Building - Low-Rise EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #4 Office Building - Low-Rise					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$57,790	\$3,179	\$60,969	-	-
Package - Optimum EE	\$48,904	\$2,727	\$51,631	\$90,874	9.7
Package - Optimum EE + PV	\$29,187	\$2,727	\$31,914	\$532,195	17.2
CoolRoof - Abs=0.25	\$57,303	\$3,179	\$60,482	\$4,937	10.1
DHW - EF=0.640	\$57,790	\$3,065	\$60,855	\$620	5.4
DHW - EF=0.823	\$57,790	\$2,727	\$60,517	\$741	1.6
HVAC - EER 12.19, COP 3.52	\$55,995	\$3,179	\$59,174	\$7,807	4.3
HVAC - EER 12.06, COP 3.48	\$56,159	\$3,179	\$59,338	\$23,422	14.4
HVAC - EER 12.80, COP 3.66	\$55,163	\$3,179	\$58,342	\$39,037	14.9
Lighting - 0.90 watts/sf	\$54,017	\$3,179	\$57,196	\$0	0.0
PV - 8976 sqft	\$37,216	\$3,179	\$40,395	\$446,258	19.4
Roof - U=R15 rigid	\$57,633	\$3,179	\$60,812	\$3,740	23.8
Roof - U=R20 rigid	\$57,507	\$3,179	\$60,686	\$6,732	23.8
Walls - R19 batt	\$57,743	\$3,179	\$60,922	\$844	18.0
Walls - R21 batt	\$57,735	\$3,179	\$60,914	\$1,151	20.9
Walls - R21 batt + R5 rigid	\$57,709	\$3,179	\$60,888	\$3,070	37.9
Windows - U=0.43, SHGC=0.39	\$57,807	\$3,179	\$60,986	\$4,196	Never
Windows - U=0.26, SHGC=0.37	\$57,715	\$3,179	\$60,894	\$12,537	167.2
Windows - U=0.22, SHGC=0.22	\$55,447	\$3,179	\$58,626	\$38,275	16.3

Table 28 - Office Building - Low-Rise EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #4 Office Building - Low-Rise					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	332,469	1,134	249	1,384	-
Package - Optimum EE	285,304	973	215	1,188	196
Package - Optimum EE + PV	140,418	479	215	694	690
CoolRoof - Abs=0.25	330,023	1,126	249	1,375	9
DHW - EF=0.640	332,469	1,134	241	1,375	9
DHW - EF=0.823	332,469	1,134	215	1,349	35
HVAC - EER 12.19, COP 3.52	324,079	1,106	249	1,355	29
HVAC - EER 12.06, COP 3.48	324,940	1,109	249	1,358	26
HVAC - EER 12.80, COP 3.66	320,072	1,092	249	1,341	43
Lighting - 0.90 watts/sf	311,084	1,061	249	1,311	73
PV - 8976 sqft	186,338	636	249	885	499
Roof - U=R15 rigid	332,158	1,133	249	1,383	1
Roof - U=R20 rigid	331,336	1,131	249	1,380	4
Walls - R19 batt	332,247	1,134	249	1,383	1
Walls - R21 batt	332,188	1,133	249	1,383	1
Walls - R21 batt + R5 rigid	332,098	1,133	249	1,382	2
Windows - U=0.43, SHGC=0.39	332,691	1,135	249	1,384	0
Windows - U=0.26, SHGC=0.37	332,701	1,135	249	1,384	0
Windows - U=0.22, SHGC=0.22	320,189	1,092	249	1,342	42

Table 29 - Office Building - Low-Rise EE Package and Single EE Measures Impacts on TDVI

Prototype #4 Office Building - Low-Rise					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	29,920	214	9	223	-
Package - Optimum EE	29,920	182	8	190	33
Package - Optimum EE + PV	29,920	84	8	92	131
CoolRoof - Abs=0.25	29,920	212	9	221	2
DHW - EF=0.640	29,920	214	9	223	0
DHW - EF=0.823	29,920	214	8	222	1
HVAC - EER 12.19, COP 3.52	29,920	208	9	217	6
HVAC - EER 12.06, COP 3.48	29,920	209	9	218	5
HVAC - EER 12.80, COP 3.66	29,920	205	9	214	9
Lighting - 0.90 watts/sf	29,920	200	9	209	14
PV - 8976 sqft	29,920	115	9	124	99
Roof - U=R15 rigid	29,920	214	9	223	0
Roof - U=R20 rigid	29,920	213	9	222	1
Walls - R19 batt	29,920	214	9	223	0
Walls - R21 batt	29,920	214	9	223	0
Walls - R21 batt + R5 rigid	29,920	214	9	223	0
Windows - U=0.43, SHGC=0.39	29,920	214	9	223	0
Windows - U=0.26, SHGC=0.37	29,920	214	9	223	0
Windows - U=0.22, SHGC=0.22	29,920	205	9	215	8

Detailed Modeling Results - Prototype 5 – Office Building - Mid-Rise

Table30 - Office Building - Mid-Rise EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 4.90	HVAC - COP 6.13	None	None	Alternative 1
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 14982 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - R15 rigid	Roof - R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3
DG	None	DG - 180 kW MT w/ 78 ton absorb	None	None	No Alternative
Thermal Strg	None	TS - 65% of max daily cooling load	None	None	No Alternative

Table 31 - Office Building - Mid-Rise EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #5 Office Building - Mid-Rise					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$219,910	\$13,085	\$232,995	-	-
Package - Optimum EE	\$181,419	\$11,385	\$192,805	\$136,780	3.4
Package - Optimum EE + PV	\$147,838	\$11,383	\$159,221	\$873,397	11.7
CoolRoof - Abs=0.25	\$218,164	\$13,088	\$231,252	\$8,240	4.7
DHW - EF=0.640	\$219,910	\$12,677	\$232,586	\$620	1.5
DHW - EF=0.823	\$219,910	\$11,509	\$231,419	\$741	0.5
Heating - AFUE=85%	\$219,910	\$13,056	\$232,966	\$3,113	107.3
HVAC - COP 6.13	\$208,294	\$13,085	\$221,379	\$5,602	0.5
Lighting - 0.90 watts/sf	\$205,226	\$13,116	\$218,341	\$0	0.0
PV - 14982 sqft	\$183,667	\$13,085	\$196,752	\$744,856	19.5
Roof - R15 rigid	\$219,254	\$13,040	\$232,294	\$6,243	8.9
Roof - R20 rigid	\$218,762	\$13,008	\$231,769	\$11,237	9.2
Walls - R19 batt	\$219,697	\$13,060	\$232,757	\$2,313	9.7
Walls - R21 batt	\$219,676	\$13,056	\$232,733	\$3,154	12.0
Walls - R21 batt + R5 rigid	\$219,498	\$13,034	\$232,532	\$6,098	13.2
Windows - U=0.43, SHGC=0.39	\$219,753	\$13,030	\$232,783	\$11,496	54.2
Windows - U=0.26, SHGC=0.37	\$219,348	\$12,965	\$232,314	\$34,347	50.4
Windows - U=0.22, SHGC=0.22	\$208,107	\$13,012	\$221,119	\$104,862	8.8
DG - 180 kW MT w/ 78 ton absorb	\$104,987	\$102,209	\$212,077	\$267,538	17.8
TS - 65% of max daily cooling load	-	-	\$221,873	\$138,483	12.5

Table 32 - Office Building - Mid-Rise EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #5 Office Building - Mid-Rise					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	1,255,518	4,284	849	5,133	-
Package - Optimum EE	1,049,509	3,581	724	4,305	828
Package - Optimum EE + PV	828,819	2,828	724	3,552	1,581
CoolRoof - Abs=0.25	1,245,931	4,251	849	5,100	33
DHW - EF=0.640	1,255,518	4,284	819	5,103	30
DHW - EF=0.823	1,255,518	4,284	734	5,018	115
Heating - AFUE=85%	1,255,518	4,284	847	5,131	2
HVAC - COP 6.13	1,196,117	4,081	849	4,930	203
Lighting - 0.90 watts/sf	1,171,319	3,997	851	4,848	285
PV - 14982 sqft	1,028,241	3,508	849	4,357	776
Roof - R15 rigid	1,252,773	4,274	846	5,120	13
Roof - R20 rigid	1,250,958	4,268	843	5,111	22
Walls - R19 batt	1,254,671	4,281	847	5,128	5
Walls - R21 batt	1,254,584	4,281	847	5,128	5
Walls - R21 batt + R5 rigid	1,253,766	4,278	845	5,123	10
Windows - U=0.43, SHGC=0.39	1,255,808	4,285	845	5,130	3
Windows - U=0.26, SHGC=0.37	1,255,242	4,283	840	5,123	10
Windows - U=0.22, SHGC=0.22	1,192,964	4,070	843	4,914	219
DG - 180 kW MT w/ 78 ton absorb	525,098	1,792	8,630	10,422	-5,289
TS - 65% of max daily cooling load	Not Reported				

Table 33 - Office Building - Mid-Rise EE Package and Single EE Measures Impacts on TDVI

Prototype #5 Office Building - Mid-Rise					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	99,880	244	9	253	-
Package - Optimum EE	99,880	202	8	210	3
Package - Optimum EE + PV	99,880	153	8	161	12
CoolRoof - Abs=0.25	99,880	242	9	251	5
DHW - EF=0.640	99,880	244	9	253	2
DHW - EF=0.823	99,880	244	8	252	0
Heating - AFUE=85%	99,880	244	9	253	107
HVAC - COP 6.13	99,880	232	9	241	0
Lighting - 0.90 watts/sf	99,880	228	9	237	0
PV - 14982 sqft	99,880	194	9	204	20
Roof - R15 rigid	99,880	243	9	253	9
Roof - R20 rigid	99,880	243	9	252	9
Walls - R19 batt	99,880	244	9	253	10
Walls - R21 batt	99,880	244	9	253	12
Walls - R21 batt + R5 rigid	99,880	243	9	253	13
Windows - U=0.43, SHGC=0.39	99,880	244	9	253	54
Windows - U=0.26, SHGC=0.37	99,880	244	9	253	50
Windows - U=0.22, SHGC=0.22	99,880	231	9	240	9
DG - 180 kW MT w/ 78 ton absorb	99,880	103	96	198	18
TS - 65% of max daily cooling load	99,880	Not Reported			12

Detailed Modeling Results - Prototype 6 – Office Building - High-Rise

Table 34 - Office Building - High-Rise EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 6.10	HVAC - COP 7.63	None	None	Alternative 1
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 5616 sqft	None	None	Alternative 1
Roof Insulation	Roof - Light wt. Concrete	Roof R5 rigid	Roof R10 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3
DG	None	DG - 800 kW Eng w/ 177 ton absorb	None	None	Alternative 1
Thermal Strg	None	TS - 55% of max daily cooling load	None	None	No Alternative

Table 35 - Office Building - High-Rise EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #6 Office Building - High-Rise					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$536,318	\$26,576	\$562,894	-	-
Package - Optimum EE	\$462,457	\$22,968	\$485,426	\$281,601	3.6
Package - Optimum EE + PV	\$448,746	\$22,851	\$471,597	\$553,397	6.1
Package - Optimum EE + DG	\$135,471	\$248,886	\$384,356	\$1,099,699	6.2
CoolRoof - Abs=0.25	\$534,868	\$26,685	\$561,553	\$7,413	5.5
DHW - EF=0.640	\$536,318	\$25,830	\$562,149	\$1,239	1.7
DHW - EF=0.823	\$536,318	\$23,693	\$560,011	\$1,483	0.5
Heating - AFUE=85%	\$536,318	\$26,431	\$562,750	\$5,587	38.8
HVAC - COP 7.63	\$516,287	\$26,576	\$542,863	\$33,308	1.7
Lighting - 0.90 watts/sf	\$507,155	\$26,690	\$533,845	\$0	0.0
PV - 5616 sqft	\$519,585	\$26,576	\$546,160	\$279,209	16.7
Roof R5 rigid	\$536,530	\$26,370	\$562,900	\$5,616	Never
Roof R10 rigid	\$536,689	\$26,330	\$563,019	\$10,109	Never
Walls - R19 batt	\$535,625	\$26,439	\$562,064	\$4,990	6.0
Walls - R21 batt	\$535,393	\$26,390	\$561,783	\$6,805	6.1
Walls - R21 batt + R5 rigid	\$533,781	\$26,134	\$559,915	\$13,157	4.4
Windows - U=0.43, SHGC=0.39	\$535,700	\$26,223	\$561,923	\$24,802	25.5
Windows - U=0.26, SHGC=0.37	\$535,638	\$25,823	\$561,461	\$74,103	51.7
Windows - U=0.22, SHGC=0.22	\$512,457	\$25,908	\$538,365	\$226,240	9.2
DG - 800 kW Eng w/ 177 ton absorb	\$150,079	\$275,477	\$425,555	\$818,098	7.4
TS - 55% of max daily cooling load	-	-	\$548,060	\$264,297	17.8

Table 36 - Office Building - High-Rise EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #6 Office Building - High-Rise					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	3,167,371	10,807	1,972	12,779	-
Package - Optimum EE	2,750,753	9,386	1,651	11,036	38
Package - Optimum EE + PV	2,667,247	9,101	1,640	10,741	45
Package - Optimum EE + DG	684,148	2,334	21,807	24,141	0
CoolRoof - Abs=0.25	3,159,191	10,779	1,982	12,761	0
DHW - EF=0.640	3,167,371	10,807	1,906	12,713	0
DHW - EF=0.823	3,167,371	10,807	1,715	12,522	1
Heating - AFUE=85%	3,167,371	10,807	1,960	12,767	0
HVAC - COP 7.63	3,064,212	10,455	1,972	12,427	9
Lighting - 0.90 watts/sf	2,997,716	10,228	1,983	12,211	14
PV - 5616 sqft	3,065,739	10,460	1,972	12,433	9
Roof R5 rigid	3,167,991	10,809	1,954	12,763	0
Roof R10 rigid	3,168,821	10,812	1,950	12,762	0
Walls - R19 batt	3,165,485	10,801	1,960	12,761	0
Walls - R21 batt	3,165,240	10,800	1,956	12,756	0
Walls - R21 batt + R5 rigid	3,161,814	10,788	1,933	12,721	1
Windows - U=0.43, SHGC=0.39	3,168,383	10,811	1,941	12,752	0
Windows - U=0.26, SHGC=0.37	3,180,638	10,852	1,905	12,757	-1
Windows - U=0.22, SHGC=0.22	3,022,895	10,314	1,913	12,227	12
DG - 800 kW Eng w/ 177 ton absorb	794,409	2,711	24,203	26,914	102
TS - 55% of max daily cooling load	Not Reported				

Table 37 - Office Building - High-Rise EE Package and Single EE Measures Impacts on TDVI

Prototype #6 Office Building - High-Rise					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	224,640	271	10	280	-
Package - Optimum EE	224,640	234	8	242	38
Package - Optimum EE + PV	224,640	227	8	235	45
Package - Optimum EE + DG	224,640	50	107	158	0
CoolRoof - Abs=0.25	224,640	270	10	280	0
DHW - EF=0.640	224,640	271	9	280	0
DHW - EF=0.823	224,640	271	8	279	1
Heating - AFUE=85%	224,640	271	10	280	0
HVAC - COP 7.63	224,640	261	10	271	9
Lighting - 0.90 watts/sf	224,640	256	10	266	14
PV - 5616 sqft	224,640	262	10	271	9
Roof R5 rigid	224,640	271	10	280	0
Roof R10 rigid	224,640	271	10	280	0
Walls - R19 batt	224,640	271	10	280	0
Walls - R21 batt	224,640	271	10	280	0
Walls - R21 batt + R5 rigid	224,640	270	9	279	1
Windows - U=0.43, SHGC=0.39	224,640	271	9	280	0
Windows - U=0.26, SHGC=0.37	224,640	271	9	281	-1
Windows - U=0.22, SHGC=0.22	224,640	259	9	268	12
DG - 800 kW Eng w/ 177 ton absorb	224,640	59	119	178	102
TS - 55% of max daily cooling load	224,640	0	0	0	0

Detailed Modeling Results - Prototype 7 – Large Hotel - Hotel Space

Table 38 - Large Hotel - Hotel Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	Alternative 1
Space Cooling	HVAC - COP 6.10	HVAC - COP 7.63	None	None	Alternative 1
Lighting	Lighting - 1.40 watts/sf	Lighting - 1.19 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 7199 sqft	None	None	Alternative 1
Roof Insulation	Roof - R20 rigid	Roof - R25 rigid	Roof - R30 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	None	No Alternative
DG	None	DG - 120 kW MT w/ 35 ton absorb	None	None	No Alternative
Thermal Strg	None	TS - 20% of max daily cooling load	None	None	No Alternative

Table 39 - Large Hotel - Hotel Space EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #7 Large Hotel - Hotel Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$202,183	\$57,107	\$259,289	-	-
Package - Optimum EE	\$186,438	\$47,260	\$233,698	\$74,975	2.9
Package - Optimum EE + PV	\$172,118	\$47,260	\$219,378	\$432,868	11.0
CoolRoof - Abs=0.25	\$202,386	\$58,223	\$260,609	\$5,279	Never
DHW - EF=0.640	\$202,183	\$54,924	\$257,107	\$2,168	1.0
DHW - EF=0.823	\$202,183	\$48,653	\$250,836	\$2,594	0.3
Heating - AFUE=85%	\$202,183	\$55,709	\$257,892	\$1,157	0.8
HVAC - COP 7.63	\$196,088	\$57,107	\$253,194	\$11,374	1.9
Lighting - 1.19 watts/sf	\$192,293	\$57,117	\$249,409	\$59,850	6.1
PV - 7199 sqft	\$185,145	\$57,107	\$242,252	\$357,894	21.0
Roof - R25 rigid	\$202,164	\$57,108	\$259,272	\$3,999	235.3
Roof - R30 rigid	\$202,158	\$57,110	\$259,267	\$7,199	327.2
Walls - R19 batt	\$202,255	\$57,051	\$259,306	\$2,511	Never
Walls - R21 batt	\$202,286	\$57,032	\$259,318	\$6,620	Never
Walls - R21 batt + R5 rigid	\$202,364	\$56,967	\$259,331	\$6,620	Never
Windows - U=0.26, SHGC=0.37	\$202,392	\$57,002	\$259,394	\$35,726	Never
Windows - U=0.22, SHGC=0.22	\$196,913	\$57,289	\$254,202	\$109,073	21.4
DG - 120 kW MT w/ 35 ton absorb	-	-	\$252,597	\$107,971	60.4
TS - 20% of max daily cooling load	-	-	\$256,470	\$43,791	15.5

Table 40 - Large Hotel - Hotel Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #7 Large Hotel - Hotel Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	1,472,537	5,024	4,698	9,722	-
Package - Optimum EE	1,366,154	4,661	3,819	8,480	1,242
Package - Optimum EE + PV	1,248,903	4,261	3,819	8,080	1,642
CoolRoof - Abs=0.25	1,474,051	5,029	4,797	9,826	-104
DHW - EF=0.640	1,472,537	5,024	4,503	9,527	195
DHW - EF=0.823	1,472,537	5,024	3,943	8,967	755
Heating - AFUE=85%	1,472,537	5,024	4,573	9,597	125
HVAC - COP 7.63	1,431,645	4,885	4,698	9,582	140
Lighting - 1.19 watts/sf	1,405,196	4,795	4,699	9,493	229
PV - 7199 sqft	1,332,956	4,548	4,698	9,246	476
Roof - R25 rigid	1,472,607	5,025	4,698	9,722	0
Roof - R30 rigid	1,472,681	5,025	4,698	9,722	0
Walls - R19 batt	1,473,413	5,027	4,692	9,720	2
Walls - R21 batt	1,473,740	5,028	4,691	9,719	3
Walls - R21 batt + R5 rigid	1,474,734	5,032	4,685	9,717	5
Windows - U=0.26, SHGC=0.37	1,476,249	5,037	4,688	9,725	-3
Windows - U=0.22, SHGC=0.22	1,435,843	4,899	4,714	9,613	109
DG - 120 kW MT w/ 35 ton absorb			Not Reported		
TS - 20% of max daily cooling load			Not Reported		

Table 41 - Large Hotel - Hotel Space EE Package and Single EE Measures Impacts on TDVI

Prototype #7 Large Hotel - Hotel Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	114,266	233	45	278	-
Package - Optimum EE	114,266	215	37	252	26
Package - Optimum EE + PV	114,266	195	37	231	47
CoolRoof - Abs=0.25	114,266	233	46	279	-1
DHW - EF=0.640	114,266	233	43	276	2
DHW - EF=0.823	114,266	233	38	271	7
Heating - AFUE=85%	114,266	233	44	277	1
HVAC - COP 7.63	114,266	226	45	271	7
Lighting - 1.19 watts/sf	114,266	222	45	267	11
PV - 7199 sqft	114,266	208	45	253	25
Roof - R25 rigid	114,266	233	45	278	0
Roof - R30 rigid	114,266	233	45	278	0
Walls - R19 batt	114,266	233	45	278	0
Walls - R21 batt	114,266	233	45	278	0
Walls - R21 batt + R5 rigid	114,266	233	45	278	0
Windows - U=0.26, SHGC=0.37	114,266	233	45	278	0
Windows - U=0.22, SHGC=0.22	114,266	227	45	272	6
DG - 120 kW MT w/ 35 ton absorb			Not Reported		
TS - 20% of max daily cooling load			Not Reported		

Detailed Modeling Results - Prototype 7 – Large Hotel – Restaurant

Table 42 - Large Hotel – Restaurant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=80%	Heating - AFUE=94%	None	None	Alternative 1
Space Cooling	HVAC - EER 9.5	HVAC - EER 10.5	HVAC - EER 11.5	HVAC - EER 12.5	Alternative 3
Photovoltaics	No PV	PV - 3698 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 1
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	No Alternative

Table 43 - Large Hotel – Restaurant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #7 Large Hotel - Restaurant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$48,644	\$25,387	\$74,030	-	-
Package - Optimum EE	\$46,811	\$23,238	\$70,049	\$21,313	5.4
Package - Optimum EE + PV	\$39,688	\$23,238	\$62,927	\$205,166	19.1
CoolRoof - Abs=0.25	\$48,525	\$25,446	\$73,971	\$2,441	41.4
DHW - EF=0.640	\$48,644	\$24,989	\$73,632	\$620	1.6
DHW - EF=0.823	\$48,644	\$23,844	\$72,488	\$741	0.5
Heating - AFUE=94%	\$48,644	\$24,775	\$73,419	\$1,000	1.6
HVAC - EER 10.5	\$47,924	\$25,387	\$73,311	\$16,098	22.4
HVAC - EER 11.5	\$47,329	\$25,387	\$72,716	\$18,007	13.7
HVAC - EER 12.5	\$46,830	\$25,387	\$72,217	\$19,178	10.6
PV - 3698 sqft	\$41,486	\$25,387	\$66,872	\$183,853	25.7
Roof - U=R15 rigid	\$48,696	\$25,288	\$73,984	\$1,849	40.2
Roof - U=R20 rigid	\$48,734	\$25,254	\$73,988	\$3,328	79.2
Walls - R19 batt	\$48,623	\$25,393	\$74,016	\$394	28.1
Walls - R21 batt	\$48,621	\$25,394	\$74,016	\$537	38.3
Walls - R21 batt + R5 rigid	\$48,612	\$25,398	\$74,009	\$1,431	68.1
Windows - U=0.43, SHGC=0.39	\$48,615	\$25,396	\$74,011	\$733	38.6
Windows - U=0.26, SHGC=0.37	\$48,593	\$25,343	\$73,935	\$19,178	201.9
Windows - U=0.22, SHGC=0.22	\$48,740	\$25,574	\$74,314	\$19,178	Never

Table 44 - Large Hotel – Restaurant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #7 Large Hotel - Restaurant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	332,563	1,135	1,867	3,002	-
Package - Optimum EE	322,385	1,100	1,675	2,775	227
Package - Optimum EE + PV	262,161	894	1,675	2,569	433
CoolRoof - Abs=0.25	331,885	1,132	1,872	3,004	-2
DHW - EF=0.640	332,563	1,135	1,831	2,966	36
DHW - EF=0.823	332,563	1,135	1,729	2,864	138
Heating - AFUE=94%	332,563	1,135	1,812	2,947	55
HVAC - EER 10.5	328,551	1,121	1,867	2,988	14
HVAC - EER 11.5	325,236	1,110	1,867	2,977	25
HVAC - EER 12.5	322,452	1,100	1,867	2,967	35
PV - 3698 sqft	272,338	929	1,867	2,796	206
Roof - U=R15 rigid	333,078	1,136	1,858	2,994	8
Roof - U=R20 rigid	333,342	1,137	1,855	2,992	10
Walls - R19 batt	332,503	1,135	1,867	3,002	0
Walls - R21 batt	332,496	1,134	1,868	3,002	0
Walls - R21 batt + R5 rigid	332,504	1,135	1,868	3,002	0
Windows - U=0.43, SHGC=0.39	332,450	1,134	1,867	3,002	0
Windows - U=0.26, SHGC=0.37	332,337	1,134	1,863	2,997	5
Windows - U=0.22, SHGC=0.22	332,997	1,136	1,883	3,019	-17

Table 45 - Large Hotel – Restaurant EE Package and Single EE Measures Impacts on TDVI

Prototype #7 Large Hotel - Restaurant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	7,396	844	277	1,121	-
Package - Optimum EE	7,396	815	248	1,063	58
Package - Optimum EE + PV	7,396	650	248	898	223
CoolRoof - Abs=0.25	7,396	843	278	1,120	1
DHW - EF=0.640	7,396	844	272	1,116	5
DHW - EF=0.823	7,396	844	256	1,101	20
Heating - AFUE=94%	7,396	844	269	1,113	8
HVAC - EER 10.5	7,396	833	277	1,110	11
HVAC - EER 11.5	7,396	823	277	1,100	21
HVAC - EER 12.5	7,396	815	277	1,092	29
PV - 3698 sqft	7,396	679	277	956	165
Roof - U=R15 rigid	7,396	846	276	1,121	0
Roof - U=R20 rigid	7,396	846	275	1,122	-1
Walls - R19 batt	7,396	844	277	1,121	0
Walls - R21 batt	7,396	844	277	1,121	0
Walls - R21 batt + R5 rigid	7,396	844	277	1,121	0
Windows - U=0.43, SHGC=0.39	7,396	844	277	1,121	0
Windows - U=0.26, SHGC=0.37	7,396	844	276	1,120	1
Windows - U=0.22, SHGC=0.22	7,396	846	279	1,126	-5

Detailed Modeling Results - Prototype 8 – Small Hotel - Hotel Space

Table 46 - Small Hotel - Hotel Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	Alternative 1
Space Cooling	HVAC - COP 6.10	HVAC - COP 7.63	None	None	Alternative 1
Lighting	Lighting - 1.40 watts/sf	Lighting - 1.19 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 11391 sqft	None	None	Alternative 1
Roof Insulation	Roof - R20 rigid	Roof - R25 rigid	Roof - R30 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	None	No Alternative

Table 47 - Small Hotel - Hotel Space EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #8 Small Hotel - Hotel Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$131,231	\$45,478	\$176,710	-	-
Package - Optimum EE	\$121,210	\$37,570	\$158,780	\$68,415	3.8
Package - Optimum EE + PV	\$98,960	\$37,570	\$136,530	\$634,753	16.2
DHW - EF=0.640	\$131,231	\$43,750	\$174,981	\$1,859	1.1
DHW - EF=0.823	\$131,231	\$38,789	\$170,021	\$2,224	0.3
Heating - AFUE=85%	\$131,231	\$44,251	\$175,483	\$953	0.8
HVAC - COP 7.63	\$127,378	\$45,478	\$172,856	\$7,964	2.1
Lighting - 1.19 watts/sf	\$124,915	\$45,483	\$170,398	\$48,600	7.7
PV - 11391 sqft	\$103,249	\$45,478	\$148,728	\$566,339	20.1
Roof - R25 rigid	\$131,219	\$45,479	\$176,699	\$6,329	575.3
Roof - R30 rigid	\$131,404	\$45,476	\$176,880	\$11,391	Never
Walls - R19 batt	\$131,203	\$45,412	\$176,615	\$2,385	25.1
Walls - R21 batt	\$131,183	\$45,399	\$176,582	\$3,253	25.4
Walls - R21 batt + R5 rigid	\$131,091	\$45,350	\$176,441	\$8,674	32.2
Windows - U=0.26, SHGC=0.37	\$131,394	\$45,380	\$176,773	\$22,584	Never
Windows - U=0.22, SHGC=0.22	\$127,922	\$45,641	\$173,562	\$68,951	21.9

Table 48 - Small Hotel - Hotel Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #8 Small Hotel - Hotel Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	952,639	3,250	3,660	6,910	-
Package - Optimum EE	885,766	3,022	2,954	5,976	934
Package - Optimum EE + PV	700,295	2,389	2,954	5,344	1,566
DHW - EF=0.640	952,639	3,250	3,506	6,756	154
DHW - EF=0.823	952,639	3,250	3,063	6,314	596
Heating - AFUE=85%	952,639	3,250	3,551	6,801	109
HVAC - COP 7.63	927,470	3,165	3,660	6,825	85
Lighting - 1.19 watts/sf	909,740	3,104	3,660	6,764	146
PV - 11391 sqft	719,217	2,454	3,660	6,114	796
Roof - R25 rigid	952,947	3,251	3,660	6,911	-1
Roof - R30 rigid	953,927	3,255	3,660	6,915	-5
Walls - R19 batt	953,033	3,252	3,654	6,906	4
Walls - R21 batt	953,062	3,252	3,653	6,904	6
Walls - R21 batt + R5 rigid	952,927	3,251	3,648	6,900	10
Windows - U=0.26, SHGC=0.37	955,394	3,260	3,651	6,911	-1
Windows - U=0.22, SHGC=0.22	929,388	3,171	3,675	6,846	64

Table 49 - Small Hotel - Hotel Space EE Package and Single EE Measures Impacts on TDVI

Prototype #8 Small Hotel - Hotel Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	72,327	238	55	294	-
Package - Optimum EE	72,327	221	45	266	28
Package - Optimum EE + PV	72,327	169	45	214	80
DHW - EF=0.640	72,327	238	53	291	3
DHW - EF=0.823	72,327	238	46	285	9
Heating - AFUE=85%	72,327	238	54	292	2
HVAC - COP 7.63	72,327	231	55	287	7
Lighting - 1.19 watts/sf	72,327	228	55	283	11
PV - 11391 sqft	72,327	172	55	228	66
Roof - R25 rigid	72,327	238	55	294	0
Roof - R30 rigid	72,327	239	55	294	0
Walls - R19 batt	72,327	238	55	294	0
Walls - R21 batt	72,327	238	55	294	0
Walls - R21 batt + R5 rigid	72,327	238	55	293	1
Windows - U=0.26, SHGC=0.37	72,327	239	55	294	0
Windows - U=0.22, SHGC=0.22	72,327	232	55	288	6

Detailed Modeling Results - Prototype 8 – Small Hotel - Office Space

Table 50 - Small Hotel - Office Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 5005 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R20 rigid	Roof - R25 rigid	Roof - R30 rigid	None	No Alternative
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 51 - Small Hotel - Office Space EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #8 Small Hotel - Office Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$38,018	\$2,092	\$40,110	-	-
Package - Optimum EE	\$32,729	\$1,787	\$34,516	\$46,157	8.3
Package - Optimum EE + PV	\$21,478	\$1,787	\$23,265	\$294,989	16.8
CoolRoof - Abs=0.25	\$37,868	\$2,092	\$39,960	\$3,303	22.0
DHW - EF=0.640	\$38,018	\$2,015	\$40,033	\$620	8.0
DHW - EF=0.823	\$38,018	\$1,787	\$39,805	\$741	2.4
HVAC - EER 12.19, COP 3.52	\$36,841	\$2,092	\$38,933	\$4,845	4.1
HVAC - EER 12.06, COP 3.48	\$36,962	\$2,092	\$39,054	\$14,534	13.8
HVAC - EER 12.80, COP 3.66	\$36,318	\$2,092	\$38,410	\$24,224	14.2
Lighting - 0.90 watts/sf	\$35,445	\$2,092	\$37,537	\$0	0.0
PV - 5005 sqft	\$26,362	\$2,092	\$28,454	\$248,832	19.4
Roof - R25 rigid	\$38,014	\$2,092	\$40,106	\$2,503	625.6
Roof - R30 rigid	\$38,122	\$2,092	\$40,214	\$4,505	Never
Walls - R19 batt	\$38,002	\$2,092	\$40,094	\$2,385	149.1
Walls - R21 batt	\$37,985	\$2,092	\$40,077	\$3,253	98.6
Walls - R21 batt + R5 rigid	\$37,975	\$2,092	\$40,067	\$8,674	201.7
Windows - U=0.43, SHGC=0.39	\$38,044	\$2,092	\$40,136	\$2,323	Never
Windows - U=0.26, SHGC=0.37	\$37,957	\$2,092	\$40,049	\$6,941	113.8
Windows - U=0.22, SHGC=0.22	\$36,634	\$2,092	\$38,726	\$21,191	15.3

Table 52 - Small Hotel - Office Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #8 Small Hotel - Office Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	218,013	744	167	911	-
Package - Optimum EE	190,128	649	144	792	119
Package - Optimum EE + PV	108,668	371	144	514	397
CoolRoof - Abs=0.25	217,215	741	167	908	3
DHW - EF=0.640	218,013	744	161	905	6
DHW - EF=0.823	218,013	744	144	888	23
HVAC - EER 12.19, COP 3.52	212,482	725	167	892	19
HVAC - EER 12.06, COP 3.48	213,048	727	167	894	17
HVAC - EER 12.80, COP 3.66	210,046	717	167	883	28
Lighting - 0.90 watts/sf	203,336	694	167	861	50
PV - 5005 sqft	136,390	465	167	632	279
Roof - R25 rigid	218,062	744	167	911	0
Roof - R30 rigid	218,518	746	167	912	-1
Walls - R19 batt	218,058	744	167	911	0
Walls - R21 batt	217,947	744	167	910	1
Walls - R21 batt + R5 rigid	217,978	744	167	911	0
Windows - U=0.43, SHGC=0.39	218,390	745	167	912	-1
Windows - U=0.26, SHGC=0.37	218,150	744	167	911	0
Windows - U=0.22, SHGC=0.22	210,882	720	167	886	25

Table 53 - Small Hotel - Office Space EE Package and Single EE Measures Impacts on TDVI

Prototype #8 Small Hotel - Office Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	20,020	209	9	218	-
Package - Optimum EE	20,020	181	8	189	29
Package - Optimum EE + PV	20,020	99	8	107	111
CoolRoof - Abs=0.25	20,020	208	9	218	0
DHW - EF=0.640	20,020	209	9	218	0
DHW - EF=0.823	20,020	209	8	217	1
HVAC - EER 12.19, COP 3.52	20,020	203	9	213	5
HVAC - EER 12.06, COP 3.48	20,020	204	9	213	5
HVAC - EER 12.80, COP 3.66	20,020	201	9	210	8
Lighting - 0.90 watts/sf	20,020	195	9	204	14
PV - 5005 sqft	20,020	127	9	136	82
Roof - R25 rigid	20,020	209	9	218	0
Roof - R30 rigid	20,020	210	9	219	-1
Walls - R19 batt	20,020	209	9	218	0
Walls - R21 batt	20,020	209	9	218	0
Walls - R21 batt + R5 rigid	20,020	209	9	218	0
Windows - U=0.43, SHGC=0.39	20,020	209	9	219	-1
Windows - U=0.26, SHGC=0.37	20,020	209	9	218	0
Windows - U=0.22, SHGC=0.22	20,020	202	9	211	7

Detailed Modeling Results - Prototype 8 – Small Hotel – Restaurant

Table 54 - Small Hotel – Restaurant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=80%	Heating - AFUE=94%	None	None	Alternative 1
Space Cooling	HVAC - EER 9.5	HVAC - EER 10.5	HVAC - EER 11.5	HVAC - EER 12.5	Alternative 3
Photovoltaics	No PV	PV - 3698 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 2

Table 55 - Small Hotel – Restaurant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #8 Small Hotel - Restaurant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$48,864	\$25,055	\$73,919	-	-
Package - Optimum EE	\$46,888	\$22,823	\$69,711	\$26,976	6.4
Package - Optimum EE + PV	\$39,749	\$22,823	\$62,572	\$210,828	19.2
CoolRoof - Abs=0.25	\$48,667	\$25,111	\$73,777	\$2,441	17.2
DHW - EF=0.640	\$48,864	\$24,656	\$73,520	\$620	1.6
DHW - EF=0.823	\$48,864	\$23,511	\$72,375	\$741	0.5
Heating - AFUE=94%	\$48,864	\$24,492	\$73,357	\$1,000	1.8
HVAC - EER 10.5	\$48,132	\$25,055	\$73,187	\$16,098	22.0
HVAC - EER 11.5	\$47,537	\$25,055	\$72,591	\$18,007	13.6
HVAC - EER 12.5	\$47,032	\$25,055	\$72,087	\$19,178	10.5
PV - 3698 sqft	\$41,687	\$25,055	\$66,742	\$183,853	25.6
Roof - U=R15 rigid	\$48,844	\$24,985	\$73,830	\$1,849	20.8
Roof - U=R20 rigid	\$48,814	\$24,946	\$73,760	\$3,328	20.9
Walls - R19 batt	\$48,839	\$25,046	\$73,885	\$394	11.6
Walls - R21 batt	\$48,834	\$25,048	\$73,881	\$537	14.1
Walls - R21 batt + R5 rigid	\$48,817	\$25,055	\$73,872	\$1,431	30.4
Windows - U=0.43, SHGC=0.39	\$48,832	\$25,043	\$73,876	\$733	17.1
Windows - U=0.26, SHGC=0.37	\$48,738	\$24,984	\$73,722	\$2,191	11.1
Windows - U=0.22, SHGC=0.22	\$48,616	\$25,222	\$73,837	\$6,690	81.6

Table 56 - Small Hotel – Restaurant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #8 Small Hotel - Restaurant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	333,775	1,139	1,837	2,976	-
Package - Optimum EE	323,017	1,102	1,638	2,740	236
Package - Optimum EE + PV	262,792	897	1,638	2,534	442
CoolRoof - Abs=0.25	332,627	1,135	1,842	2,977	-1
DHW - EF=0.640	333,775	1,139	1,801	2,940	36
DHW - EF=0.823	333,775	1,139	1,699	2,838	138
Heating - AFUE=94%	333,775	1,139	1,787	2,925	51
HVAC - EER 10.5	329,740	1,125	1,837	2,962	14
HVAC - EER 11.5	326,407	1,114	1,837	2,951	25
HVAC - EER 12.5	323,606	1,104	1,837	2,941	35
PV - 3698 sqft	273,550	933	1,837	2,770	206
Roof - U=R15 rigid	333,801	1,139	1,831	2,970	6
Roof - U=R20 rigid	333,739	1,139	1,827	2,966	10
Walls - R19 batt	333,648	1,138	1,836	2,975	1
Walls - R21 batt	333,624	1,138	1,836	2,975	1
Walls - R21 batt + R5 rigid	333,538	1,138	1,837	2,975	1
Windows - U=0.43, SHGC=0.39	333,667	1,138	1,836	2,975	1
Windows - U=0.26, SHGC=0.37	333,152	1,137	1,831	2,967	9
Windows - U=0.22, SHGC=0.22	332,126	1,133	1,852	2,985	-9

Table 57 - Small Hotel – Restaurant EE Package and Single EE Measures Impacts on TDVI

Prototype #8 Small Hotel - Restaurant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	7,396	847	272	1,120	-
Package - Optimum EE	7,396	816	243	1,059	61
Package - Optimum EE + PV	7,396	651	243	894	226
CoolRoof - Abs=0.25	7,396	844	273	1,117	3
DHW - EF=0.640	7,396	847	267	1,114	6
DHW - EF=0.823	7,396	847	252	1,099	21
Heating - AFUE=94%	7,396	847	265	1,112	8
HVAC - EER 10.5	7,396	836	272	1,108	12
HVAC - EER 11.5	7,396	826	272	1,098	22
HVAC - EER 12.5	7,396	818	272	1,090	30
PV - 3698 sqft	7,396	682	272	954	166
Roof - U=R15 rigid	7,396	847	271	1,119	1
Roof - U=R20 rigid	7,396	847	271	1,118	2
Walls - R19 batt	7,396	847	272	1,119	1
Walls - R21 batt	7,396	847	272	1,119	1
Walls - R21 batt + R5 rigid	7,396	847	272	1,119	1
Windows - U=0.43, SHGC=0.39	7,396	847	272	1,119	1
Windows - U=0.26, SHGC=0.37	7,396	846	271	1,117	3
Windows - U=0.22, SHGC=0.22	7,396	843	275	1,118	2

Detailed Modeling Results - Prototype 8 – Small Hotel – External Retail Tenant

Table 59 - Small Hotel – External Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 60 - Small Hotel – External Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #8 Small Hotel - External Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$8,112	\$1,939	\$10,051	-	-
Package - Optimum EE	\$6,954	\$1,802	\$8,756	\$9,556	7.4
DHW - EF=0.640	\$8,112	\$1,904	\$10,016	\$310	8.9
DHW - EF=0.823	\$8,112	\$1,802	\$9,914	\$371	2.7
HVAC - EER 12.19, COP 3.52	\$7,830	\$1,939	\$9,769	\$1,172	4.2
HVAC - EER 12.06, COP 3.48	\$7,873	\$1,939	\$9,812	\$3,517	14.7
HVAC - EER 12.80, COP 3.66	\$7,740	\$1,939	\$9,679	\$4,593	12.3
Walls - R19 batt	\$8,103	\$1,939	\$10,042	\$452	50.2
Walls - R21 batt	\$8,102	\$1,939	\$10,041	\$616	61.6
Walls - R21 batt + R5 rigid	\$8,099	\$1,939	\$10,038	\$1,642	126.3
Windows - U=0.43, SHGC=0.39	\$7,754	\$1,939	\$9,693	\$503	1.4
Windows - U=0.26, SHGC=0.37	\$7,718	\$1,939	\$9,657	\$1,504	3.8
Windows - U=0.22, SHGC=0.22	\$7,418	\$1,939	\$9,357	\$4,593	6.6

Table 61 - Small Hotel – External Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #8 Small Hotel - External Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	48,403	165	36	201	-
Package - Optimum EE	42,027	143	26	169	32
DHW - EF=0.640	48,403	165	33	198	3
DHW - EF=0.823	48,403	165	26	191	10
HVAC - EER 12.19, COP 3.52	47,256	161	36	197	4
HVAC - EER 12.06, COP 3.48	47,367	162	36	198	3
HVAC - EER 12.80, COP 3.66	46,775	160	36	195	6
Walls - R19 batt	48,495	165	36	201	0
Walls - R21 batt	48,474	165	36	201	0
Walls - R21 batt + R5 rigid	48,525	166	36	201	0
Windows - U=0.43, SHGC=0.39	46,439	158	36	194	7
Windows - U=0.26, SHGC=0.37	46,472	159	36	194	7
Windows - U=0.22, SHGC=0.22	44,857	153	36	189	12

Table 62 - Small Hotel – External Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #8 Small Hotel - External Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	2,752	340	14	354	-
Package - Optimum EE	2,752	293	10	303	7
DHW - EF=0.640	2,752	340	13	353	9
DHW - EF=0.823	2,752	340	10	350	3
HVAC - EER 12.19, COP 3.52	2,752	330	14	344	4
HVAC - EER 12.06, COP 3.48	2,752	331	14	345	15
HVAC - EER 12.80, COP 3.66	2,752	326	14	340	12
Walls - R19 batt	2,752	340	14	354	50
Walls - R21 batt	2,752	340	14	354	62
Walls - R21 batt + R5 rigid	2,752	340	14	354	126
Windows - U=0.43, SHGC=0.39	2,752	325	14	339	1
Windows - U=0.26, SHGC=0.37	2,752	325	14	339	4
Windows - U=0.22, SHGC=0.22	2,752	313	14	327	7

Detailed Modeling Results - Prototype 8 – Small Hotel – Internal Tenant

Table 63 - Small Hotel – Internal Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 64 - Small Hotel – Internal Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #8 Small Hotel - Internal Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$7,838	\$1,939	\$9,777	-	-
Package - Optimum EE	\$6,850	\$1,802	\$8,652	\$8,881	7.9
DHW - EF=0.640	\$7,838	\$1,904	\$9,742	\$310	8.9
DHW - EF=0.823	\$7,838	\$1,802	\$9,640	\$371	2.7
HVAC - EER 12.19, COP 3.52	\$7,572	\$1,939	\$9,511	\$996	3.7
HVAC - EER 12.06, COP 3.48	\$7,603	\$1,939	\$9,542	\$2,988	12.7
HVAC - EER 12.80, COP 3.66	\$7,490	\$1,939	\$9,429	\$4,980	14.3
Walls - R19 batt	\$7,841	\$1,939	\$9,780	\$467	-155.8
Walls - R21 batt	\$7,841	\$1,939	\$9,780	\$637	-212.4
Walls - R21 batt + R5 rigid	\$7,830	\$1,939	\$9,769	\$1,699	212.4
Windows - U=0.43, SHGC=0.39	\$7,553	\$1,939	\$9,492	\$387	1.4
Windows - U=0.26, SHGC=0.37	\$7,446	\$1,939	\$9,385	\$1,156	3.0
Windows - U=0.22, SHGC=0.22	\$7,099	\$1,939	\$9,038	\$3,531	4.8

Table 65 - Small Hotel – Internal Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #8 Small Hotel - Internal Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	47,488	162	36	198	-
Package - Optimum EE	41,746	142	26	168	30
DHW - EF=0.640	47,488	162	33	195	3
DHW - EF=0.823	47,488	162	26	188	10
HVAC - EER 12.19, COP 3.52	46,220	158	36	194	4
HVAC - EER 12.06, COP 3.48	46,338	158	36	194	4
HVAC - EER 12.80, COP 3.66	45,787	156	36	192	6
Walls - R19 batt	47,535	162	36	198	0
Walls - R21 batt	47,534	162	36	198	0
Walls - R21 batt + R5 rigid	47,558	162	36	198	0
Windows - U=0.43, SHGC=0.39	45,866	156	36	192	6
Windows - U=0.26, SHGC=0.37	45,105	154	36	190	8
Windows - U=0.22, SHGC=0.22	42,996	147	36	183	15

Table 66 - Small Hotel – Internal Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #8 Small Hotel - Internal Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	2,752	331	14	346	-
Package - Optimum EE	2,752	290	10	300	46
DHW - EF=0.640	2,752	331	13	345	1
DHW - EF=0.823	2,752	331	10	342	4
HVAC - EER 12.19, COP 3.52	2,752	321	14	336	10
HVAC - EER 12.06, COP 3.48	2,752	322	14	337	9
HVAC - EER 12.80, COP 3.66	2,752	318	14	332	14
Walls - R19 batt	2,752	331	14	346	0
Walls - R21 batt	2,752	331	14	346	0
Walls - R21 batt + R5 rigid	2,752	332	14	346	0
Windows - U=0.43, SHGC=0.39	2,752	319	14	334	12
Windows - U=0.26, SHGC=0.37	2,752	314	14	329	17
Windows - U=0.22, SHGC=0.22	2,752	300	14	314	32

Detailed Modeling Results - Prototype 9 – Retail/Commercial Mixed Use - Office Space

Table 67 - Retail/Commercial Mixed Use - Office Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 4.90	HVAC - COP 6.13	None	None	Alternative 1
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 8424 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 68 - Retail/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #9 Retail/Commercial Mixed Use - Office Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$147,134	\$9,468	\$156,602	-	-
Package - Optimum EE	\$120,197	\$8,204	\$128,402	\$102,694	3.6
Package - Optimum EE + PV	\$101,180	\$8,196	\$109,376	\$510,388	10.8
CoolRoof - Abs=0.25	\$144,836	\$9,487	\$154,323	\$11,120	4.9
DHW - EF=0.640	\$147,134	\$9,194	\$156,328	\$620	2.3
DHW - EF=0.823	\$147,134	\$8,406	\$155,540	\$741	0.7
Heating - AFUE=85%	\$147,134	\$9,430	\$156,564	\$2,199	57.9
HVAC - COP 6.13	\$139,279	\$9,468	\$148,747	\$3,865	0.5
Lighting - 0.90 watts/sf	\$137,272	\$9,542	\$146,814	\$0	0.0
PV - 8424 sqft	\$109,766	\$9,468	\$119,234	\$418,814	10.2
Roof - U=R15 rigid	\$146,145	\$9,352	\$155,496	\$8,424	7.6
Roof - U=R20 rigid	\$145,462	\$9,316	\$154,778	\$15,163	8.3
Walls - R19 batt	\$146,999	\$9,434	\$156,433	\$1,497	8.9
Walls - R21 batt	\$146,975	\$9,430	\$156,406	\$2,041	10.4
Walls - R21 batt + R5 rigid	\$146,804	\$9,394	\$156,197	\$3,946	9.7
Windows - U=0.43, SHGC=0.39	\$146,994	\$9,397	\$156,392	\$7,439	35.4
Windows - U=0.26, SHGC=0.37	\$146,510	\$9,320	\$155,830	\$22,226	28.8
Windows - U=0.22, SHGC=0.22	\$139,316	\$9,387	\$148,703	\$67,859	8.6

Table 69 - Retail/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #9 Retail/Commercial Mixed Use - Office Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	836,700	2,855	585	3,440	-
Package - Optimum EE	694,112	2,368	493	2,861	579
Package - Optimum EE + PV	570,561	1,947	492	2,439	1,001
CoolRoof - Abs=0.25	823,975	2,811	587	3,398	42
DHW - EF=0.640	836,700	2,855	566	3,420	20
DHW - EF=0.823	836,700	2,855	508	3,363	77
Heating - AFUE=85%	836,700	2,855	583	3,437	3
HVAC - COP 6.13	797,070	2,720	585	3,305	135
Lighting - 0.90 watts/sf	779,800	2,661	591	3,252	188
PV - 8424 sqft	593,592	2,025	585	2,611	829
Roof - U=R15 rigid	832,565	2,841	577	3,417	23
Roof - U=R20 rigid	829,782	2,831	574	3,405	35
Walls - R19 batt	836,285	2,853	583	3,436	4
Walls - R21 batt	836,207	2,853	583	3,436	4
Walls - R21 batt + R5 rigid	835,462	2,851	580	3,430	10
Windows - U=0.43, SHGC=0.39	836,818	2,855	580	3,435	5
Windows - U=0.26, SHGC=0.37	835,553	2,851	574	3,425	15
Windows - U=0.22, SHGC=0.22	795,397	2,714	579	3,293	147

Table 70 - Retail/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on TDVI

Prototype #9 Retail/Commercial Mixed Use - Office Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	67,392	241	10	251	-
Package - Optimum EE	67,392	198	8	206	45
Package - Optimum EE + PV	67,392	158	8	166	85
CoolRoof - Abs=0.25	67,392	237	10	247	4
DHW - EF=0.640	67,392	241	9	250	1
DHW - EF=0.823	67,392	241	8	249	2
Heating - AFUE=85%	67,392	241	10	251	0
HVAC - COP 6.13	67,392	229	10	238	13
Lighting - 0.90 watts/sf	67,392	225	10	234	17
PV - 8424 sqft	67,392	158	10	168	83
Roof - U=R15 rigid	67,392	240	9	249	2
Roof - U=R20 rigid	67,392	239	9	248	3
Walls - R19 batt	67,392	241	10	250	1
Walls - R21 batt	67,392	241	10	250	1
Walls - R21 batt + R5 rigid	67,392	241	9	250	1
Windows - U=0.43, SHGC=0.39	67,392	241	9	250	1
Windows - U=0.26, SHGC=0.37	67,392	240	9	250	1
Windows - U=0.22, SHGC=0.22	67,392	228	9	238	13

Detailed Modeling Results - Prototype 9 – Retail/Commercial Mixed Use - Corner Retail Tenant

Table 71 - Retail/Commercial Mixed Use - Corner Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 72 - Retail/Commercial Mixed Use - Corner Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #9 Retail/Commercial Mixed Use - Corner Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,514	\$1,698	\$6,212	-	-
Package - Optimum EE	\$3,971	\$1,629	\$5,600	\$5,745	9.4
DHW - EF=0.640	\$4,514	\$1,678	\$6,192	\$310	15.5
DHW - EF=0.823	\$4,514	\$1,629	\$6,143	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$4,394	\$1,698	\$6,092	\$557	4.6
HVAC - EER 12.06, COP 3.48	\$4,401	\$1,698	\$6,099	\$1,672	14.8
HVAC - EER 12.80, COP 3.66	\$4,326	\$1,698	\$6,024	\$2,786	14.8
Walls - R19 batt	\$4,525	\$1,698	\$6,223	\$200	Never
Walls - R21 batt	\$4,524	\$1,698	\$6,222	\$272	Never
Walls - R21 batt + R5 rigid	\$4,531	\$1,698	\$6,229	\$526	Never
Windows - U=0.43, SHGC=0.39	\$4,298	\$1,698	\$5,996	\$284	1.3
Windows - U=0.26, SHGC=0.37	\$4,279	\$1,698	\$5,977	\$848	3.6
Windows - U=0.22, SHGC=0.22	\$4,072	\$1,698	\$5,770	\$2,588	5.9

Table 73 - Retail/Commercial Mixed Use - Corner Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #9 Retail/Commercial Mixed Use - Corner Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	25,640	87	18	106	-
Package - Optimum EE	22,908	78	13	91	15
DHW - EF=0.640	25,640	87	17	104	2
DHW - EF=0.823	25,640	87	13	101	5
HVAC - EER 12.19, COP 3.52	24,968	85	18	103	3
HVAC - EER 12.06, COP 3.48	25,045	85	18	104	2
HVAC - EER 12.80, COP 3.66	24,477	84	18	102	4
Walls - R19 batt	25,694	88	18	106	0
Walls - R21 batt	25,708	88	18	106	0
Walls - R21 batt + R5 rigid	25,750	88	18	106	0
Windows - U=0.43, SHGC=0.39	24,172	82	18	101	5
Windows - U=0.26, SHGC=0.37	24,221	83	18	101	5
Windows - U=0.22, SHGC=0.22	23,417	80	18	98	8

Table 74 - Retail/Commercial Mixed Use - Corner Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #9 Retail/Commercial Mixed Use - Corner Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	350	14	364	-
Package - Optimum EE	1,404	308	10	318	46
DHW - EF=0.640	1,404	350	13	363	1
DHW - EF=0.823	1,404	350	10	361	3
HVAC - EER 12.19, COP 3.52	1,404	339	14	354	10
HVAC - EER 12.06, COP 3.48	1,404	341	14	355	9
HVAC - EER 12.80, COP 3.66	1,404	332	14	346	18
Walls - R19 batt	1,404	351	14	365	-1
Walls - R21 batt	1,404	351	14	365	-1
Walls - R21 batt + R5 rigid	1,404	351	14	366	-2
Windows - U=0.43, SHGC=0.39	1,404	329	14	343	21
Windows - U=0.26, SHGC=0.37	1,404	329	14	343	21
Windows - U=0.22, SHGC=0.22	1,404	317	14	331	33

Detailed Modeling Results - Prototype 9 – Retail/Commercial Mixed Use - Internal Retail Tenant

Table 75 - Retail/Commercial Mixed Use - Internal Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 76 - Retail/Commercial Mixed Use - Internal Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #9 Retail/Commercial Mixed Use - Internal Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,293	\$1,698	\$5,991	-	-
Package - Optimum EE	\$3,837	\$1,629	\$5,466	\$4,200	8.0
DHW - EF=0.640	\$4,293	\$1,678	\$5,971	\$310	15.5
DHW - EF=0.823	\$4,293	\$1,629	\$5,922	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$4,178	\$1,698	\$5,876	\$443	3.8
HVAC - EER 12.06, COP 3.48	\$4,184	\$1,698	\$5,882	\$1,328	12.2
HVAC - EER 12.80, COP 3.66	\$4,088	\$1,698	\$5,786	\$2,213	10.8
Walls - R19 batt	\$4,292	\$1,698	\$5,990	\$214	Never
Walls - R21 batt	\$4,290	\$1,698	\$5,988	\$292	Never
Walls - R21 batt + R5 rigid	\$4,291	\$1,698	\$5,989	\$564	Never
Windows - U=0.43, SHGC=0.39	\$4,105	\$1,698	\$5,803	\$177	0.9
Windows - U=0.26, SHGC=0.37	\$4,099	\$1,698	\$5,797	\$529	2.7
Windows - U=0.22, SHGC=0.22	\$3,997	\$1,698	\$5,695	\$1,616	5.5

Table 77 - Retail/Commercial Mixed Use - Internal Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #9 Retail/Commercial Mixed Use - Internal Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	24,373	83	18	101	-
Package - Optimum EE	21,837	75	13	88	13
DHW - EF=0.640	24,373	83	17	100	1
DHW - EF=0.823	24,373	83	13	96	5
HVAC - EER 12.19, COP 3.52	23,955	82	18	100	1
HVAC - EER 12.06, COP 3.48	23,996	82	18	100	1
HVAC - EER 12.80, COP 3.66	23,777	81	18	99	2
Walls - R19 batt	24,393	83	18	101	0
Walls - R21 batt	24,402	83	18	102	-1
Walls - R21 batt + R5 rigid	24,424	83	18	102	-1
Windows - U=0.43, SHGC=0.39	23,733	81	18	99	2
Windows - U=0.26, SHGC=0.37	23,679	81	18	99	2
Windows - U=0.22, SHGC=0.22	23,014	79	18	97	4

Table 78 - Retail/Commercial Mixed Use - Internal Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #9 Retail/Commercial Mixed Use - Internal Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	330	14	345	-
Package - Optimum EE	1,404	293	10	304	41
DHW - EF=0.640	1,404	330	13	344	1
DHW - EF=0.823	1,404	330	10	341	4
HVAC - EER 12.19, COP 3.52	1,404	323	14	338	7
HVAC - EER 12.06, COP 3.48	1,404	324	14	338	7
HVAC - EER 12.80, COP 3.66	1,404	320	14	335	10
Walls - R19 batt	1,404	330	14	345	0
Walls - R21 batt	1,404	331	14	345	0
Walls - R21 batt + R5 rigid	1,404	331	14	345	0
Windows - U=0.43, SHGC=0.39	1,404	321	14	335	10
Windows - U=0.26, SHGC=0.37	1,404	320	14	335	10
Windows - U=0.22, SHGC=0.22	1,404	310	14	325	20

Detailed Modeling Results - Prototype 10 – Retail/Residential Mixed Use Mid-Rise - Residential Space

Table 79 - Retail/Residential Mixed Use Mid-Rise - Residential Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Appliance	Dish EF=.46, Clothes MMEF=1.26	Dish EF=.64, Clothes MMEF=2.0	Dish EF=.64, Clothes MMEF=2.2	None	Alternative 1
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 6.10	HVAC - COP 7.63	None	None	Alternative 1
Lighting	Lighting - 0.713 watts/sf	Lighting - 0.674 watts/sf	None	None	No Alternative
Photovoltaics	No PV	PV - 9301 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - U=R15 rigid	Roof - U=R20 rigid	None	No Alternative
Wall Insulation	Walls - R13 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.48, SHGC=0.47	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 80 - Retail/Residential Mixed Use Mid-Rise - Residential Space Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Residential Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$166,804	\$25,058	\$191,862	-	-
Package - Optimum EE	\$154,484	\$21,093	\$175,577	\$112,688	6.9
Package - Optimum EE + PV	\$119,468	\$21,091	\$140,559	\$568,264	11.2
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	\$164,271	\$25,057	\$189,328	\$29,110	11.5
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	\$164,116	\$25,057	\$189,173	\$39,450	14.7
CoolRoof - Abs=0.25	\$165,107	\$25,057	\$190,164	\$6,820	4.0
DHW - EF=0.640	\$166,804	\$24,037	\$190,841	\$34,075	33.4
DHW - EF=0.823	\$166,804	\$21,104	\$187,908	\$40,770	10.3
Heating - AFUE=85%	\$166,804	\$25,048	\$191,852	\$1,000	100.0
HVAC - COP 7.63	\$162,643	\$25,058	\$187,701	\$4,809	1.2
Lighting - 0.674 watts/sf	\$162,857	\$25,058	\$187,915	\$99,000	25.1
PV - 9301 sqft	\$129,686	\$25,058	\$154,744	\$462,396	12.2
Roof - U=R15 rigid	\$166,778	\$25,053	\$191,831	\$5,167	166.7
Roof - U=R20 rigid	\$166,616	\$25,048	\$191,664	\$9,301	47.0
Walls - R19 batt	\$166,673	\$25,056	\$191,729	\$2,723	20.5
Walls - R21 batt	\$166,610	\$25,053	\$191,663	\$3,934	19.8
Walls - R21 batt + R5 rigid	\$166,181	\$25,052	\$191,233	\$11,498	18.3
Windows - U=0.43, SHGC=0.39	\$165,786	\$25,058	\$190,844	\$2,157	2.1
Windows - U=0.26, SHGC=0.37	\$165,866	\$25,054	\$190,920	\$6,446	6.8
Windows - U=0.22, SHGC=0.22	\$163,042	\$25,056	\$188,098	\$19,680	5.2

Table 81 - Retail/Residential Mixed Use Mid-Rise - Residential Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Residential Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	683,630	2,333	1,912	4,244	-
Package - Optimum EE	633,886	2,163	1,610	3,773	471
Package - Optimum EE + PV	491,935	1,678	1,610	3,289	955
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	673,315	2,297	1,912	4,209	35
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	672,685	2,295	1,912	4,207	37
CoolRoof - Abs=0.25	676,752	2,309	1,912	4,221	23
DHW - EF=0.640	683,630	2,333	1,834	4,167	77
DHW - EF=0.823	683,630	2,333	1,611	3,944	300
Heating - AFUE=85%	683,630	2,333	1,911	4,244	0
HVAC - COP 7.63	666,931	2,276	1,912	4,187	57
Lighting - 0.674 watts/sf	667,562	2,278	1,912	4,190	54
PV - 9301 sqft	533,163	1,819	1,912	3,731	513
Roof - U=R15 rigid	683,580	2,332	1,911	4,244	0
Roof - U=R20 rigid	682,951	2,330	1,911	4,241	3
Walls - R19 batt	683,133	2,331	1,912	4,243	1
Walls - R21 batt	682,892	2,330	1,911	4,241	3
Walls - R21 batt + R5 rigid	681,185	2,324	1,911	4,235	9
Windows - U=0.43, SHGC=0.39	679,505	2,318	1,912	4,230	14
Windows - U=0.26, SHGC=0.37	679,850	2,320	1,912	4,231	13
Windows - U=0.22, SHGC=0.22	668,390	2,281	1,912	4,192	52

Table 82 - Retail/Residential Mixed Use Mid-Rise - Residential Space EE Package and Single EE Measures Impacts on TDVI

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Residential Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	103,339	98	20	117	-
Package - Optimum EE	103,339	90	17	107	10
Package - Optimum EE + PV	103,339	67	17	84	33
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	103,339	96	20	116	1
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	103,339	96	20	116	1
CoolRoof - Abs=0.25	103,339	97	20	116	1
DHW - EF=0.640	103,339	98	19	116	1
DHW - EF=0.823	103,339	98	17	114	3
Heating - AFUE=85%	103,339	98	20	117	0
HVAC - COP 7.63	103,339	95	20	115	2
Lighting - 0.674 watts/sf	103,339	95	20	115	2
PV - 9301 sqft	103,339	74	20	93	24
Roof - U=R15 rigid	103,339	98	20	117	0
Roof - U=R20 rigid	103,339	97	20	117	0
Walls - R19 batt	103,339	98	20	117	0
Walls - R21 batt	103,339	97	20	117	0
Walls - R21 batt + R5 rigid	103,339	97	20	117	0
Windows - U=0.43, SHGC=0.39	103,339	97	20	117	0
Windows - U=0.26, SHGC=0.37	103,339	97	20	117	0
Windows - U=0.22, SHGC=0.22	103,339	95	20	115	2

Detailed Modeling Results - Prototype 10 – Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant

Table 83 - Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 84 - Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,514	\$1,698	\$6,212	-	-
Package - Optimum EE	\$3,946	\$1,629	\$5,575	\$5,482	8.6
DHW - EF=0.640	\$4,514	\$1,678	\$6,192	\$310	15.5
DHW - EF=0.823	\$4,514	\$1,629	\$6,143	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$4,391	\$1,698	\$6,089	\$487	4.0
HVAC - EER 12.06, COP 3.48	\$4,414	\$1,698	\$6,112	\$1,460	14.6
HVAC - EER 12.80, COP 3.66	\$4,318	\$1,698	\$6,016	\$2,434	12.4
Walls - R19 batt	\$4,517	\$1,698	\$6,215	\$207	Never
Walls - R21 batt	\$4,516	\$1,698	\$6,214	\$282	-141.2
Walls - R21 batt + R5 rigid	\$4,520	\$1,698	\$6,218	\$753	-125.5
Windows - U=0.43, SHGC=0.39	\$4,298	\$1,698	\$5,996	\$294	1.4
Windows - U=0.26, SHGC=0.37	\$4,299	\$1,698	\$5,997	\$877	4.1
Windows - U=0.22, SHGC=0.22	\$4,093	\$1,698	\$5,791	\$2,678	6.4

Table 85 - Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	25,609	87	18	106	-
Package - Optimum EE	22,730	78	13	91	15
DHW - EF=0.640	25,609	87	17	104	2
DHW - EF=0.823	25,609	87	13	101	5
HVAC - EER 12.19, COP 3.52	24,861	85	18	103	3
HVAC - EER 12.06, COP 3.48	24,949	85	18	103	3
HVAC - EER 12.80, COP 3.66	24,570	84	18	102	4
Walls - R19 batt	25,655	88	18	106	0
Walls - R21 batt	25,643	87	18	106	0
Walls - R21 batt + R5 rigid	25,691	88	18	106	0
Windows - U=0.43, SHGC=0.39	24,254	83	18	101	5
Windows - U=0.26, SHGC=0.37	24,289	83	18	101	5
Windows - U=0.22, SHGC=0.22	23,387	80	18	98	8

Table 86 - Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	350	14	364	-
Package - Optimum EE	1,404	306	10	316	48
DHW - EF=0.640	1,404	350	13	363	1
DHW - EF=0.823	1,404	350	10	360	4
HVAC - EER 12.19, COP 3.52	1,404	338	14	352	12
HVAC - EER 12.06, COP 3.48	1,404	339	14	354	10
HVAC - EER 12.80, COP 3.66	1,404	333	14	348	16
Walls - R19 batt	1,404	350	14	365	-1
Walls - R21 batt	1,404	350	14	364	0
Walls - R21 batt + R5 rigid	1,404	350	14	365	-1
Windows - U=0.43, SHGC=0.39	1,404	330	14	345	19
Windows - U=0.26, SHGC=0.37	1,404	330	14	344	20
Windows - U=0.22, SHGC=0.22	1,404	317	14	331	33

Detailed Modeling Results - Prototype 10 – Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant

Table 87 - Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 89 - Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,274	\$1,698	\$5,972	-	-
Package - Optimum EE	\$3,832	\$1,629	\$5,461	\$4,020	7.9
DHW - EF=0.640	\$4,274	\$1,678	\$5,952	\$310	15.5
DHW - EF=0.823	\$4,274	\$1,629	\$5,903	\$371	5.4
HVAC - EER 12.19, COP 3.52	\$4,133	\$1,698	\$5,831	\$395	2.8
HVAC - EER 12.06, COP 3.48	\$4,156	\$1,698	\$5,854	\$1,184	10.0
HVAC - EER 12.80, COP 3.66	\$4,077	\$1,698	\$5,775	\$1,973	10.0
Walls - R19 batt	\$4,273	\$1,698	\$5,971	\$90	Never
Walls - R21 batt	\$4,273	\$1,698	\$5,971	\$122	122.4
Walls - R21 batt + R5 rigid	\$4,274	\$1,698	\$5,972	\$326	Never
Windows - U=0.43, SHGC=0.39	\$4,100	\$1,698	\$5,798	\$184	1.1
Windows - U=0.26, SHGC=0.37	\$4,106	\$1,698	\$5,804	\$549	3.3
Windows - U=0.22, SHGC=0.22	\$3,994	\$1,698	\$5,692	\$1,676	6.0

Table 90 - Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	24,434	83	18	102	-
Package - Optimum EE	21,803	74	13	88	14
DHW - EF=0.640	24,434	83	17	100	2
DHW - EF=0.823	24,434	83	13	97	5
HVAC - EER 12.19, COP 3.52	23,854	81	18	100	2
HVAC - EER 12.06, COP 3.48	23,903	82	18	100	2
HVAC - EER 12.80, COP 3.66	23,552	80	18	99	3
Walls - R19 batt	24,445	83	18	102	0
Walls - R21 batt	24,445	83	18	102	0
Walls - R21 batt + R5 rigid	24,456	83	18	102	0
Windows - U=0.43, SHGC=0.39	23,517	80	18	98	4
Windows - U=0.26, SHGC=0.37	23,571	80	18	99	3
Windows - U=0.22, SHGC=0.22	23,002	78	18	97	5

Table 91 - Retail/Residential Mixed Use Mid-Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #10 Retail/Residential Mixed Use Mid-Rise - Corner Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	331	14	345	-
Package - Optimum EE	1,404	293	10	303	42
DHW - EF=0.640	1,404	331	13	344	1
DHW - EF=0.823	1,404	331	10	341	4
HVAC - EER 12.19, COP 3.52	1,404	322	14	337	8
HVAC - EER 12.06, COP 3.48	1,404	323	14	338	7
HVAC - EER 12.80, COP 3.66	1,404	318	14	332	13
Walls - R19 batt	1,404	331	14	345	0
Walls - R21 batt	1,404	331	14	345	0
Walls - R21 batt + R5 rigid	1,404	331	14	345	0
Windows - U=0.43, SHGC=0.39	1,404	318	14	333	12
Windows - U=0.26, SHGC=0.37	1,404	319	14	333	12
Windows - U=0.22, SHGC=0.22	1,404	310	14	324	21

Detailed Modeling Results - Prototype 11 – Retail/Residential Mixed Use Low-Rise - Residential Space

Table 92 - Retail/Residential Mixed Use Low -Rise - Residential Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Appliance	Dish EF=.46, Clothes MMEF=1.26	Dish EF=.64, Clothes MMEF=2.0	Dish EF=.64, Clothes MMEF=2.2	None	Alternative 1
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Lighting	Lighting - 0.713 watts/sf	Lighting - 0.667 watts/sf	None	None	No Alternative
Photovoltaics	No PV	PV - 9904 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R30 batt	Roof - R38 batt	Roof - R49 batt	None	No Alternative
Wall Insulation	Walls - R13 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 93 - Retail/Residential Mixed Use Low -Rise - Residential Space Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #11 Retail/Residential Mixed Use Low-Rise - Residential Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$58,486	\$10,460	\$68,946	-	-
Package - Optimum EE	\$55,127	\$8,808	\$63,935	\$53,550	10.7
Package - Optimum EE + PV	\$15,750	\$8,808	\$24,558	\$580,062	11.8
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	\$57,392	\$10,460	\$67,852	\$12,173	11.1
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	\$57,319	\$10,460	\$67,779	\$16,497	14.1
CoolRoof - Abs=0.25	\$57,901	\$10,460	\$68,361	\$7,263	12.4
DHW - EF=0.640	\$58,486	\$10,034	\$68,520	\$14,249	33.4
DHW - EF=0.823	\$58,486	\$8,808	\$67,294	\$17,049	10.3
HVAC - EER 12.19, COP 3.52	\$57,535	\$10,460	\$67,995	\$2,844	3.0
HVAC - EER 12.06, COP 3.48	\$57,643	\$10,460	\$68,103	\$8,532	10.1
HVAC - EER 12.80, COP 3.66	\$57,251	\$10,460	\$67,711	\$14,220	11.5
Lighting - 0.667 watts/sf	\$56,821	\$10,460	\$67,281	\$41,400	24.9
PV - 9904 sqft	\$18,684	\$10,460	\$29,144	\$492,375	10.2
Roof - R38 batt	\$58,516	\$10,460	\$68,976	\$4,182	Never
Roof - R49 batt	\$58,662	\$10,460	\$69,122	\$14,525	Never
Walls - R19 batt	\$58,535	\$10,460	\$68,995	\$1,112	Never
Walls - R21 batt	\$58,584	\$10,460	\$69,044	\$1,606	Never
Walls - R21 batt + R5 rigid	\$58,542	\$10,460	\$69,002	\$4,695	Never
Windows - U=0.43, SHGC=0.39	\$58,577	\$10,460	\$69,037	\$1,002	Never
Windows - U=0.26, SHGC=0.37	\$58,710	\$10,460	\$69,170	\$2,994	Never
Windows - U=0.22, SHGC=0.22	\$57,559	\$10,460	\$68,019	\$2,844	3.1

Table 94 - Retail/Residential Mixed Use Low -Rise - Residential Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #11 Retail/Residential Mixed Use Low-Rise - Residential Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	240,792	822	803	1,624	-
Package - Optimum EE	227,239	775	677	1,452	172
Package - Optimum EE + PV	67,612	231	677	908	716
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	236,341	806	803	1,609	15
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	236,045	805	803	1,608	16
CoolRoof - Abs=0.25	238,416	813	803	1,616	8
DHW - EF=0.640	240,792	822	770	1,592	32
DHW - EF=0.823	240,792	822	677	1,499	125
HVAC - EER 12.19, COP 3.52	236,996	809	803	1,611	13
HVAC - EER 12.06, COP 3.48	237,417	810	803	1,613	11
HVAC - EER 12.80, COP 3.66	235,856	805	803	1,607	17
Lighting - 0.667 watts/sf	234,028	799	803	1,601	23
PV - 9904 sqft	79,448	271	803	1,074	550
Roof - R38 batt	240,932	822	803	1,625	-1
Roof - R49 batt	241,550	824	803	1,627	-3
Walls - R19 batt	241,003	822	803	1,625	-1
Walls - R21 batt	241,212	823	803	1,626	-2
Walls - R21 batt + R5 rigid	241,080	823	803	1,625	-1
Windows - U=0.43, SHGC=0.39	241,171	823	803	1,625	-1
Windows - U=0.26, SHGC=0.37	241,722	825	803	1,627	-3
Windows - U=0.22, SHGC=0.22	237,054	809	803	1,611	13

Table 95 - Retail/Residential Mixed Use Low-Rise - Residential Space EE Package and Single EE Measures Impacts on TDVI

Prototype #11 Retail/Residential Mixed Use Low-Rise - Residential Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	44,017	81	19	100	-
Package - Optimum EE	44,017	76	16	92	11
Package - Optimum EE + PV	44,017	17	16	33	12
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	44,017	79	19	99	11
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	44,017	79	19	99	14
CoolRoof - Abs=0.25	44,017	80	19	99	12
DHW - EF=0.640	44,017	81	19	99	33
DHW - EF=0.823	44,017	81	16	97	10
HVAC - EER 12.19, COP 3.52	44,017	80	19	99	3
HVAC - EER 12.06, COP 3.48	44,017	80	19	99	10
HVAC - EER 12.80, COP 3.66	44,017	79	19	98	12
Lighting - 0.667 watts/sf	44,017	79	19	98	25
PV - 9904 sqft	44,017	21	19	41	10
Roof - R38 batt	44,017	81	19	100	-139
Roof - R49 batt	44,017	81	19	100	-83
Walls - R19 batt	44,017	81	19	100	-23
Walls - R21 batt	44,017	81	19	100	-16
Walls - R21 batt + R5 rigid	44,017	81	19	100	-84
Windows - U=0.43, SHGC=0.39	44,017	81	19	100	-11
Windows - U=0.26, SHGC=0.37	44,017	81	19	100	-13
Windows - U=0.22, SHGC=0.22	44,017	80	19	99	3

Detailed Modeling Results - Prototype 11 – Retail/Residential Mixed Use Low-Rise - Corner Retail Tenant

Table 96 - Retail/Residential Mixed Use Low -Rise - Corner Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 97 - Retail/Residential Mixed Use Low -Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #11 Retail/Residential Mixed Use Low-Rise - Corner Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,514	\$1,698	\$6,212	-	-
Package - Optimum EE	\$3,948	\$1,629	\$5,577	\$5,629	9
DHW - EF=0.640	\$4,514	\$1,678	\$6,192	\$310	15
DHW - EF=0.823	\$4,514	\$1,629	\$6,143	\$371	5
HVAC - EER 12.19, COP 3.52	\$4,381	\$1,698	\$6,079	\$516	4
HVAC - EER 12.06, COP 3.48	\$4,390	\$1,698	\$6,088	\$1,548	12
HVAC - EER 12.80, COP 3.66	\$4,326	\$1,698	\$6,024	\$2,581	14
Walls - R19 batt	\$4,523	\$1,698	\$6,221	\$207	Never
Walls - R21 batt	\$4,522	\$1,698	\$6,220	\$282	Never
Walls - R21 batt + R5 rigid	\$4,512	\$1,698	\$6,210	\$546	Never
Windows - U=0.43, SHGC=0.39	\$4,301	\$1,698	\$5,999	\$294	1
Windows - U=0.26, SHGC=0.37	\$4,301	\$1,698	\$5,999	\$877	4
Windows - U=0.22, SHGC=0.22	\$4,085	\$1,698	\$5,783	\$2,678	6

Table 98 - Retail/Residential Mixed Use Low -Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #11 Retail/Residential Mixed Use Low-Rise - Corner Retail Tenant					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	25,696	88	18	106	-
Package - Optimum EE	22,746	78	13	91	15
DHW - EF=0.640	25,696	88	17	105	1
DHW - EF=0.823	25,696	88	13	101	5
HVAC - EER 12.19, COP 3.52	24,857	85	18	103	3
HVAC - EER 12.06, COP 3.48	24,923	85	18	103	3
HVAC - EER 12.80, COP 3.66	24,516	84	18	102	4
Walls - R19 batt	25,761	88	18	106	0
Walls - R21 batt	25,782	88	18	106	0
Walls - R21 batt + R5 rigid	25,722	88	18	106	0
Windows - U=0.43, SHGC=0.39	24,224	83	18	101	5
Windows - U=0.26, SHGC=0.37	24,265	83	18	101	5
Windows - U=0.22, SHGC=0.22	23,434	80	18	98	8

Table 99 - Retail/Residential Mixed Use Low -Rise - Corner Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #11 Retail/Residential Mixed Use Low-Rise - Corner Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	351	14	365	-
Package - Optimum EE	1,404	306	10	317	48
DHW - EF=0.640	1,404	351	13	364	1
DHW - EF=0.823	1,404	351	10	361	4
HVAC - EER 12.19, COP 3.52	1,404	338	14	353	12
HVAC - EER 12.06, COP 3.48	1,404	339	14	354	11
HVAC - EER 12.80, COP 3.66	1,404	333	14	347	18
Walls - R19 batt	1,404	352	14	366	-1
Walls - R21 batt	1,404	352	14	366	-1
Walls - R21 batt + R5 rigid	1,404	351	14	365	0
Windows - U=0.43, SHGC=0.39	1,404	330	14	344	21
Windows - U=0.26, SHGC=0.37	1,404	330	14	344	21
Windows - U=0.22, SHGC=0.22	1,404	317	14	332	33

Detailed Modeling Results - Prototype 11 – Retail/Residential Mixed Use Low-Rise - Internal Retail Tenant

Table 100 - Retail/Residential Mixed Use Low -Rise - Internal Retail Tenant EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.57, SHGC=0.61	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 101 - Retail/Residential Mixed Use Low -Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #11 Retail/Residential Mixed Use Low-Rise - Internal Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,293	\$1,698	\$5,991	-	-
Package - Optimum EE	\$3,834	\$1,629	\$5,463	\$5,125	9.7
DHW - EF=0.640	\$4,293	\$1,678	\$5,971	\$310	15
DHW - EF=0.823	\$4,293	\$1,629	\$5,922	\$371	5
HVAC - EER 12.19, COP 3.52	\$4,151	\$1,698	\$5,849	\$415	3
HVAC - EER 12.06, COP 3.48	\$4,169	\$1,698	\$5,867	\$1,246	10
HVAC - EER 12.80, COP 3.66	\$4,084	\$1,698	\$5,782	\$2,076	10
Walls - R19 batt	\$4,296	\$1,698	\$5,994	\$222	Never
Walls - R21 batt	\$4,285	\$1,698	\$5,983	\$302	Never
Walls - R21 batt + R5 rigid	\$4,300	\$1,698	\$5,998	\$585	Never
Windows - U=0.43, SHGC=0.39	\$4,119	\$1,698	\$5,817	\$294	2
Windows - U=0.26, SHGC=0.37	\$4,126	\$1,698	\$5,824	\$877	5
Windows - U=0.22, SHGC=0.22	\$3,999	\$1,698	\$5,697	\$2,678	9

Table 102 - Retail/Residential Mixed Use Low -Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #11 Retail/Residential Mixed Use Low-Rise - Internal Retail Tenant					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$4,293	\$1,698	\$5,991	-	-
Package - Optimum EE	\$3,834	\$1,629	\$5,463	\$5,125	9.7
DHW - EF=0.640	\$4,293	\$1,678	\$5,971	\$310	15
DHW - EF=0.823	\$4,293	\$1,629	\$5,922	\$371	5
HVAC - EER 12.19, COP 3.52	\$4,151	\$1,698	\$5,849	\$415	3
HVAC - EER 12.06, COP 3.48	\$4,169	\$1,698	\$5,867	\$1,246	10
HVAC - EER 12.80, COP 3.66	\$4,084	\$1,698	\$5,782	\$2,076	10
Walls - R19 batt	\$4,296	\$1,698	\$5,994	\$222	Never
Walls - R21 batt	\$4,285	\$1,698	\$5,983	\$302	Never
Walls - R21 batt + R5 rigid	\$4,300	\$1,698	\$5,998	\$585	Never
Windows - U=0.43, SHGC=0.39	\$4,119	\$1,698	\$5,817	\$294	2
Windows - U=0.26, SHGC=0.37	\$4,126	\$1,698	\$5,824	\$877	5
Windows - U=0.22, SHGC=0.22	\$3,999	\$1,698	\$5,697	\$2,678	9

Table 103 - Retail/Residential Mixed Use Low -Rise - Internal Retail Tenant EE Package and Single EE Measures Impacts on TDVI

Prototype #11 Retail/Residential Mixed Use Low-Rise - Internal Retail Tenant					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	1,404	331	14	345	-
Package - Optimum EE	1,404	293	10	303	42
DHW - EF=0.640	1,404	331	13	344	1
DHW - EF=0.823	1,404	331	10	341	4
HVAC - EER 12.19, COP 3.52	1,404	322	14	337	8
HVAC - EER 12.06, COP 3.48	1,404	324	14	339	6
HVAC - EER 12.80, COP 3.66	1,404	319	14	334	11
Walls - R19 batt	1,404	331	14	345	0
Walls - R21 batt	1,404	331	14	345	0
Walls - R21 batt + R5 rigid	1,404	331	14	346	-1
Windows - U=0.43, SHGC=0.39	1,404	320	14	335	10
Windows - U=0.26, SHGC=0.37	1,404	321	14	335	10
Windows - U=0.22, SHGC=0.22	1,404	310	14	325	20

Detailed Modeling Results - Prototype 12 – Civic/Commercial Mixed Use – Library

Table 104 - Civic/Commercial Mixed Use – Library EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 4.90	HVAC - COP 6.13	None	None	Alternative 1
Lighting	Lighting - 1.10 watts/sf	Lighting - 1.02 watts/sf	None	None	Alternative 1
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 105 - Civic/Commercial Mixed Use – Library EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #12 Civic/Commercial Mixed Use - Library					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$69,637	\$5,333	\$74,970	-	-
Package - Optimum EE	\$54,935	\$4,669	\$59,604	\$45,404	3.0
DHW - EF=0.640	\$69,637	\$5,169	\$74,806	\$310	1.9
DHW - EF=0.823	\$69,637	\$4,701	\$74,338	\$371	0.6
Heating - AFUE=85%	\$69,637	\$5,322	\$74,959	\$889	80.8
HVAC - COP 6.13	\$65,721	\$5,333	\$71,054	\$3,426	0.9
Lighting - 1.02 watts/sf	\$61,752	\$5,370	\$67,122	\$0	0.0
Walls - R19 batt	\$69,557	\$5,320	\$74,877	\$891	9.6
Walls - R21 batt	\$69,542	\$5,320	\$74,862	\$1,215	11.3
Walls - R21 batt + R5 rigid	\$69,469	\$5,310	\$74,778	\$40,392	210.4
Windows - U=0.43, SHGC=0.39	\$69,540	\$5,311	\$74,851	\$4,428	37.2
Windows - U=0.26, SHGC=0.37	\$69,247	\$5,281	\$74,527	\$13,230	29.9
Windows - U=0.22, SHGC=0.22	\$64,893	\$5,304	\$70,198	\$40,392	8.5

Table 106 - Civic/Commercial Mixed Use – Library EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #12 Civic/Commercial Mixed Use - Library					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	393,633	1,343	283	1,626	-
Package - Optimum EE	314,390	1,073	235	1,308	318
DHW - EF=0.640	393,633	1,343	272	1,615	11
DHW - EF=0.823	393,633	1,343	237	1,580	46
Heating - AFUE=85%	393,633	1,343	283	1,626	0
HVAC - COP 6.13	373,678	1,275	283	1,558	68
Lighting - 1.02 watts/sf	348,339	1,189	286	1,475	151
Walls - R19 batt	393,261	1,342	282	1,624	2
Walls - R21 batt	393,175	1,342	282	1,624	2
Walls - R21 batt + R5 rigid	392,909	1,341	282	1,622	4
Windows - U=0.43, SHGC=0.39	393,623	1,343	282	1,625	1
Windows - U=0.26, SHGC=0.37	392,768	1,340	279	1,619	7
Windows - U=0.22, SHGC=0.22	368,113	1,256	281	1,537	89

Table 107 - Civic/Commercial Mixed Use – Library EE Package and Single EE Measures Impacts on TDVI

Prototype #12 Civic/Commercial Mixed Use - Library					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	26,600	288	12	300	-
Package - Optimum EE	26,600	228	10	238	62
DHW - EF=0.640	26,600	288	11	299	1
DHW - EF=0.823	26,600	288	10	298	2
Heating - AFUE=85%	26,600	288	12	300	0
HVAC - COP 6.13	26,600	273	12	284	16
Lighting - 1.02 watts/sf	26,600	255	12	267	33
Walls - R19 batt	26,600	288	12	299	1
Walls - R21 batt	26,600	288	12	299	1
Walls - R21 batt + R5 rigid	26,600	287	12	299	1
Windows - U=0.43, SHGC=0.39	26,600	288	12	299	1
Windows - U=0.26, SHGC=0.37	26,600	287	12	298	2
Windows - U=0.22, SHGC=0.22	26,600	268	12	280	20

Detailed Modeling Results - Prototype 12 – Civic/Commercial Mixed Use - Office Space

Table 108 - Civic/Commercial Mixed Use - Office Space EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 4.90	HVAC - COP 6.13	None	None	Alternative 1
Lighting	Lighting - 1.10 watts/sf	Lighting - 0.90 watts/sf	None	None	Alternative 1
Photovoltaics	No PV	PV - 11970 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 rigid	Roof - R15 rigid	Roof - R20 rigid	None	Alternative 2
Wall Insulation	Walls - R11 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 2
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 109 - Civic/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #12 Civic/Commercial Mixed Use - Office Space					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$237,414	\$13,894	\$251,308	-	-
Package - Optimum EE	\$194,821	\$12,062	\$206,883	\$157,498	3.5
Package - Optimum EE + PV	\$166,552	\$12,058	\$178,609	\$743,829	10.2
CoolRoof - Abs=0.25	\$235,610	\$13,897	\$249,506	\$8,778	4.9
DHW - EF=0.640	\$237,414	\$13,456	\$250,870	\$929	2.1
DHW - EF=0.823	\$237,414	\$12,209	\$249,623	\$1,112	0.7
Heating - AFUE=85%	\$237,414	\$13,858	\$251,272	\$3,424	95.1
HVAC - COP 6.13	\$224,331	\$13,894	\$238,225	\$6,194	0.5
Lighting - 0.90 watts/sf	\$221,850	\$13,940	\$235,790	\$0	0.0
PV - 11970 sqft	\$207,332	\$13,894	\$221,226	\$595,110	19.2
Roof - R15 rigid	\$236,782	\$13,849	\$250,631	\$6,650	9.8
Roof - R20 rigid	\$236,319	\$13,816	\$250,135	\$11,970	10.2
Walls - R19 batt	\$237,236	\$13,865	\$251,101	\$2,772	13.4
Walls - R21 batt	\$237,212	\$13,863	\$251,075	\$3,780	16.2
Walls - R21 batt + R5 rigid	\$236,956	\$13,841	\$250,798	\$7,308	14.3
Windows - U=0.43, SHGC=0.39	\$237,266	\$13,840	\$251,106	\$13,776	68.2
Windows - U=0.26, SHGC=0.37	\$236,700	\$13,736	\$250,436	\$41,160	47.2
Windows - U=0.22, SHGC=0.22	\$223,378	\$13,810	\$237,188	\$125,664	8.9

Table 110 - Civic/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #12 Civic/Commercial Mixed Use - Office Space					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	1,355,741	4,626	908	5,533	-
Package - Optimum EE	1,125,886	3,842	774	4,616	917
Package - Optimum EE + PV	945,252	3,225	774	3,999	1,534
CoolRoof - Abs=0.25	1,345,463	4,591	908	5,499	34
DHW - EF=0.640	1,355,741	4,626	876	5,502	31
DHW - EF=0.823	1,355,741	4,626	785	5,411	122
Heating - AFUE=85%	1,355,741	4,626	905	5,531	2
HVAC - COP 6.13	1,288,801	4,397	908	5,305	228
Lighting - 0.90 watts/sf	1,266,044	4,320	911	5,231	302
PV - 11970 sqft	1,168,899	3,988	908	4,896	637
Roof - R15 rigid	1,353,171	4,617	904	5,521	12
Roof - R20 rigid	1,351,279	4,611	902	5,512	21
Walls - R19 batt	1,354,931	4,623	906	5,529	4
Walls - R21 batt	1,354,817	4,623	905	5,528	5
Walls - R21 batt + R5 rigid	1,353,640	4,619	904	5,522	11
Windows - U=0.43, SHGC=0.39	1,356,307	4,628	904	5,531	2
Windows - U=0.26, SHGC=0.37	1,355,163	4,624	896	5,520	13
Windows - U=0.22, SHGC=0.22	1,280,186	4,368	901	5,269	264

Table 111 - Civic/Commercial Mixed Use - Office Space EE Package and Single EE Measures Impacts on TDVI

Prototype #12 Civic/Commercial Mixed Use - Office Space					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	106,400	248	9	257	-
Package - Optimum EE	106,400	204	8	212	45
Package - Optimum EE + PV	106,400	167	8	175	82
CoolRoof - Abs=0.25	106,400	246	9	255	2
DHW - EF=0.640	106,400	248	9	257	0
DHW - EF=0.823	106,400	248	8	256	1
Heating - AFUE=85%	106,400	248	9	257	0
HVAC - COP 6.13	106,400	235	9	244	13
Lighting - 0.90 watts/sf	106,400	231	9	241	16
PV - 11970 sqft	106,400	210	9	220	37
Roof - R15 rigid	106,400	247	9	256	1
Roof - R20 rigid	106,400	247	9	256	1
Walls - R19 batt	106,400	247	9	257	0
Walls - R21 batt	106,400	247	9	257	0
Walls - R21 batt + R5 rigid	106,400	247	9	256	1
Windows - U=0.43, SHGC=0.39	106,400	247	9	257	0
Windows - U=0.26, SHGC=0.37	106,400	247	9	256	1
Windows - U=0.22, SHGC=0.22	106,400	233	9	242	15

Detailed Modeling Results - Prototype 13 – Residential Multi-Family/Town Home

Table 112 - Residential Multi-Family/Town Home EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Appliance	Dish EF=.46, Clothes MMEF=1.26	Dish EF=.64, Clothes MMEF=2.0	Dish EF=.64, Clothes MMEF=2.2	None	No Alternative
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Lighting	Lighting - 0.706 watts/sf	Lighting - 0.657 watts/sf	None	None	No Alternative
Photovoltaics	No PV	PV - 2205 watts/sf	None	None	Alternative 1
Roof Insulation	Roof - U=R30 batt	Roof - R38 batt	Roof - R49 batt	None	No Alternative
Wall Insulation	Walls - R13 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3
Solar Thermal	No Solar Thermal	ST - 441 sqft, 840 gal	None	None	No Alternative

Table 113 - Residential Multi-Family/Town Home EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #13 Residential Multi-Family/Town Home					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$11,384	\$2,117	\$13,501	-	-
Package - Optimum EE	\$10,929	\$1,698	\$12,627	\$13,644	15.6
Package - Optimum EE + PV	\$2,291	\$1,698	\$3,989	\$132,089	11.6
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	\$11,305	\$2,117	\$13,422	\$1,852	23.4
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	\$11,305	\$2,117	\$13,422	\$2,510	31.8
DHW - EF=0.640	\$11,384	\$2,007	\$13,391	\$4,337	39.4
DHW - EF=0.823	\$11,384	\$1,698	\$13,082	\$5,189	12.4
HVAC - EER 12.19, COP 3.52	\$11,237	\$2,117	\$13,354	\$736	5.0
HVAC - EER 12.06, COP 3.48	\$11,254	\$2,117	\$13,371	\$2,209	17.0
HVAC - EER 12.80, COP 3.66	\$11,149	\$2,117	\$13,266	\$3,682	15.7
Lighting - 0.657 watts/sf	\$11,078	\$2,117	\$13,195	\$8,820	28.8
PV - 2205 sqft	\$2,692	\$2,117	\$4,809	\$109,625	10.3
Roof - R38 batt	\$11,366	\$2,117	\$13,483	\$931	51.7
Roof - R49 batt	\$11,325	\$2,117	\$13,442	\$3,234	54.8
Walls - R19 batt	\$11,384	\$2,117	\$13,501	\$464	Never
Walls - R21 batt	\$11,386	\$2,117	\$13,503	\$671	Never
Walls - R21 batt + R5 rigid	\$11,374	\$2,117	\$13,491	\$1,961	196.1
Windows - U=0.43, SHGC=0.39	\$11,393	\$2,117	\$13,510	\$523	Never
Windows - U=0.26, SHGC=0.37	\$11,421	\$2,117	\$13,538	\$1,563	Never
Windows - U=0.22, SHGC=0.22	\$11,092	\$2,117	\$13,209	\$4,772	16.3
ST - 441 sqft, 840 gal	Not Reported				

Table 114 - Residential Multi-Family/Town Home EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #13 Residential Multi-Family/Town Home					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	49,337	168	169	337	-
Package - Optimum EE	47,521	162	137	299	38
Package - Optimum EE + PV	11,820	40	137	177	160
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	49,028	167	169	336	1
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	49,018	167	169	336	1
DHW - EF=0.640	49,337	168	160	329	8
DHW - EF=0.823	49,337	168	137	305	32
HVAC - EER 12.19, COP 3.52	48,750	166	169	335	2
HVAC - EER 12.06, COP 3.48	48,816	167	169	335	2
HVAC - EER 12.80, COP 3.66	48,392	165	169	334	3
Lighting - 0.657 watts/sf	48,103	164	169	333	4
PV - 2205 watts/sf	13,639	47	169	215	122
Roof - R38 batt	49,268	168	169	337	0
Roof - R49 batt	49,101	168	169	336	1
Walls - R19 batt	49,335	168	169	337	0
Walls - R21 batt	49,344	168	169	337	0
Walls - R21 batt + R5 rigid	49,299	168	169	337	0
Windows - U=0.43, SHGC=0.39	49,373	168	169	337	0
Windows - U=0.26, SHGC=0.37	49,486	169	169	337	0
Windows - U=0.22, SHGC=0.22	48,179	164	169	333	4
ST - 441 sqft, 840 gal	Not Reported				

Table 115 - Residential Multi-Family/Town Home EE Package and Single EE Measures Impacts on TDVI

Prototype #13 Residential Multi-Family/Town Home					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	9,800	75	18	93	-
Package - Optimum EE	9,800	72	15	87	6
Package - Optimum EE + PV	9,800	13	15	27	66
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	9,800	75	18	93	0
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	9,800	75	18	93	0
DHW - EF=0.640	9,800	75	17	92	1
DHW - EF=0.823	9,800	75	15	90	3
HVAC - EER 12.19, COP 3.52	9,800	74	18	92	1
HVAC - EER 12.06, COP 3.48	9,800	74	18	92	1
HVAC - EER 12.80, COP 3.66	9,800	73	18	92	1
Lighting - 0.657 watts/sf	9,800	73	18	91	2
PV - 2205 watts/sf	9,800	16	18	34	59
Roof - R38 batt	9,800	75	18	93	0
Roof - R49 batt	9,800	75	18	93	0
Walls - R19 batt	9,800	75	18	93	0
Walls - R21 batt	9,800	75	18	93	0
Walls - R21 batt + R5 rigid	9,800	75	18	93	0
Windows - U=0.43, SHGC=0.39	9,800	75	18	93	0
Windows - U=0.26, SHGC=0.37	9,800	75	18	93	0
Windows - U=0.22, SHGC=0.22	9,800	73	18	91	2
ST - 441 sqft, 840 gal	9,800	0	0	0	0

Detailed Modeling Results - Prototype 14 – Residential Low-Rise

Table 116 - Residential Low-Rise EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Appliance	Dish EF=.46, Clothes MMEF=1.26	Dish EF=.64, Clothes MMEF=2.0	Dish EF=.64, Clothes MMEF=2.2	None	Alternative 1
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Htg/Clg	HVAC - EER 11.07, COP 3.28	HVAC - EER 12.19, COP 3.52	HVAC - EER 12.06, COP 3.48	HVAC - EER 12.80, COP 3.66	Alternative 3
Lighting	Lighting - 0.711 watts/sf	Lighting - 0.648 watts/sf	None	None	No Alternative
Photovoltaics	No PV	PV - 9375 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R30 batt	Roof - R38 batt	Roof - R49 batt	None	No Alternative
Wall Insulation	Walls - R13 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	No Alternative
Windows	Windows - U=0.56, SHGC=0.42	Windows - U=0.43, SHGC=0.39	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	Alternative 3

Table 117 - Residential Low-Rise EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #14 Residential Low-Rise					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$84,776	\$14,469	\$99,245	-	-
Package - Optimum EE	\$80,010	\$12,243	\$92,253	\$62,740	9.0
Package - Optimum EE + PV	\$42,669	\$12,243	\$54,912	\$584,627	12.0
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	\$83,400	\$14,469	\$97,869	\$16,408	11.9
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	\$83,346	\$14,469	\$97,815	\$22,236	15.5
CoolRoof - Abs=0.25	\$84,432	\$14,469	\$98,901	\$6,875	20.0
DHW - EF=0.640	\$84,776	\$13,894	\$98,670	\$19,206	33.4
DHW - EF=0.823	\$84,776	\$12,243	\$97,019	\$22,980	10.3
HVAC - EER 12.19, COP 3.52	\$83,337	\$14,469	\$97,806	\$3,925	2.7
HVAC - EER 12.06, COP 3.48	\$83,559	\$14,469	\$98,028	\$11,776	9.7
HVAC - EER 12.80, COP 3.66	\$82,601	\$14,469	\$97,070	\$11,676	5.4
Lighting - 0.648 watts/sf	\$82,566	\$14,469	\$97,035	\$55,800	25.2
PV - 9375 sqft	\$47,153	\$14,469	\$61,622	\$466,087	11.0
Roof - R38 batt	\$84,850	\$14,469	\$99,319	\$3,958	Never
Roof - R49 batt	\$85,046	\$14,469	\$99,515	\$13,750	Never
Walls - R19 batt	\$84,900	\$14,469	\$99,369	\$1,420	Never
Walls - R21 batt	\$85,016	\$14,469	\$99,485	\$2,051	Never
Walls - R21 batt + R5 rigid	\$85,103	\$14,469	\$99,572	\$5,996	Never
Windows - U=0.43, SHGC=0.39	\$84,861	\$14,469	\$99,330	\$1,280	Never
Windows - U=0.26, SHGC=0.37	\$85,135	\$14,469	\$99,604	\$3,824	Never
Windows - U=0.22, SHGC=0.22	\$83,835	\$14,469	\$98,304	\$11,676	12.4

Table 118 - Residential Low-Rise EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #14 Residential Low-Rise					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	347,832	1,187	1,107	2,294	-
Package - Optimum EE	328,556	1,121	938	2,059	235
Package - Optimum EE + PV	177,176	605	938	1,543	751
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	342,215	1,168	1,107	2,275	19
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	341,995	1,167	1,107	2,274	20
CoolRoof - Abs=0.25	346,445	1,182	1,107	2,289	5
DHW - EF=0.640	347,832	1,187	1,064	2,250	44
DHW - EF=0.823	347,832	1,187	938	2,125	169
HVAC - EER 12.19, COP 3.52	342,034	1,167	1,107	2,274	20
HVAC - EER 12.06, COP 3.48	342,942	1,170	1,107	2,277	17
HVAC - EER 12.80, COP 3.66	339,075	1,157	1,107	2,264	30
Lighting - 0.648 watts/sf	338,826	1,156	1,107	2,263	31
PV - 9375 sqft	195,328	666	1,107	1,774	520
Roof - R38 batt	348,148	1,188	1,107	2,295	-1
Roof - R49 batt	348,972	1,191	1,107	2,298	-4
Walls - R19 batt	348,371	1,189	1,107	2,296	-2
Walls - R21 batt	348,857	1,190	1,107	2,297	-3
Walls - R21 batt + R5 rigid	349,239	1,192	1,107	2,299	-5
Windows - U=0.43, SHGC=0.39	348,197	1,188	1,107	2,295	-1
Windows - U=0.26, SHGC=0.37	349,335	1,192	1,107	2,299	-5
Windows - U=0.22, SHGC=0.22	344,037	1,174	1,107	2,281	13

Table 119 - Residential Low-Rise EE Package and Single EE Measures Impacts on TDVI

Prototype #14 Residential Low-Rise					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	62,498	82	19	101	-
Package - Optimum EE	62,498	77	16	93	8
Package - Optimum EE + PV	62,498	38	16	54	47
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	62,498	81	19	100	1
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	62,498	81	19	99	2
CoolRoof - Abs=0.25	62,498	82	19	100	1
DHW - EF=0.640	62,498	82	18	100	1
DHW - EF=0.823	62,498	82	16	98	3
HVAC - EER 12.19, COP 3.52	62,498	81	19	99	2
HVAC - EER 12.06, COP 3.48	62,498	81	19	100	1
HVAC - EER 12.80, COP 3.66	62,498	80	19	99	2
Lighting - 0.648 watts/sf	62,498	80	19	99	2
PV - 9375 sqft	62,498	42	19	61	40
Roof - R38 batt	62,498	82	19	101	0
Roof - R49 batt	62,498	82	19	101	0
Walls - R19 batt	62,498	82	19	101	0
Walls - R21 batt	62,498	82	19	101	0
Walls - R21 batt + R5 rigid	62,498	82	19	101	0
Windows - U=0.43, SHGC=0.39	62,498	82	19	101	0
Windows - U=0.26, SHGC=0.37	62,498	82	19	101	0
Windows - U=0.22, SHGC=0.22	62,498	81	19	100	1

Detailed Modeling Results - Prototype 15 – Residential Low-Rise

Table 120 - Residential Low-Rise EE Package Composition

Measure	Baseline	Alternative 1	Alternative 2	Alternative 3	EE Package
Appliance	Dish EF=.46, Clothes MMEF=1.26	Dish EF=.64, Clothes MMEF=2.0	Dish EF=.64, Clothes MMEF=2.2	None	No Alternative
Roof Material	CoolRoof - Abs=0.40	CoolRoof - Abs=0.25	None	None	Alternative 1
Water Heating	DHW - EF=0.594	DHW - EF=0.640	DHW - EF=0.823	None	Alternative 2
Space Heating	Heating - AFUE=75%	Heating - AFUE=85%	None	None	No Alternative
Space Cooling	HVAC - COP 6.10	HVAC - COP 7.63	None	None	Alternative 1
Lighting	Lighting - 0.703 watts/sf	Lighting - 0.664 watts/sqft	None	None	No Alternative
Photovoltaics	No PV	PV - 9763 sqft	None	None	Alternative 1
Roof Insulation	Roof - U=R10 batt	Roof - U=R15 rigid	Roof - U=R20 rigid	None	Alternative 2
Wall Insulation	Walls - R13 batt	Walls - R19 batt	Walls - R21 batt	Walls - R21 batt + R5 rigid	Alternative 3
Windows	Windows - U=0.48, SHGC=0.47	Windows - U=0.26, SHGC=0.37	Windows - U=0.22, SHGC=0.22	None	Alternative 2

Table 121 - Residential Low-Rise EE Package and Single EE Measures Impacts on Utility Costs and Paybacks

Prototype #15 Residential Low-Rise					
Alternative	Elec Utility \$	Gas Utility \$	Total Utility	Alt Cost \$	Payback yrs
Baseline	\$181,789	\$48,919	\$230,709	-	-
Package - Optimum EE	\$168,877	\$44,007	\$212,885	\$106,601	6.0
Package - Optimum EE + PV	\$131,077	\$44,004	\$175,081	\$584,814	10.6
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	\$179,739	\$48,922	\$228,661	\$35,726	17.4
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	\$179,616	\$48,922	\$228,538	\$48,416	22.3
CoolRoof - Abs=0.25	\$180,046	\$48,922	\$228,968	\$7,159	4.1
DHW - EF=0.640	\$182,651	\$47,563	\$230,214	\$41,819	84.5
DHW - EF=0.823	\$181,789	\$44,064	\$225,853	\$50,036	10.3
Heating - AFUE=85%	\$181,789	\$48,909	\$230,698	\$1,000	90.9
HVAC - COP 7.63	\$176,440	\$48,919	\$225,360	\$5,671	1.1
Lighting - 0.664 watts/sqft	\$176,990	\$48,925	\$225,915	\$121,500	25.3
PV - 9763 sqft	\$142,691	\$48,919	\$191,611	\$485,372	12.4
Roof - U=R15 rigid	\$181,671	\$48,909	\$230,580	\$5,424	42.0
Roof - U=R20 rigid	\$181,467	\$48,894	\$230,362	\$9,763	28.1
Walls - R19 batt	\$181,659	\$48,914	\$230,573	\$2,967	21.8
Walls - R21 batt	\$181,580	\$48,913	\$230,493	\$4,285	19.8
Walls - R21 batt + R5 rigid	\$181,117	\$48,900	\$230,017	\$12,527	18.1
Windows - U=0.26, SHGC=0.37	\$178,474	\$48,914	\$227,388	\$7,024	2.1
Windows - U=0.22, SHGC=0.22	\$175,595	\$48,918	\$224,513	\$21,445	3.5

Table 122 - Residential Low-Rise EE Package and Single EE Measures Impacts on Energy Consumption

Prototype #15 Residential Low-Rise					
Alternative	Elec kWh	Elec MMBtu	Gas MMBtu	Total MMBtu	MMBtu Saved
Baseline	744,371	2,540	3,725	6,264	-
Package - Optimum EE	692,345	2,362	3,351	5,714	550
Package - Optimum EE + PV	539,100	1,839	3,351	5,191	1,073
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	736,021	2,511	3,725	6,236	28
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	735,522	2,510	3,725	6,234	30
CoolRoof - Abs=0.25	737,301	2,516	3,725	6,240	24
DHW - EF=0.640	745,095	2,542	3,622	6,164	100
DHW - EF=0.823	744,371	2,540	3,356	5,896	368
Heating - AFUE=85%	744,371	2,540	3,724	6,263	1
HVAC - COP 7.63	722,879	2,466	3,725	6,191	73
Lighting - 0.664 watts/sqft	724,843	2,473	3,725	6,198	66
PV - 9763 sqft	585,882	1,999	3,725	5,724	540
Roof - U=R15 rigid	743,934	2,538	3,724	6,262	2
Roof - U=R20 rigid	743,132	2,536	3,723	6,258	6
Walls - R19 batt	743,872	2,538	3,724	6,262	2
Walls - R21 batt	743,558	2,537	3,724	6,261	3
Walls - R21 batt + R5 rigid	741,716	2,531	3,723	6,254	10
Windows - U=0.26, SHGC=0.37	730,946	2,494	3,724	6,218	46
Windows - U=0.22, SHGC=0.22	719,268	2,454	3,724	6,179	85

Table 123 - Residential Low-Rise EE Package and Single EE Measures Impacts on TDVI

Prototype #15 Residential Low-Rise					
Alternative	Space Sqft	Elec TDVI	Gas TDVI	Total TDVI	TDVI Saved
Baseline	130,171	85	30	115	-
Package - Optimum EE	130,171	78	27	106	9
Package - Optimum EE + PV	130,171	59	27	86	29
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 1.26	130,171	84	30	114	1
Appliance - Dishwasher EF=0.64, Clothes Washer MMEF = 2.00	130,171	84	30	114	1
CoolRoof - Abs=0.25	130,171	84	30	114	1
DHW - EF=0.640	130,171	85	29	114	1
DHW - EF=0.823	130,171	85	27	112	3
Heating - AFUE=85%	130,171	85	30	115	0
HVAC - COP 7.63	130,171	82	30	112	3
Lighting - 0.664 watts/sqft	130,171	82	30	113	2
PV - 9763 sqft	130,171	65	30	95	20
Roof - U=R15 rigid	130,171	84	30	115	0
Roof - U=R20 rigid	130,171	84	30	115	0
Walls - R19 batt	130,171	85	30	115	0
Walls - R21 batt	130,171	84	30	115	0
Walls - R21 batt + R5 rigid	130,171	84	30	115	0
Windows - U=0.26, SHGC=0.37	130,171	83	30	113	2
Windows - U=0.22, SHGC=0.22	130,171	82	30	112	3

APPENDIX A

Eastern Urban Center Modeling Assumptions

Eastern Urban Center Construction Types

For the purposes of this study, the following construction types apply unless otherwise noted.

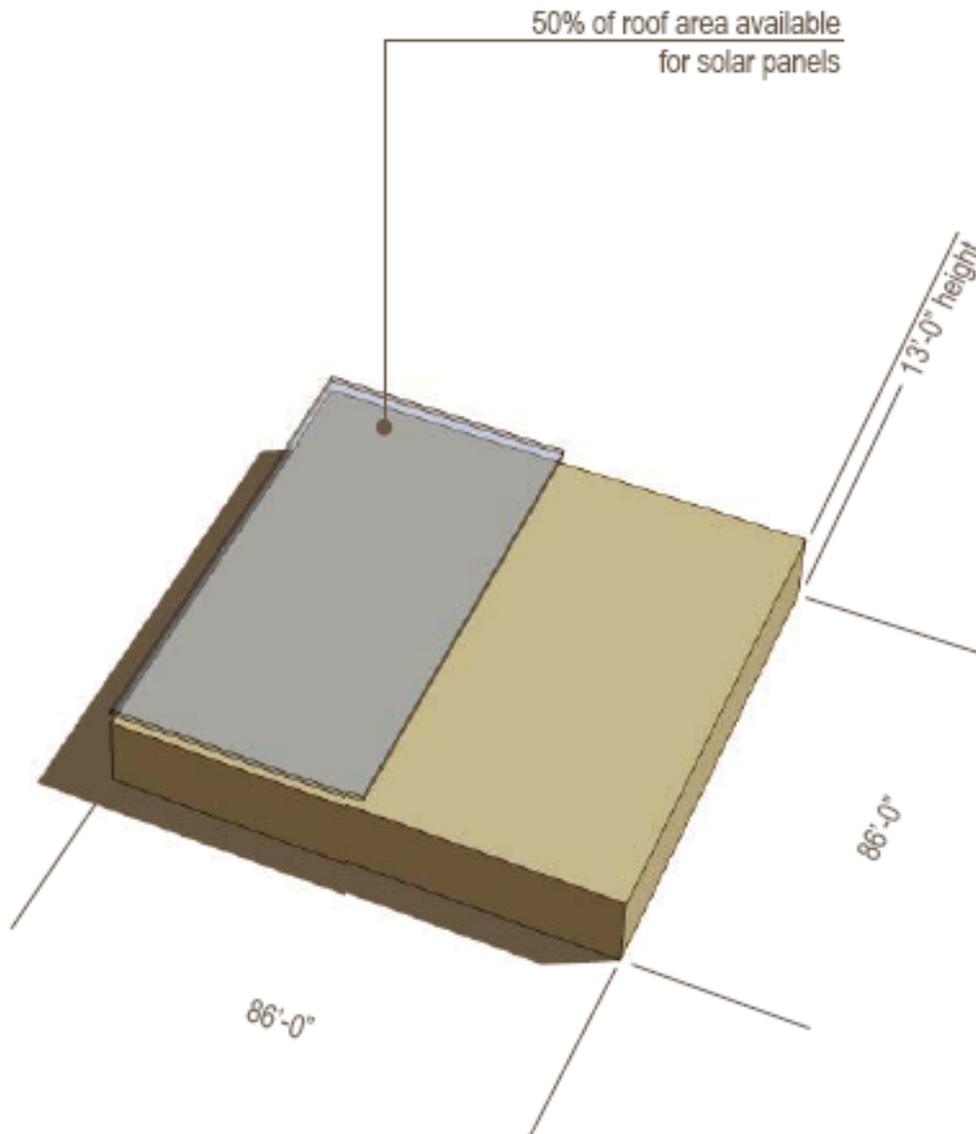
- Type I: Structural steel frame with exterior metal studs skinned with stone tiles on cement plaster system. Mineral fiber batts are placed between the framing studs and Gypsum board is used for the interior. Roofs are flat lightweight concrete poured into metal decking with a 3-ply BUR over the concrete.
- Type II: Reinforced “poured-in-place” concrete exterior walls with plaster exterior finish. Steel framing is attached to the inside of the concrete walls with mineral fiber batts between the studs and Gypsum board on the interior. Roofs are flat 3-ply BUR over 2” rigid insulation boards over metal decking.
- Type III: Wood framed walls with lath/plaster and brick veneer exterior. The walls are filled with mineral fiber batts between the studs and Gypsum board will be on the interior. Roofs are flat wood trusses with rigid insulation over plywood decking. A 3-ply built-up-roof covers the rigid insulation.
- Type V: Wood framed with plaster exterior finish, fiberglass batts within the framing, and Gypsum interior. Roofs are flat wood trusses with fiberglass batt insulation below the wood decking. A 3-ply built-up-roof covers the wood decking. If the roofs are pitched with an attic, fiberglass batt insulation is placed at the attic floor and flat concrete tiles cover the roof exterior.

Eastern Urban Center Building Prototypes

Note: For classification purposes, although in some cases more than one type of construction may be used, a single construction type for each prototype was selected. The construction types are intended to meet the code but be specific to this study.

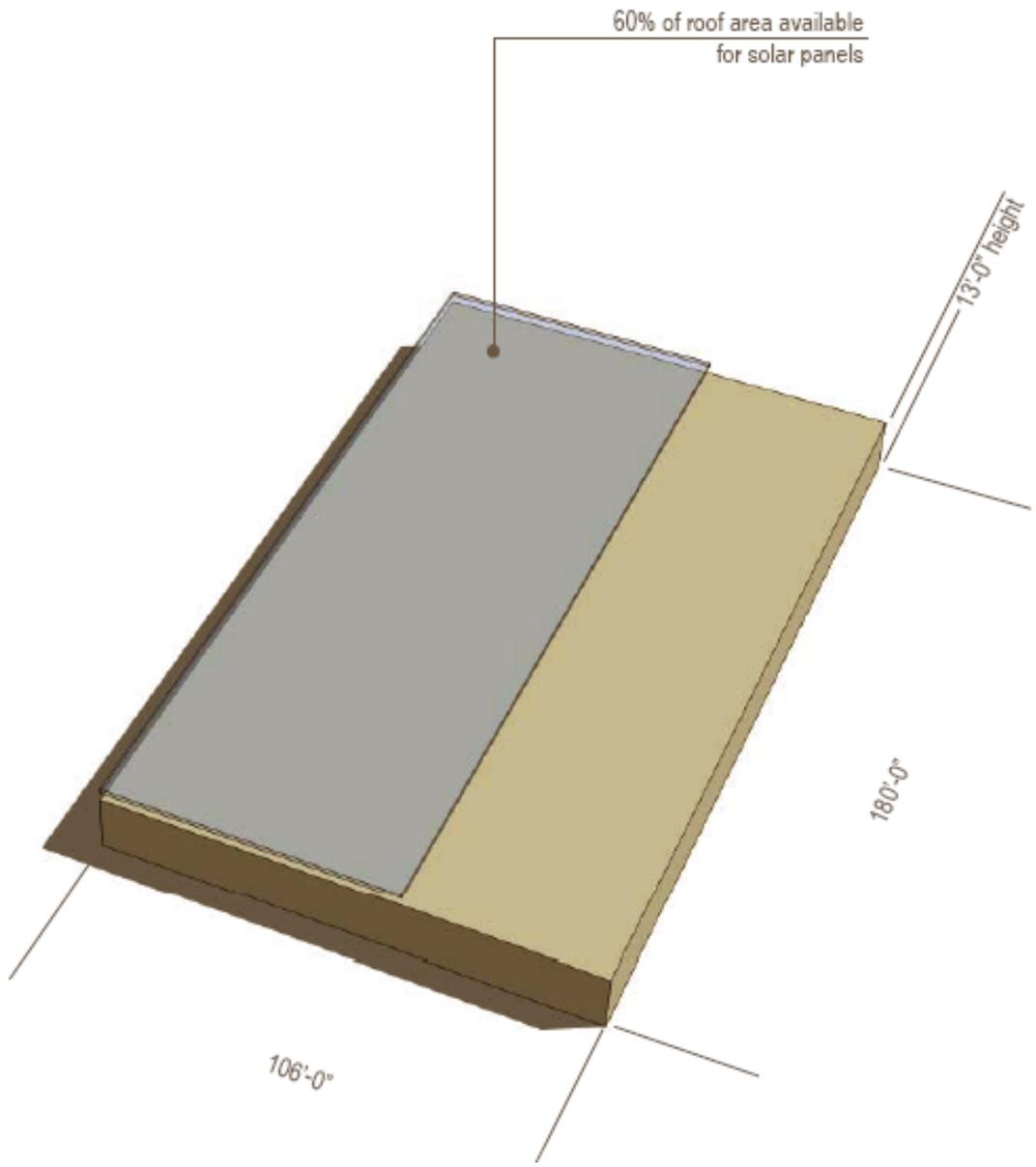
Commercial Buildings – Prototypes 1-8

1. Freestanding Full-Service Restaurant Building; Type III construction, approximately 7,400 sf single-story slab on grade, typical of a national-chain casual full-service restaurant with three independently controlled zone types (Dining Room, Kitchen, and Hood). The floor-to-floor height is 13'-0" and 50% of the roof area is available for solar cells.

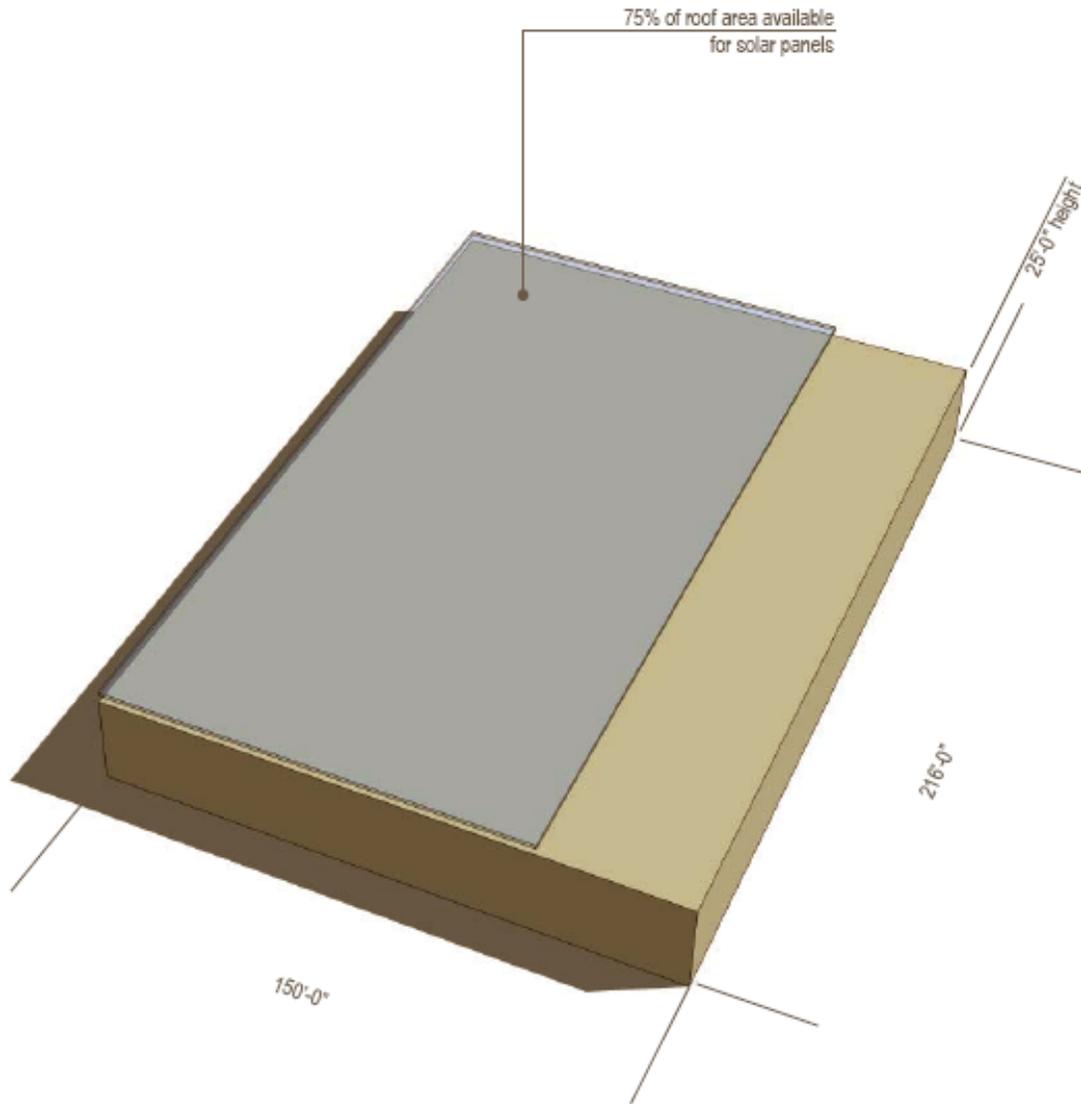


2. Multi-Tenant Retail Shop Buildings; Type III construction, approximately 20,000 sf single-story slab on grade, accommodating 14 individual tenants

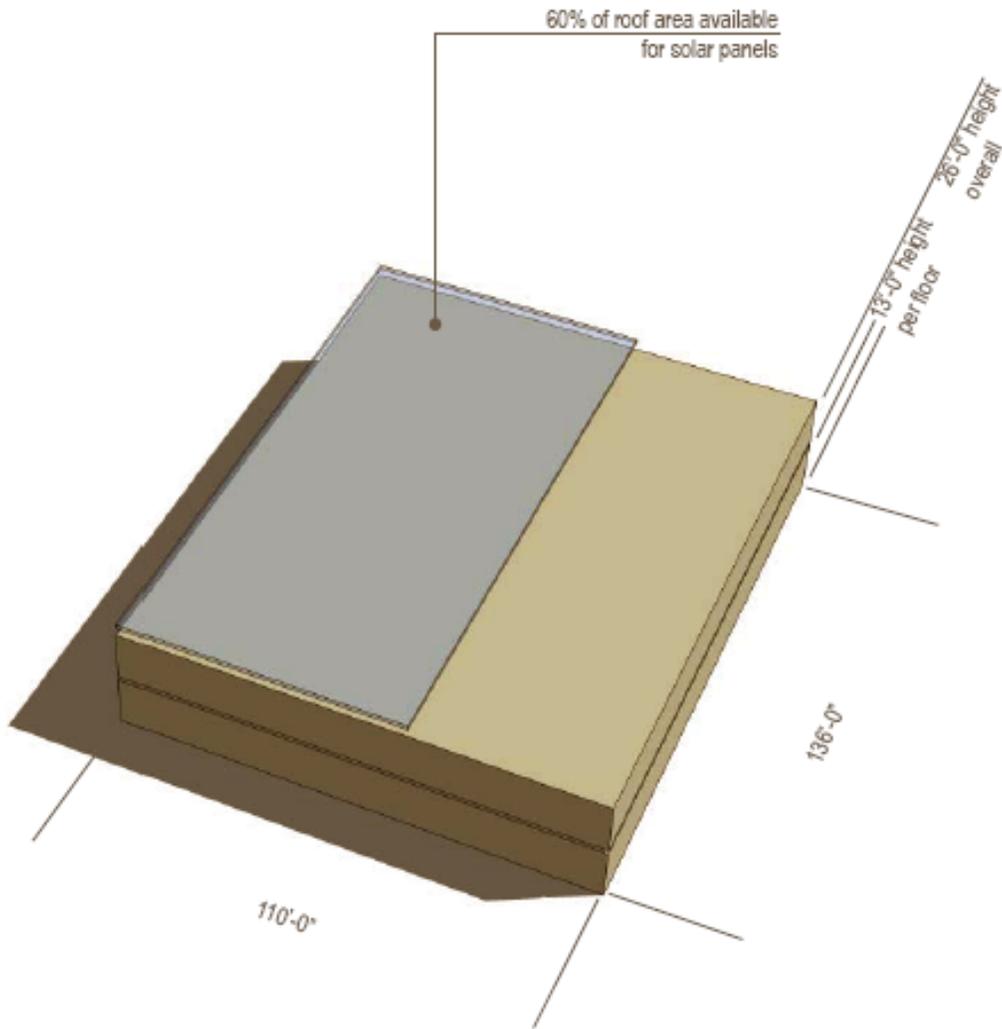
averaging 1,400 sf each. The floor-to-floor height is 13'-0". 60% of the roof area is available for solar cells.



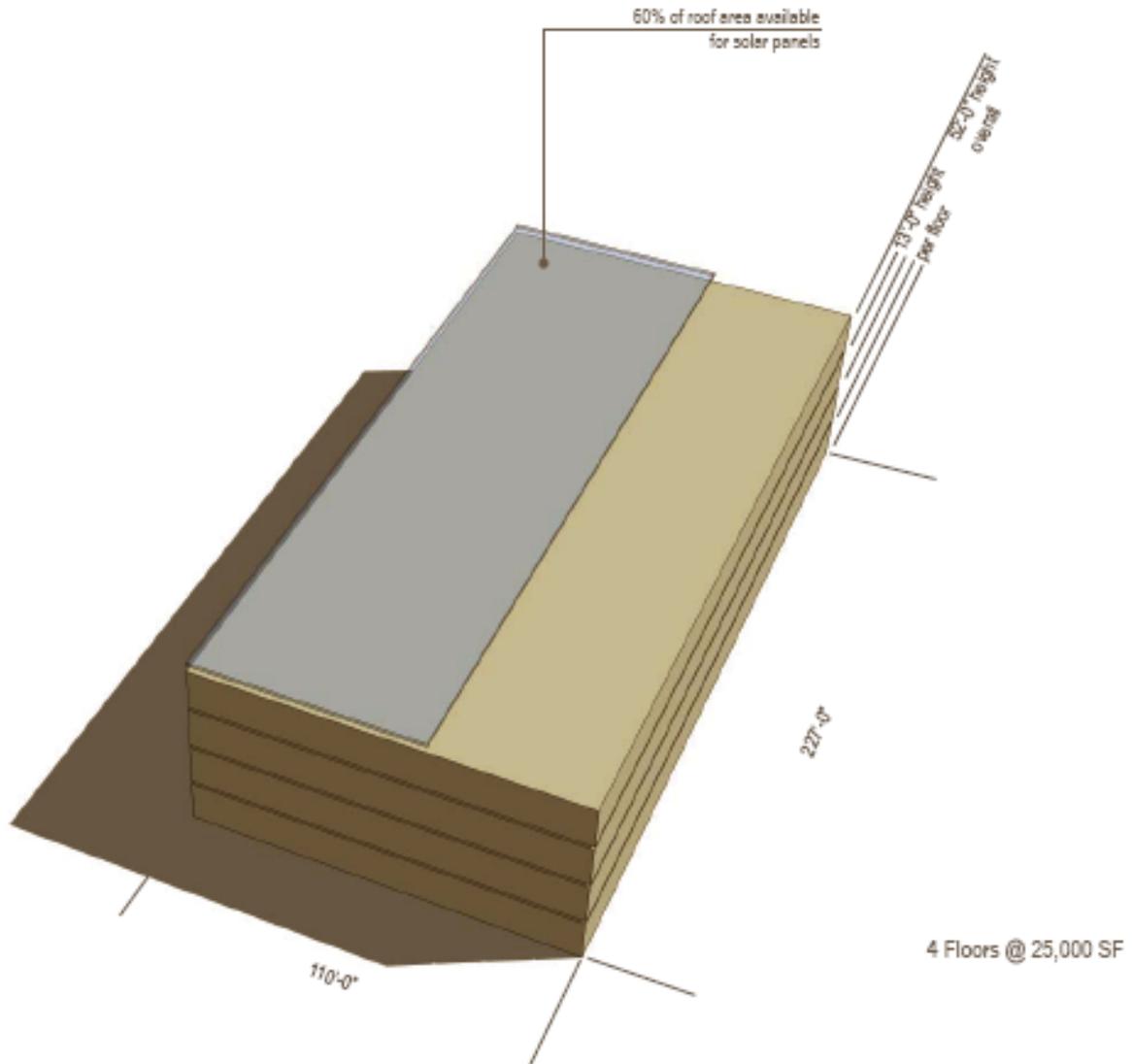
3. Major Retailer Building; Type III construction, approximately 32,500 sf free standing single-story slab on grade, typical of a larger department store with 25'-0" floor height and 75% of the roof area available for solar cells.



4. Office Building - Low-Rise; Type III construction, approximately 30,000 sf two-story slab on 15,000 sf grade, typical of a suburban office park. The floor-to-floor height is 13'-0" and 60% of the roof area is available for solar cells.

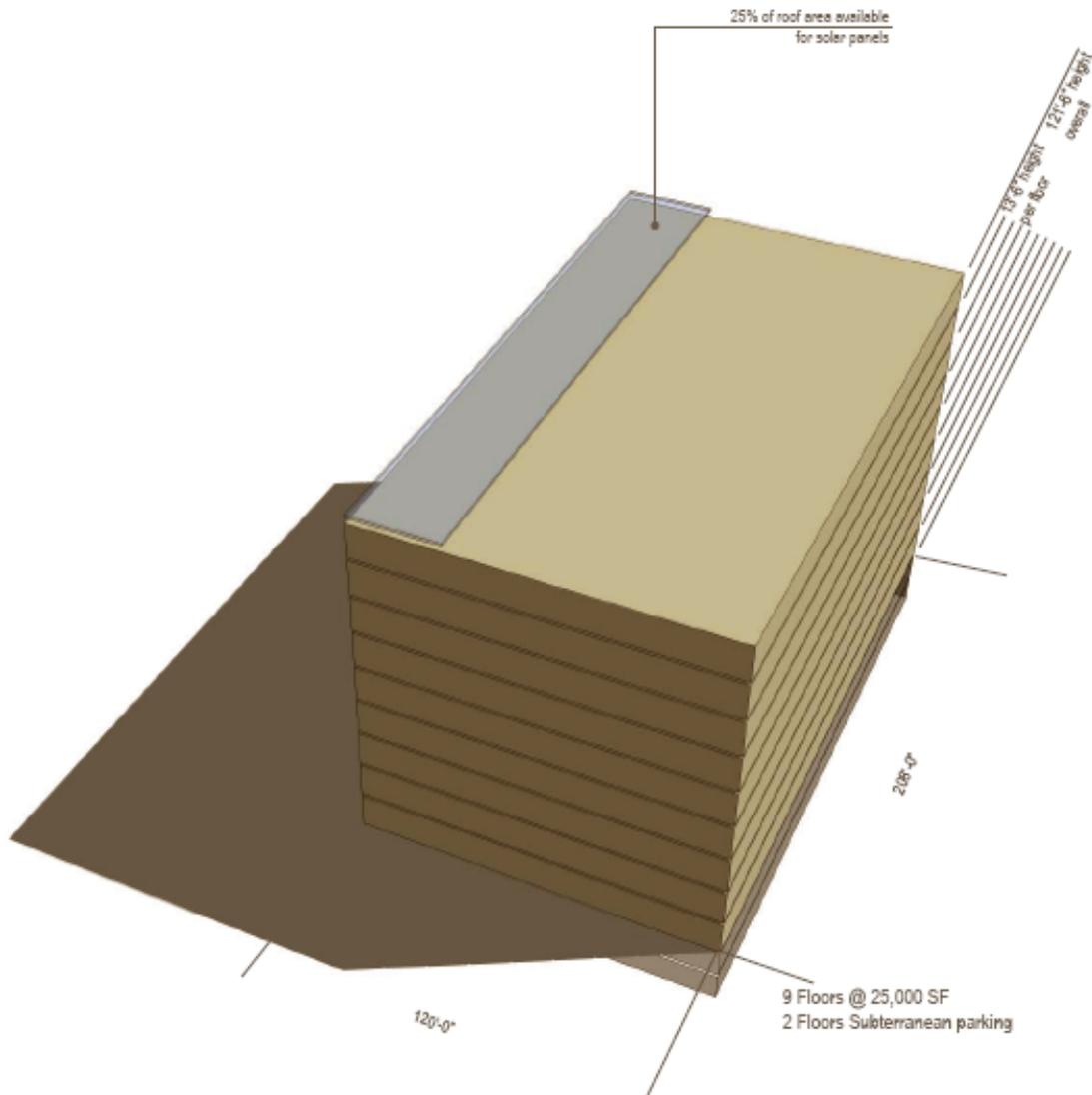


5. Office Building - Mid-Rise; Type II construction, approximately 100,000 sf four-story slab on 25,000 sf grade, typical of a suburban office park. The floor-to-floor height is 13'-0" and 60% of the roof area available for solar cells.



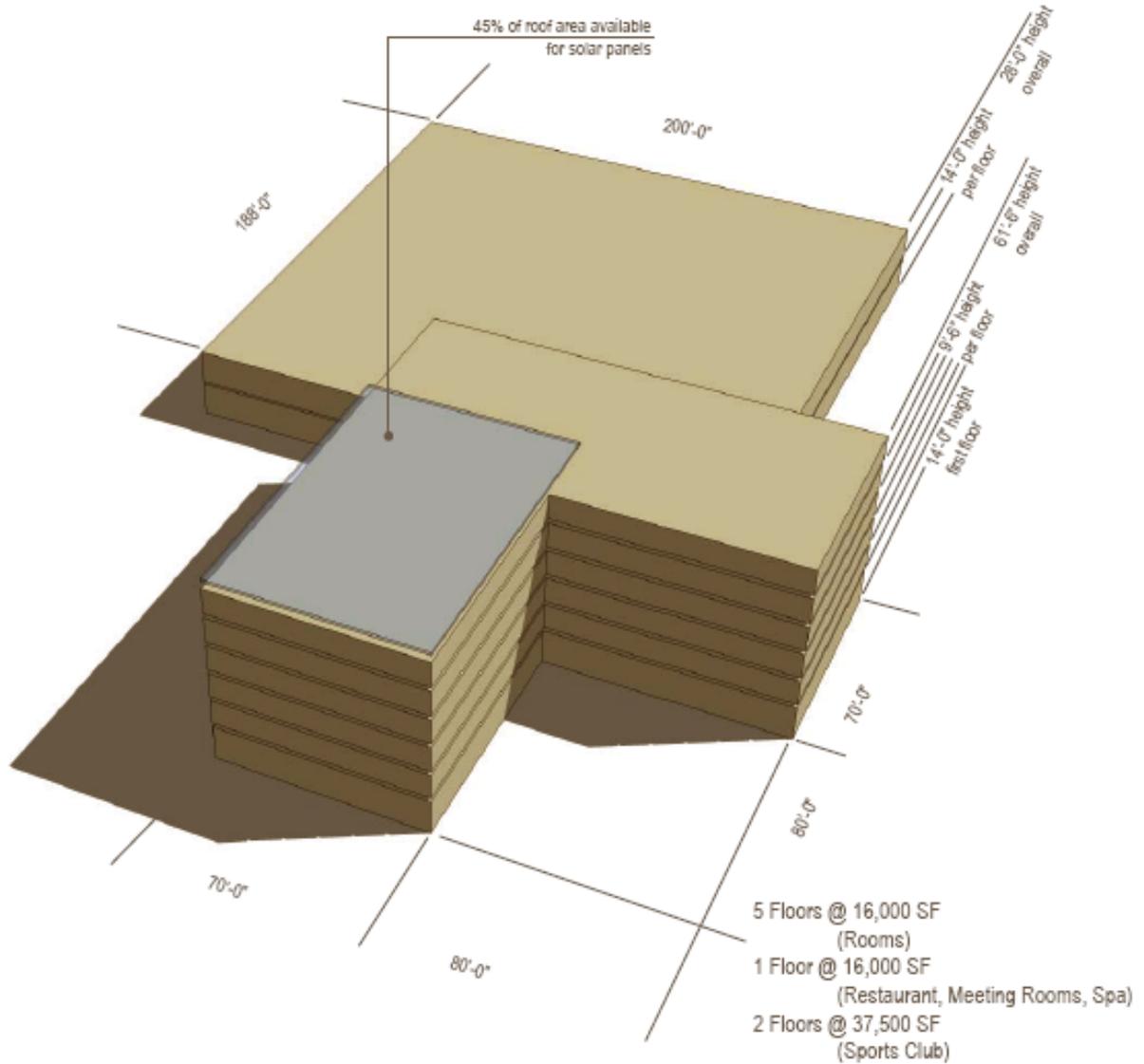
6. Office Building - High-Rise; Type I construction, approximately 225,000 sf nine-story at 25,000 sf per floor, two floors of subterranean parking. The

floor-to-floor height is 13'-6" and 25% of the roof area is available for solar cells.



7. Hotel - Large; Type II construction, approximately 171,000 sf, six-story slab on 54,000 sf grade. First floor at 16,000 sf includes a 7,400 sf restaurant and meeting rooms. Five upper floors at 16,000 sf each are guest rooms.

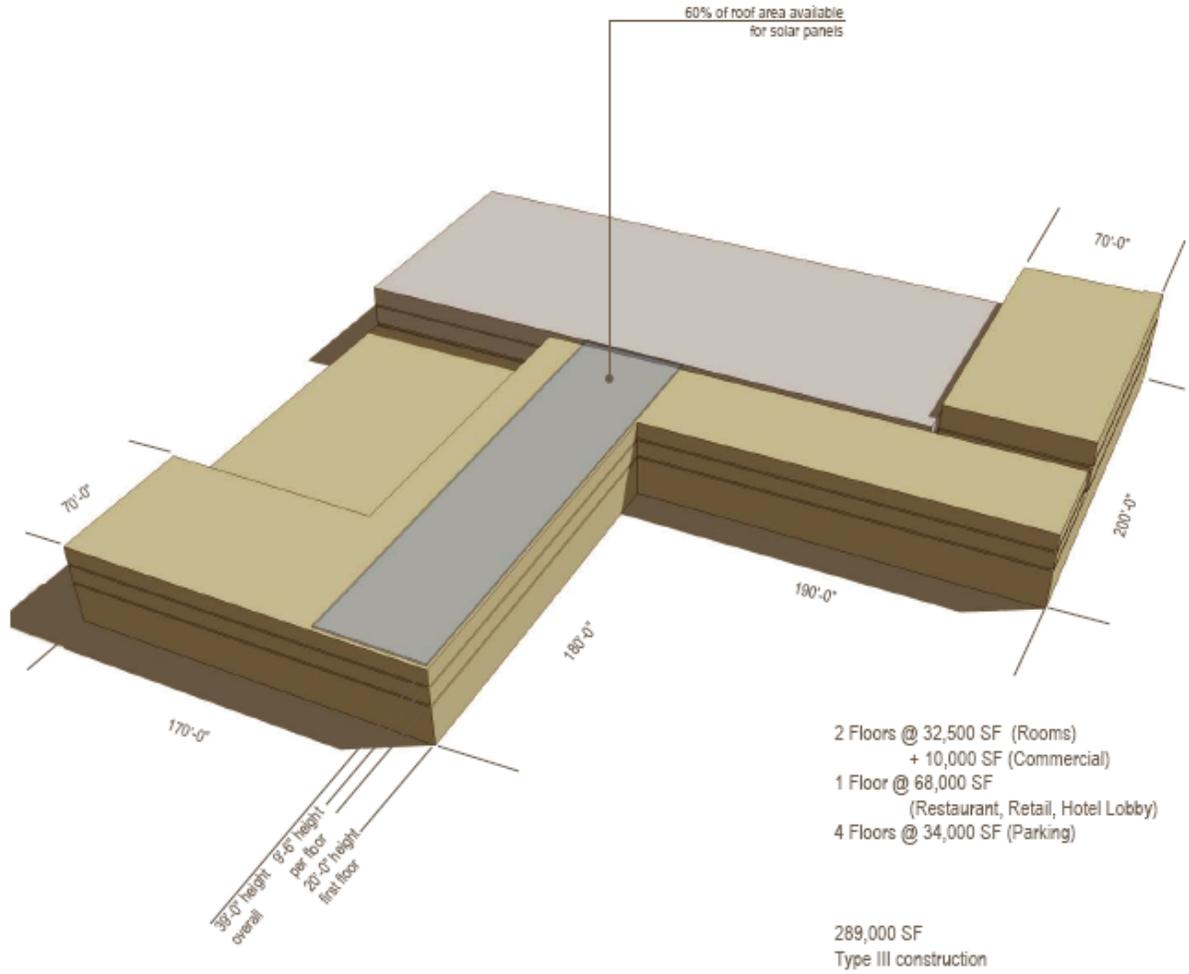
Two-story adjacent sports club at 37,500 sf per floor. The floor-to-floor height is 14'-0" except guest rooms are 9'-6". 45% of the roof area is available for solar cells.



8. Hotel - Small; Type III construction, approximately 152,000 sf three-story slab on 102,600 sf grade. Guest rooms and commercial space are located at upper two levels. The first level includes a 7,400 sf restaurant, retail and the hotel lobby. Interior floor space demised to accommodate 19 individual

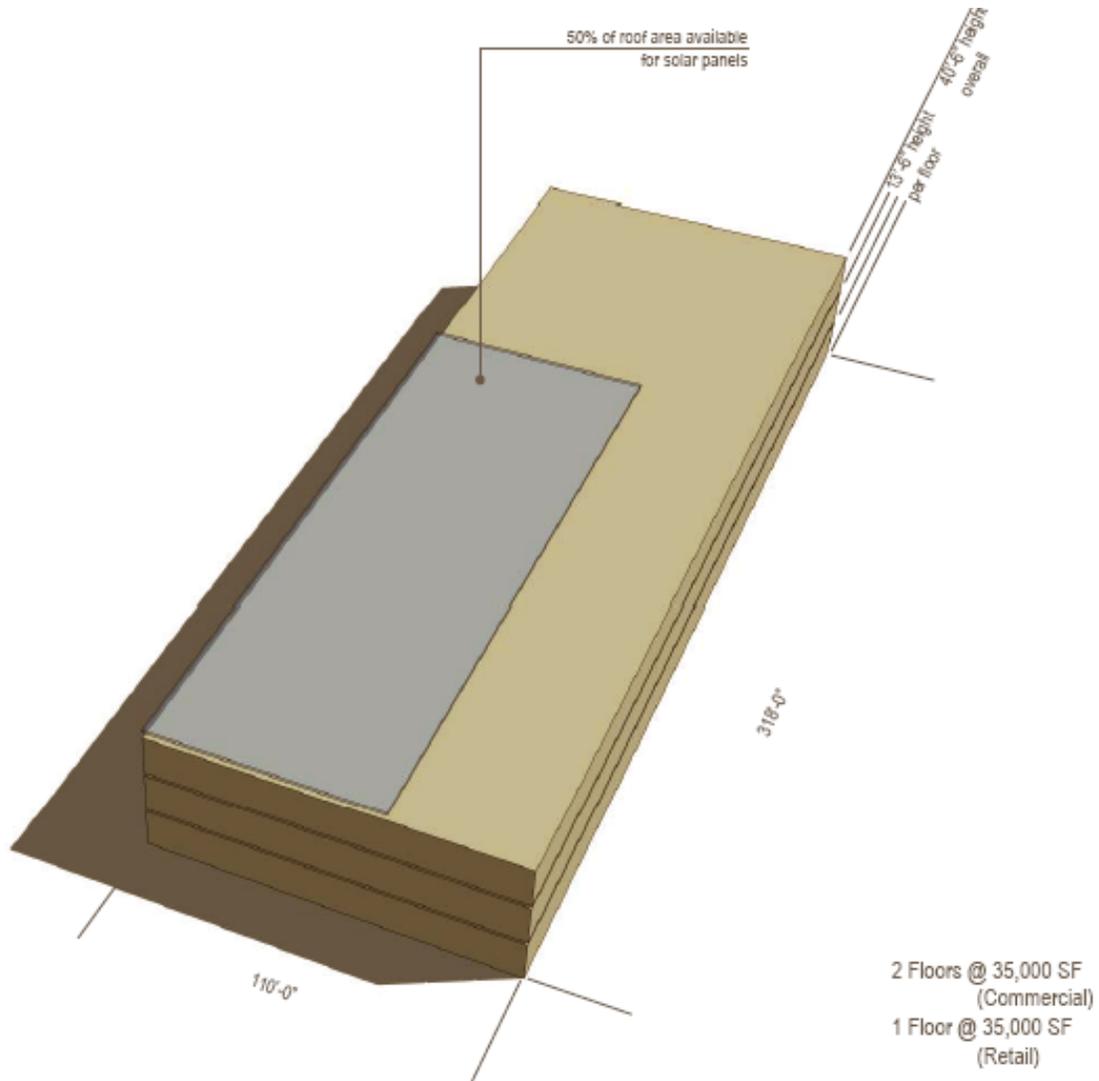
retail tenants at street level averaging 2,700 sf each. The first level floor-to-floor height is 20'-0". The guest room levels are 9'-6". 60% of the roof area is available for solar cells.

Adjacent to the hotel complex is a two-story parking structure, approximately 68,000 sf.

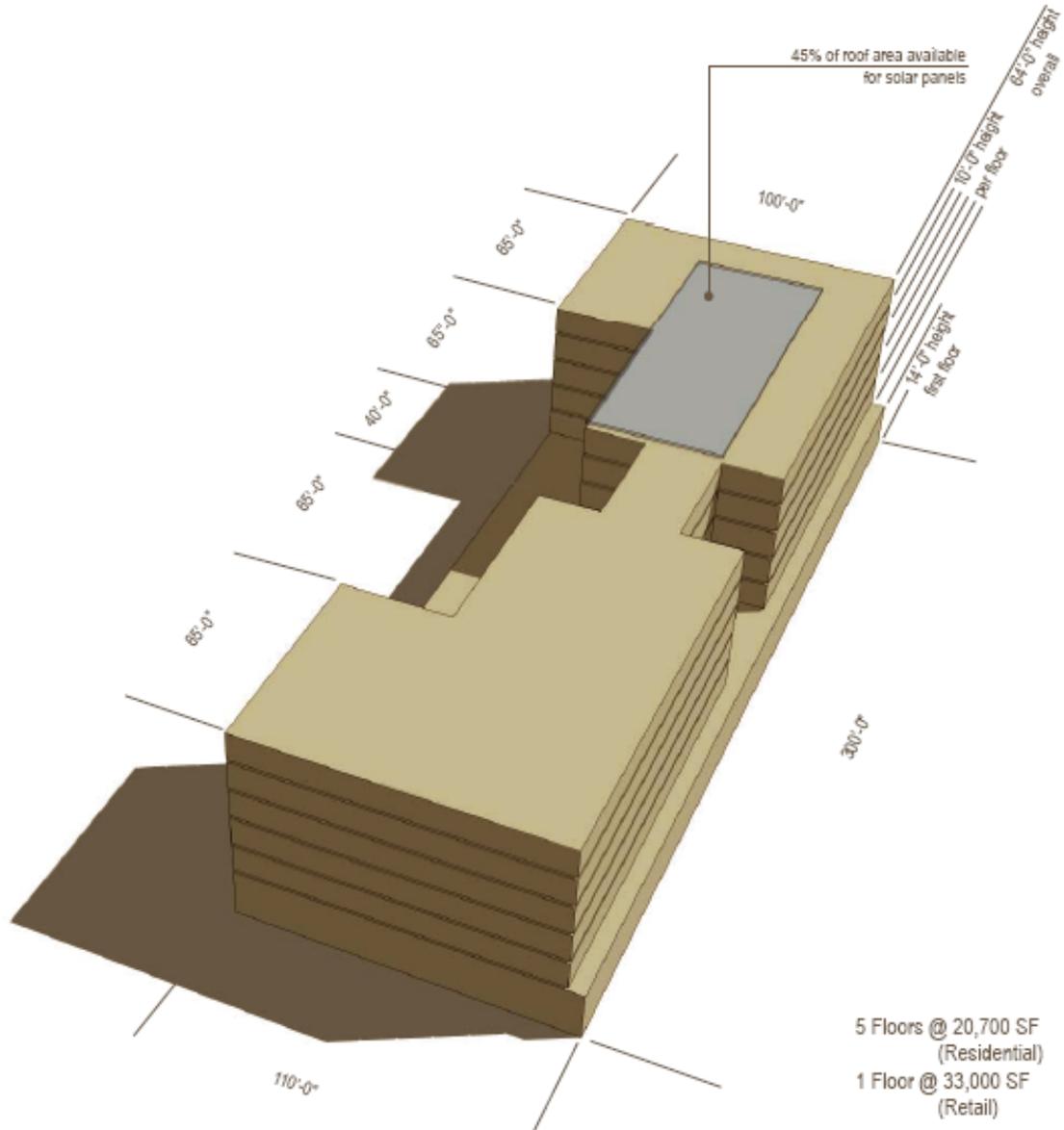


Mixed Use Buildings – Prototypes 9-12

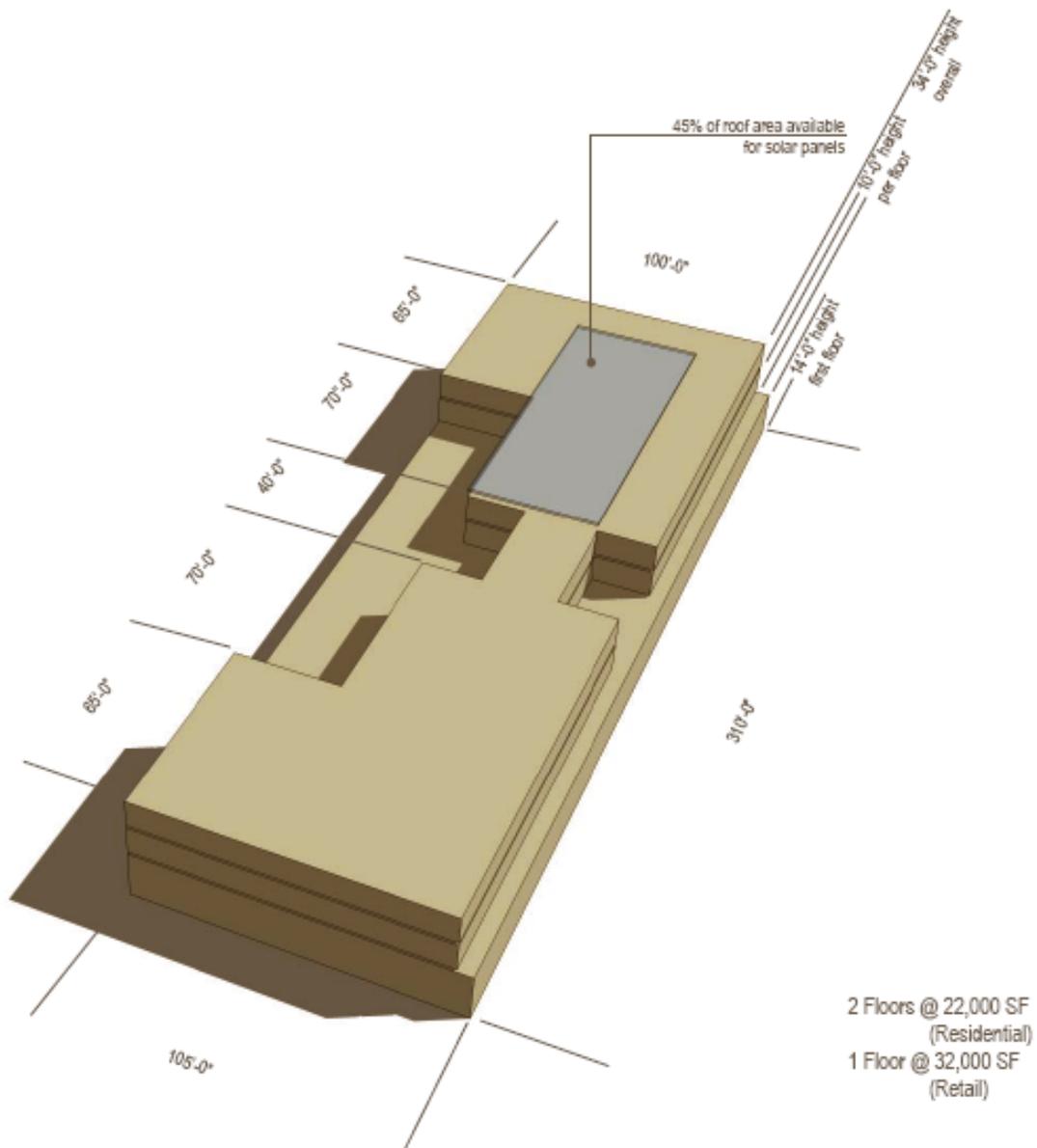
9. Retail/Commercial Mixed Use Building: Type II construction, approximately 105,000 sf three-story slab on 35,000 sf grade, mixed use building with street level retail shops and two floor levels of service commercial or office space above. Interior floor space demised to accommodate 24 individual retail tenants at street level averaging 1,400 sf each. The floor-to-floor height is 13'-6" and 50% of the roof area is available for solar cells.



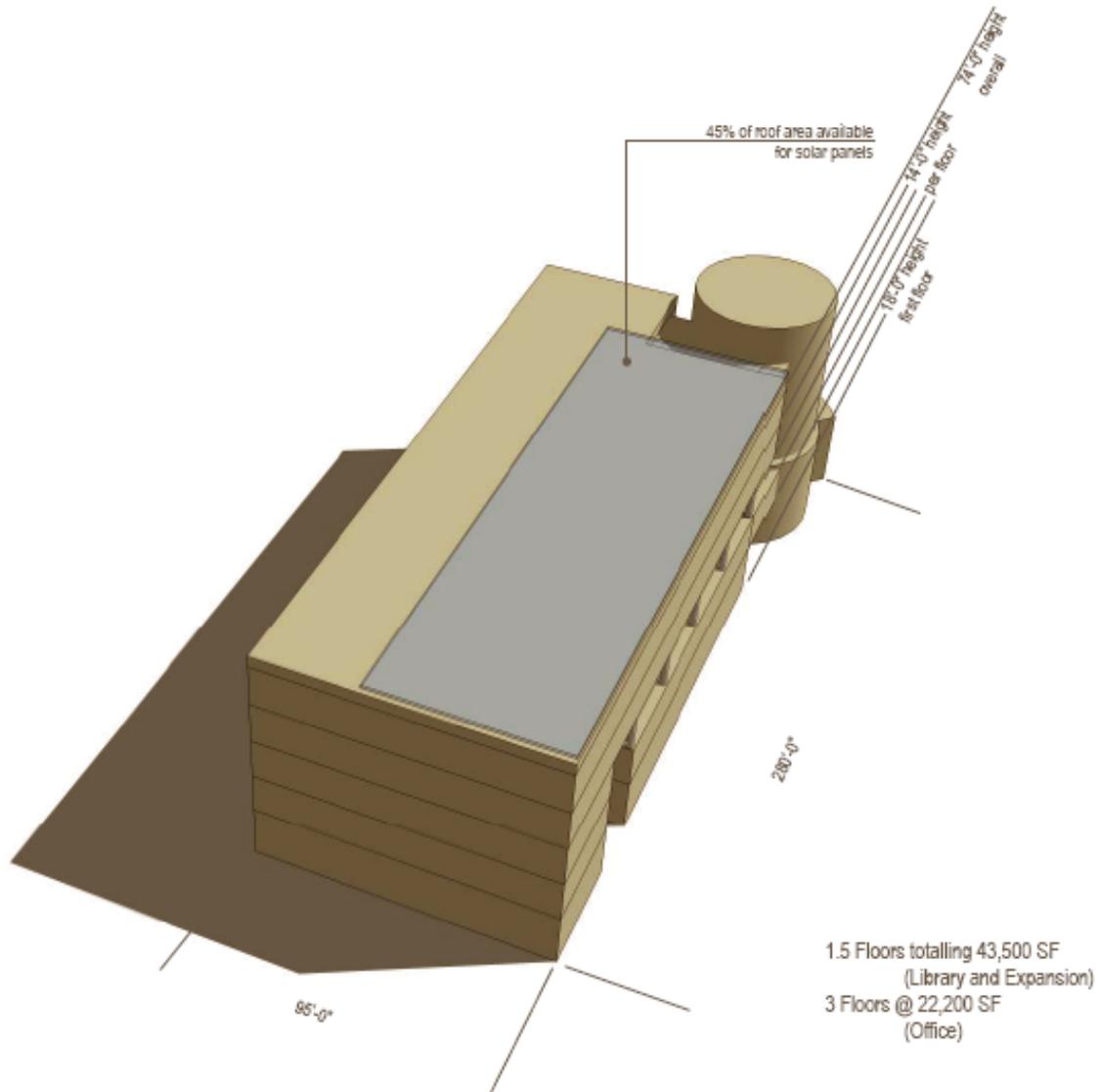
10. Retail/Residential Mixed Use Mid-Rise Building: Type III construction, approximately 136,000 sf six-story mixed use slab on 33,000 sf grade. Interior floor space demised to accommodate 24 individual retail tenants at street level averaging 1,400 sf each. Five floor levels of residential apartments above the first floor totaling approximately 103,300 sf. Residential floor space demised to accommodate 110 individual units; 47 Studios, 34 2BR and 29 3BR units ranging from approximately 600 to 1,300 sf each. The floor-to-floor height for the first floor retail is 14'-0" and 10'-0" for the residential levels above. 50% of the roof area is available for solar cells.



11. Retail/Residential Mixed Use Low-Rise Building; Type II construction at ground level and type V construction above, approximately 76,000 sf three-story mixed use slab on 33,000 sf grade. Interior floor space demised to accommodate 24 individual retail tenants at street level averaging 1,400 sf each. Two floor levels of residential apartments above the first floor totaling approximately 44,000 sf. Residential floor space demised to accommodate 46 individual units; 18 Studios, 16 2BR and 12 3BR units ranging from approximately 600 to 1,300 sf each. The floor-to-floor height for the first floor retail is 14'-0" and 10'-0" for the residential levels above. 45% of the roof area is available for solar cells.

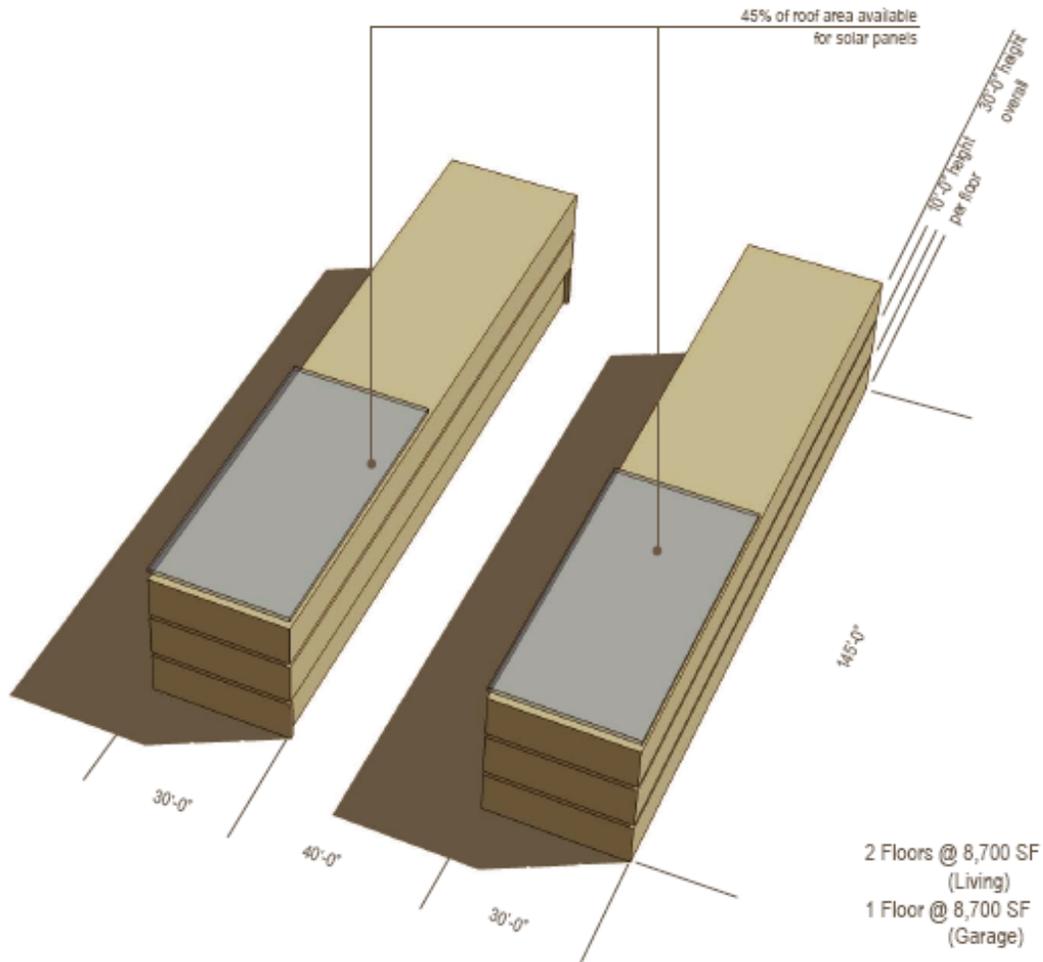


12. Civic/Commercial Mixed Use Building: Type II construction, approximately 110,000 sf five-story slab on 27,000 sf grade, mixed use building with 1.5 levels of civic (library) space and 3.5 levels of office space above. Interior floor space demised to accommodate 43,500 sf of library and 66,600 sf of office space. The ground level floor-to-floor height is 18'-0" and 14'-0" for the four levels above. 45% of the roof area is available for solar cells.

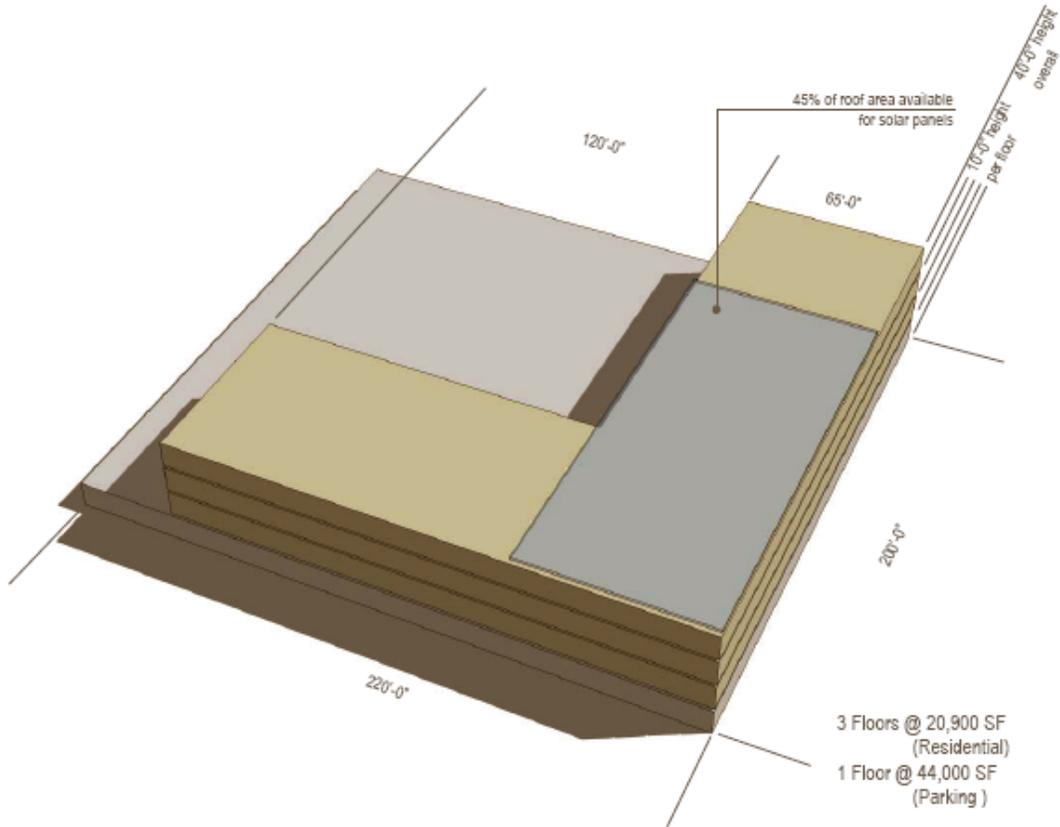


Residential Buildings – Prototypes 13-15

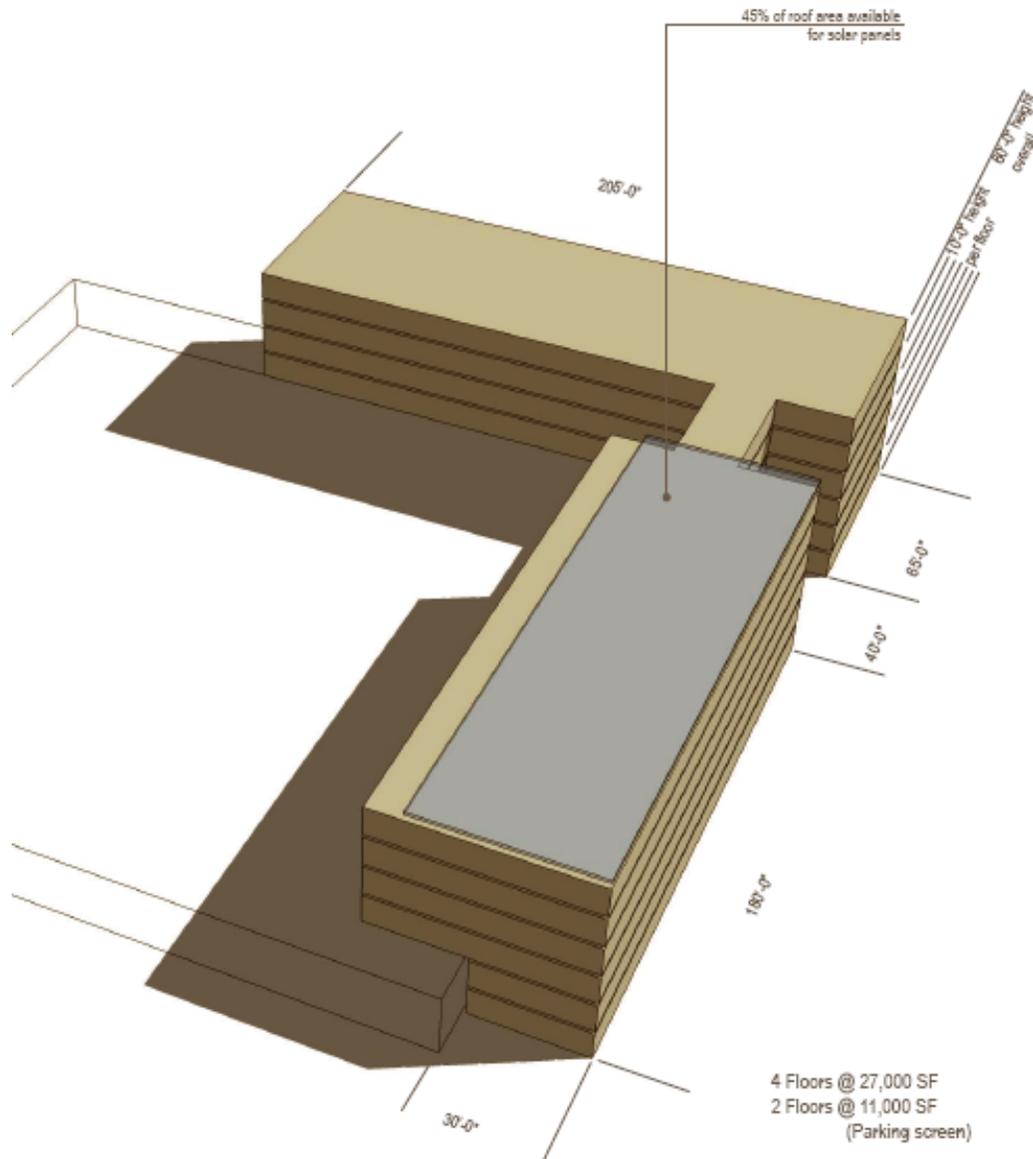
13. Residential Multi-Family/Town Home (20+ DU/acre); Type V construction, two parallel town home buildings approximately 9,800 sf each. Three-story structure with tuck-under parking. Interior floor space demised to accommodate 7 individual units; three 2BR, three 3BR, and one 4 BR units ranging from approximately 1300 sf to 1,600 sf each. The floor-to-floor height is 10'-0" and 45% of the roof area is available for solar cells.



14. Residential – Low Rise (30-40+ DU/acre); Type II construction at ground level parking and type V construction above, approximately 63,000 sf three-story residential above 44,000 sf parking structure. Residential floor space demised to accommodate 62 individual units; 19 Studios, 24 2BR and 19 3BR units ranging from approximately 600 to 1,300 sf each. The floor-to-floor height is 10'-0" for the residential levels. 45% of the roof area is available for solar cells.



15. Residential – Mid-Rise (60-75+ DU/acre); Type III construction, approximately 130,000 sf six-story residential above parking structure. Residential floor space demised to accommodate 135 individual units; 19 Studios, 48 2BR and 36 3BR units ranging from approximately 600 to 1,300 sf each. The floor-to-floor height is 10'-0" for the residential levels. 45% of the roof area is available for solar cells.



External Walls

External Walls – Prototype 6

Applicable to the following Type I commercial prototypes:	Prototype #
Office Building – High-rise	6

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Metal frame, metal studs 2x6.16 16 Ga. R11 mineral batt, 1" stone tile ext. on lath/plaster, 5/8" GWB int.	Metal frame, metal studs 2x6.16 16 Ga. R19 mineral batt, 1" stone tile ext. on lath/plaster, 5/8" GWB int.	Metal frame, metal studs 2x6.16 16 Ga. R21 mineral batt, 1" stone tile ext. on lath/plaster, 5/8" GWB int.	Metal frame, metal studs 2x6.16 16 Ga. R21 mineral batt, 1" stone tile ext. on lath/plaster over 1" R5 rigid insul, 5/8" GWB int.
Overall U = 0.158	Overall U = 0.136	Overall U = 0.132	Overall U = 0.080

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.11/sqft	\$0.15/sqft	\$0.29/sqft

External Walls – Prototypes 5, 7, 10, 11, and 12

Applicable to the following Type II commercial prototypes:	Prototype #
Office Building – Mid-rise	5
Hotel – Large	7
Retail/Residential Mixed Use Mid-rise Building (Retail only)	10
Retail/Residential Mixed Use Low-Rise Building (Retail only)	11
Civic/Commercial Mixed Use	12

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
5" poured-in-place conc, metal studs 2x6.16 16 Ga. R11 mineral batt, 1" plaster ext, 5/8" GWB int.	5" poured-in-place conc, metal studs 2x6.16 16 Ga. R19 mineral batt, 1" plaster ext, 5/8" GWB int.	5" poured-in-place conc, metal studs 2x6.16 16 Ga. R21 mineral batt, 1" plaster ext, 5/8" GWB int.	5" poured-in-place conc, metal studs 2x6.16 16 Ga. R21 mineral batt, 1" plaster over 1" R5 rigid insul, 5/8" GWB int.
Overall U = 0.152	Overall U = 0.118	Overall U = 0.112	Overall U = 0.070

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.11/sqft	\$0.15/sqft	\$0.29/sqft

External Walls – Prototypes 1, 2, 3, 4, 8, and 9

Applicable to the following Type III commercial prototypes:	Prototype #
Freestanding Full-Service Restaurant Building	1
Multi-tenant Retail Shop Building	2
Major Retailer Building	3
Office Building – Low-rise	4
Hotel – Small	8
Retail/Commercial Mixed Use Building	9

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Wood frame, wood studs 2x6.16 w/ R11 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R19 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 3" brick veneer ext. on lath/plaster over 1" R5 rigid insul, 5/8" GWB int.
Overall U = 0.086	Overall U = 0.062	Overall U = 0.056	Overall U = 0.042

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.11/sqft	\$0.15/sqft	\$0.40/sqft

External Walls – Prototype 15

Applicable to the following Type III residential prototypes:	Prototype #
Residential Mid-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R13

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Wood frame, wood studs 2x6.16 w/ R13 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R19 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 3" brick veneer ext. on lath/plaster, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 3" brick veneer ext. on lath/plaster over 1" R5 rigid insul, 5/8" GWB int.
Overall U = 0.076	Overall U = 0.062	Overall U = 0.056	Overall U = 0.042

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.09/sqft	\$0.13/sqft	\$0.38/sqft

External Walls – Prototype 10, 11, 13, and 14

Applicable to the following Type V residential prototypes:	Prototype #
Retail/Residential Mixed Use Mid-rise Building (Residential only)	10
Retail/Residential Mixed Use Low-Rise Building (Residential only)	11
Residential Multi-Family	13
Residential Low-Rise	14

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R13

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Wood frame, wood studs 2x6.16 w/ R13 mineral batt, 1" plaster ext, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R19 mineral batt, 1" plaster ext, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 1" plaster ext, 5/8" GWB int.	Wood frame, wood studs 2x6.16 w/ R21 mineral batt, 1" plaster ext over 1" R5 rigid insul, 5/8" GWB int.
Overall U = 0.078	Overall U = 0.064	Overall U = 0.058	Overall U = 0.042

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.09/sqft	\$0.13/sqft	\$0.38/sqft

Roofing Material

Roofing Material – Prototype 6

Applicable to the following Type I commercial prototype:	Prototype #
Office Building – High-rise	6

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11
None	Reflectance > 0.70
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over 5.5" lightweight concrete over 20 Ga. metal deck	3-ply BUR over 1" R5 rigid insul over 5.5" lightweight concrete over 20 Ga. metal deck	3-ply BUR over 2" R5 rigid insul over 5.5" lightweight concrete over 20 Ga. metal deck	3-ply BUR w/ white elastomeric roof coating over 5.5" lightweight concrete over 20 Ga. metal deck
Overall U = 0.148	Overall U = 0.084	Overall U = 0.060	Overall U = 0.148
Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.25/sqft	\$0.45/sqft	\$0.33/sqft

Roofing Material – Prototypes 5 and 12

Applicable to the following Type II commercial prototypes:	Prototype #
Office Building – Mid-rise	5
Civic/Commercial Mixed Use	12

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11
None	Reflectance > 0.70
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over 2” R10 rigid insul over 20 Ga. metal deck	3-ply BUR over 3” R15 rigid insul over 20 Ga. metal deck	3-ply BUR over 4” R20 rigid insul over 20 Ga. metal deck	3-ply BUR w/ white elastomeric roof coating over 2” R10 rigid insul over 20 Ga. metal deck
Overall U = 0.088	Overall U = 0.062	Overall U = 0.046	Overall U = 0.088
Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.25/sqft	\$0.45/sqft	\$0.33/sqft

Roofing Material – Prototype 7

Applicable to the following Type II commercial prototype:	Prototype #
Hotel – Large	7

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R19
None	Reflectance > 0.70
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over 4” R20 rigid insul over 20 Ga. metal deck	3-ply BUR over 5” R25 rigid insul over 20 Ga. metal deck	3-ply BUR over 6” R30 rigid insul over 20 Ga. metal deck	3-ply BUR w/ white elastomeric roof coating over 4” R20 rigid insul over 20 Ga. metal deck
Overall U = 0.046	Overall U = 0.038	Overall U = 0.032	Overall U = 0.046
Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.25/sqft	\$0.45/sqft	\$0.33/sqft

Roofing Material – Prototypes 1, 2, 3, 4, and 9

Applicable to the following Type III commercial prototypes:	Prototype #
Freestanding Full-Service Restaurant Building	1
Multi-tenant Retail Shop Building	2
Major Retailer Building	3
Office Building – Low-rise	4
Retail/Commercial Mixed Use Building	9

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R11
None	Reflectance > 0.70
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over 2" R10 rigid insul over ¾" plywood and wood truss	3-ply BUR over 3" R15 rigid insul over ¾" plywood and wood truss	3-ply BUR over 4" R20 rigid insul over ¾" plywood and wood truss	3-ply BUR w/ white elastomeric roof coating over 2" R10 rigid insul over ¾" plywood and wood truss
Overall U = 0.082	Overall U = 0.058	Overall U = 0.044	Overall U = 0.082
Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.25/sqft	\$0.45/sqft	\$0.33/sqft

Roofing Material – Prototype 8

Applicable to the following Type III commercial prototypes:	Prototype #
Hotel - Small	8

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R19
None	Reflectance > 0.70
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over 4" R20 rigid insul over ¾" plywood and wood truss	3-ply BUR over 5" R25 rigid insul over ¾" plywood and wood truss	3-ply BUR over 6" R30 rigid insul over ¾" plywood and wood truss	3-ply BUR w/ white elastomeric roof coating over 4" R20 rigid insul over ¾" plywood and wood truss
Overall U = 0.044	Overall U = 0.036	Overall U = 0.030	Overall U = 0.044
Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.70	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.25/sqft	\$0.45/sqft	\$0.33/sqft

Roofing Material – Prototypes 10, 11, 14, and 15

Applicable to the following Type V residential prototypes:	Prototype #
Retail/Residential Mixed Use Mid-Rise	10
Retail/Residential Mixed Use Low-Rise	11
Residential Low-Rise	14
Residential Mid-Rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R30
None	Reflectance > 0.40
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
3-ply BUR over ¾" plywood and wood truss, R30 mineral batt under deck	3-ply BUR over ¾" plywood and wood truss, R38 mineral batt under deck	3-ply BUR over ¾" plywood and wood truss, R49 mineral batt under deck	3-ply BUR w/ white elastomeric roof coating over ¾" plywood and wood truss, R30 mineral batt under deck
Overall U = 0.030	Overall U = 0.024	Overall U = 0.018	Overall U = 0.030
Reflectance > 0.40	Reflectance > 0.40	Reflectance > 0.40	Reflectance > 0.84
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.89

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.19/sqft	\$0.66/sqft	\$0.33/sqft

Roofing Material – Prototype 13

Applicable to the following Type V residential prototype:	Prototype #
Residential Multi-Family	13

Title 24	
T24 Mandatory	T24 Prescriptive
None	Min Insulation R30
None	Reflectance > 0.40
None	Thermal Emittance > 0.75

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Pitched 2x4 truss, Conc. shingles over ½" plywood, R30 mineral batt at attic floor	Pitched 2x4 truss, Conc. shingles over ½" plywood, R38 mineral batt at attic floor	Pitched 2x4 truss, Conc. shingles over ½" plywood, R49 mineral batt at attic floor	NA
Overall U = 0.030	Overall U = 0.024	Overall U = 0.018	
Reflectance > 0.40	Reflectance > 0.40	Reflectance > 0.40	
Thermal Emittance > 0.75	Thermal Emittance > 0.75	Thermal Emittance > 0.75	

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.19/sqft	\$0.66/sqft	NA

Windows

Windows – Prototypes 11, 13, and 14

Applicable to the following prototypes:	Prototype #	WWR
Retail/Residential Mixed Use Low-Rise (Residential only)	11	9%
Residential Multi-Family/Town Homes	13	11%
Residential Low Rise	14	8%

Title 24	
T24 Mandatory	T24 Prescriptive
None	Max 20% of gross floor area Max 5% West facing area
Max Air leakage = 0.30 cfm/sf	None
None	U = 0.670
None	SHGC = 0.400

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
2-pane, tinted/clear	2-pane, LowE	2-pane, LowE	←
Max Air leakage = 0.30 cfm/sf	←	←	←
U = 0.56	U = 0.43	U = 0.26	U = 0.22
SHGC = 0.42	SHGC = 0.39	SHGC = 0.37	SHGC = 0.22

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.82/sqft	\$2.45/sqft	\$7.48/sqft

Windows – Prototypes 7, 8, 10, and 15

Applicable to the following prototypes:	Prototype #	WWR
Hotel – Large (Guest rooms, lobby and meeting rooms)	7	40%
Hotel – Small (Guest rooms, lobby and meeting rooms)	8	31%
Retail/Residential Mixed Use High-rise (Residential only)	10	8%
Residential High-rise	15	8%

Title 24			
T24 Mandatory		T24 Prescriptive	
None		Max 40% of gross wall area	
Max Air leakage = 0.30 cfm/sf		NA	
None		U = 0.47	
None	SHGC	Non-North	North
	0-10% WWR	0.47	0.61
	11-21% WWR	0.4	0.61
	21-30% WWR	0.36	0.61
	31-40% WWR	0.31	0.61

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
1- or 2-pane, clear Max 40% of gross fl area	2-pane, LowE Max 40% of gross fl area	2-pane, LowE Max 40% of gross fl area	←
Max Air leakage = 0.30 cfm/sf	←	←	←
Hotel U = 0.43	Hotel U = 0.26	Hotel U = 0.26	Hotel U = NA
Residential U = 0.48	Residential U = 0.43	Residential U = 0.26	Residential U = 0.22
Hotel SHG = 0.39	Hotel SHG = 0.37	Hotel SHG = 0.37	Hotel SHG = NA
Res SHGC = 0.47	Res SHGC = 0.39	Res SHGC = 0.37	Res SHGC = 0.22

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Residential \$0.82/sqft	Residential \$2.45/sqft	Residential \$7.48/sqft
Hotel \$2.45/sqft	Hotel \$7.48/sqft	NA

Windows – Prototypes 1-6, and 9-12

Applicable to the following prototypes:	Prototype #	WWR
Freestanding Full-Service Restaurant Building	1	20%
Multi-tenant Retail Shop Building (Internal/Corner)	2	10%/20%
Major Retailer Building	3	10%
Office Building – Low-rise	4	40%
Office Building – Mid-rise	5	40%
Office Building – High-rise	6	40%
Hotel – Large (Restaurant)	7	15%
Hotel – Small (Restaurant)	8	15%
Hotel – Small (Commercial)	8	35%
Hotel – Small (Retail – Internal/End)	8	10%/28%
Retail/Commercial Mixed Use (Commercial)	9	40%
Retail/Commercial Mixed Use (Retail – Internal/Corner)	9	10%/20%
Retail/Residential MU High-rise (Retail – Internal/Corner)	10	10%/20%
Retail/Residential MU Low-Rise (Retail – Internal/Corner)	11	10%/20%
Civic/Commercial Mixed Use	12	40%

Title 24			
T24 Mandatory	T24 Prescriptive		
None	Max 40% of gross wall area		
Max Air leakage = 0.30 cfm/sf	NA		
None	U = 0.77		
None	SHGC	Non-North	North
	0-10% WWR	0.61	0.61
	11-21% WWR	0.61	0.61
	21-30% WWR	0.39	0.61
	31-40% WWR	0.34	0.61

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
1- or 2-pane, clear/tinted	2-pane, LowE	2-pane, LowE	←
Max Air leakage = 0.30 cfm/sf	←	←	←

0% - 21% WWR U = 0.57	0% - 21% WWR U = 0.43	0% - 21% WWR U = 0.26	0% - 21% WWR U = 0.22
21% - 40% WWR U = 0.56	0% - 21% WWR U = 0.43	0% - 21% WWR U = 0.26	0% - 21% WWR U = 0.22
0% - 21% WWR SHGC = 0.61	0% - 21% WWR SHGC = 0.39	0% - 21% WWR SHGC = 0.37	0% - 21% WWR SHGC = 0.22
0% - 21% WWR SHGC = 0.42	0% - 21% WWR SHGC = 0.39	0% - 21% WWR SHGC = 0.37	0% - 21% WWR SHGC = 0.22

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.82/sqft	\$2.45/sqft	\$7.48/sqft

Entry Doors

Entry Doors – Prototypes 1-15

Applicable to the following prototypes:	Prototype #
All	

Title 24	
T24 Mandatory	T24 Prescriptive
Max Air leakage = 0.30 cfm/sf	NA

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Foam-core insulated steel panel	Not Applicable	Not Applicable	Not Applicable
Max air leakage = 0.30 cfm/sf			
U = 0.18			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Foundation

Foundation – Prototypes 1-5, and 7-14

Applicable to the following prototypes:	Prototype #
Freestanding Full-Service Restaurant Building	1
Multi-tenant Retail Shop Building	2
Major Retailer Building	3
Office Building – Low-rise	4
Office Building – Mid-rise	5
Hotel – Large	7
Hotel – Small	8
Retail/Commercial Mixed Use Building	9
Retail/Residential Mixed Use High-rise Building	10
Retail/Residential Mixed Use Low-Rise Building	11
Civic/Commercial Mixed Use	12
Residential Multi-Family/Town Homes	13
Residential Low Rise	14

Title 24	
T24 Mandatory	T24 Prescriptive
R5 (for heated slabs only)	None

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Concrete slab on grade	Not Applicable	Not Applicable	Not Applicable
No slab insulation			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Foundation – Prototype 6

Applicable to the following prototypes:	Prototype #
Office Building – High-rise	6

Title 24	
T24 Mandatory	T24 Prescriptive
R5 (for heated slabs only)	None

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Underground basement	Not Applicable	Not Applicable	Not Applicable
No slab insulation			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Foundation – Prototype 15

Applicable to the following prototypes:	Prototype #
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
R5 (for heated slabs only)	None

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Underground Parking	Not Applicable	Not Applicable	Not Applicable
No slab insulation			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Raised Floors

Raised Floors – Prototypes 6 and 15

Applicable to the following prototypes:	Prototype #
Office Building – High-rise	6
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
None	R11

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Plywood sheathing over TJI floor joists	Not Applicable	Not Applicable	Not Applicable
R11 insulation			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

HVAC – Summary

Applicable to the following prototypes:	Prototype #	Cooling	Heating
Freestanding Full-Service Restaurant Building	1	Unitary Packaged AC	Furnace
Multi-tenant Retail Shop Building	2	Individual Split System Heat Pumps	
Major Retailer Building	3	Central Chiller Positive Disp.	Central Boiler
Office Building – Low-rise	4	Individual Split System Heat Pumps	
Office Building – Mid-rise	5	Central Chiller Positive Disp.	Central Boiler
Office Building – High-rise	6	Central Chiller Centrifugal	Central Boiler
Hotel – Large	7	Central Chiller Centrifugal	Central Boiler
Hotel – Small	8	Central Chiller Centrifugal	Central Boiler
Retail/Commercial Mixed Use (Retail)	9	Individual Split System Heat Pumps	
Retail/Commercial Mixed Use (Commercial)	9	Individual Split System Heat Pumps	
Retail/Residential Mixed Use High-rise (Retail)	10	Individual Split System Heat Pumps	
Retail/Residential Mixed Use High-rise (Residential)	10	Central Chiller Centrifugal	Central Boiler
Retail/Residential Mixed Use Low-Rise (Retail)	11	Individual Split System Heat Pumps	
Retail/Residential Mixed Use Low-Rise (Residential)	11	Individual Split System Heat Pumps	
Civic/Commercial Mixed Use (Civic)	12	Central Chiller Positive Disp.	Central Boiler
Civic/Commercial Mixed Use (Commercial)	12	Central Chiller Positive Disp.	Central Boiler
Residential Multi-Family/Town Homes	13	Individual Split System Heat Pumps	
Residential Low Rise	14	Individual Split System Heat Pumps	
Residential High-rise	15	Central Chiller Centrifugal	Central Boiler

HVAC – Cooling Details

HVAC Cooling – Prototypes 1 and 12

Applicable to the following prototypes:	Prototype #	Size Category
Freestanding Full-Service Restaurant Building	1	240 kBtuh–760 kBtuh

Title 24	
T24 Mandatory	T24 Prescriptive
EER: 9.5	Economizer for systems greater than 75 kBtuh
OAR: 0.38 cfm/sf	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Elec. operated air-cooled unitary packaged AC with economizer	←	←	←
SEER 11 EER 9.5	SEER 12 EER 10.5	SEER 13 EER 11.5	SEER 14 EER 12.5

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
20-63 tons	\$371/ton	\$415/ton	\$442/ton

HVAC Cooling – Prototypes 11, 13, and 14

Applicable to the following prototypes:	Prototype #	Size Category
Retail/Residential Mixed Use Low-rise (Residential)	11	< 65 kBtuh
Residential Multi-Family/Town Homes	13	
Residential Low Rise	14	

Title 24	
T24 Mandatory	T24 Prescriptive
SEER: 13	Not Applicable
OAR: 0.03 cfm/sf + 7.5 cfm/person	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Individual Split System Heat Pump with cooling	←	←	←
SEER 13, COP 3.28	SEER 14, COP 3.52	SEER 16, COP 3.48	SEER 18, COP 3.32

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
2 tons	\$128/ton	\$385/ton	\$642/ton
3 tons	\$98/ton	\$294/ton	\$490/ton
4 tons	\$83/ton	\$248/ton	\$413/ton
5 tons	\$74/ton	\$221/ton	\$368/ton

HVAC Cooling – Prototypes 2, 4, and 9-12

Applicable to the following prototypes:	Prototype #	Size Category
Multi-tenant Retail Shop Building	2	65k-135k Btu/h
Office Building – Low-rise	4	
Retail/Commercial Mixed Use Building (Retail)	9	
Retail/Commercial Mixed Use Building (Commercial)	9	
Retail/Residential Mixed Use High-rise Building (Retail)	10	
Retail/Residential Mixed Use Low-rise (Retail)	11	

Title 24	
T24 Mandatory	T24 Prescriptive
65k-135k Btu/h EER: 10.1 135k-240k Btu/h EER: 9.3 > 240k Btu/h EER: 9.0	Not Applicable
Hotel OAR: 30 cfm/room Retail OAR: 0.20 cfm/sf	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Individual Split System Heat Pumps	Individual Split System Heat Pumps	Individual Split System Heat Pumps	Individual Split System Heat Pumps
SEER 13, COP 3.28 EER 11.07 8.1 HSPF	SEER 14, COP 3.52 EER 12.19 8.6 HSPF	SEER 16, COP 3.48 EER 12.06 8.4 HSPF	SEER 18, COP 3.32 EER 12.8 9.2 HSPF

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
5 tons	\$97.93/ton	\$293.80/ton	\$489.68/ton

HVAC Cooling – Prototype 3 and 5

Applicable to the following prototypes:	Prototype #	Size Category
Major Retailer Building	3	< 150 tons
Office Building – Mid-rise	5	150–299 tons
Civic/Commercial Mixed Use	12	150–299 tons

Title 24	
T24 Mandatory	T24 Prescriptive
COP: 4.20	Not Applicable
Retail OAR: 0.22 cfm/sf	
Office OAR: 0.15 cfm/sf	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Water cooled chiller, electrically operated, positive displacement, VAV with economizer	←	←	←
< 150 tons: COP 4.45	< 150 tons: COP 5.57	Not Applicable	Not Applicable
150-299 tons: COP 4.90	150-299 tons: COP 6.13		

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
< 150 tons	\$49/ton	Not Applicable	Not Applicable
150-299 tons	\$25/ton		

HVAC Cooling – Prototypes 6, 7, 8, 10, and 15

Applicable to the following prototypes:	Prototype #	Size Category
Office Building – High-rise	6	> 299 tons
Hotel – Large	7	
Hotel - Small	8	
Retail/Residential Mixed Use High-rise (Residential)	10	
Residential High-rise	15	

Title 24	
T24 Mandatory	T24 Prescriptive
COP: 6.10	Not Applicable
Hotel OAR: 30 cfm/room	
Res OAR: 0.03 cfm/sf + 7.5 cfm/person	
Office OAR: 0.15 cfm/sf	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Water cooled chiller, electrically operated, Centrifugal-inlet, VAV with economizer	←	←	←
COP 6.10	COP 7.63	Not Applicable	Not Applicable

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
> 299 tons	\$66/ton	Not Applicable	Not Applicable

HVAC - Space Heating

Central Boiler – Prototypes 3, 5-8, 10, and 15

Applicable to the following prototypes:	Prototype #	Size Category
Major Retailer Building	3	>300 kBtuh and < 2,500 kBtuh
Office Building – Mid-rise	5	
Office Building – High-rise	6	
Hotel – Large	7	
Hotel - Small	8	
Retail/Residential Mixed Use High-rise (Residential)	10	
Residential High-rise	15	

Title 24	
T24 Mandatory	T24 Prescriptive
Thermal Efficiency 75%	Not Applicable

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Central gas-fired boiler	←	Not Applicable	Not Applicable
AFUE = 75%	AFUE = 85%		

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
> 300 kBtuh kBtu	\$3.57/kBtuh	Not Applicable	Not Applicable

Central Furnace – Prototypes 1 and 12

Applicable to the following prototypes:	Prototype #	Size Category
Freestanding Full-Service Restaurant Building	1	> 225,000 Btu/hr
Civic/Commercial Mixed Use (Civic – Library)	12	

Title 24	
T24 Mandatory	T24 Prescriptive
Thermal Efficiency 80%	Not Applicable

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Central gas-fired Furnace	←	Not Applicable	Not Applicable
AFUE = 80%	AFUE = 94%		

Alternative Incremental Costs (Alt X – Baseline)			
Parameter	Alternative 1	Alternative 2	Alternative 3
> 225,000 Btu/hr	\$1000/appliance	Not Applicable	Not Applicable

Appliances

Domestic Hot Water – Prototypes 1-15

Applicable to the following prototypes:	Prototype #
Freestanding Full-Service Restaurant Building	1
Multi-tenant Retail Shop Building	2
Major Retailer Building	3
Office Building – Low-rise	4
Office Building – Mid-rise	5
Office Building – High-rise	6
Hotel – Large	7
Hotel – Small	8
Retail/Commercial Mixed Use Building	9
Retail/Residential Mixed Use High-rise Building	10
Retail/Residential Mixed Use Low-Rise Building	11
Civic/Commercial Mixed Use	12
Residential Multi-Family/Town Homes	13
Residential Low Rise	14
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
Gas heating	Not Applicable
EF = 0.575 (50 gal)	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
50 gal Gas-fired storage-type water heater	50 gal Gas-fired storage-type water heater	50 gal equivalent Gas-fired tankless water heater	Not Applicable
EF = 0.594	EF = 0.64	EF = 0.823	

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$309.77/appliance	\$370.64/appliance	Not Applicable

Dishwasher – Prototypes 10, 11, and 13-5

Applicable to the following prototypes:	Prototype #
Retail/Residential Mixed Use High-rise Building	10
Retail/Residential Mixed Use Low-Rise Building	11
Residential Multi-Family/Town Homes	13
Residential Low Rise	14
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
CEC AER	Not Applicable
EF = 0.46	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
160 cycles/yr	←	Not Applicable	Not Applicable
EF = 0.46	EF = 0.64		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$133.64/appliance	Not Applicable	Not Applicable

Clothes Washer – Prototypes 10, 11, and 13-5

Applicable to the following prototypes:	Prototype #
Retail/Residential Mixed Use High-rise Building	10
Retail/Residential Mixed Use Low-Rise Building	11
Residential Multi-Family/Town Homes	13
Residential Low Rise	14
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
CEC AER	Not Applicable
MMEF = 1.26	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
160 wash cycles/yr	←	←	Not Applicable
MMEF = 1.26	MMEF = 2.00	MMEF = 2.20	

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$131/appliance	\$225/appliance	Not Applicable

Refrigerator – Prototypes 10, 11, and 13-5

Applicable to the following prototypes:	Prototype #
Retail/Residential Mixed Use High-rise Building	10
Retail/Residential Mixed Use Low-Rise Building	11
Residential Multi-Family/Town Homes	13
Residential Low Rise	14
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
CEC AER	Not Applicable
7.55AV + 258.3 AV = 1.44 x freezer + refrig vol	

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
26 cu-ft upright 9 cu-ft freezer 17 cu-ft refrigerator 485 kWh/yr	Not Applicable	Not Applicable	Not Applicable

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Lighting

Lighting – Prototypes 11, 13, and 14

Applicable to the following prototypes:	Prototype #
Retail/Residential Mixed Use Low-Rise (Residential only)	11
Residential Multi-Family/Town Homes	13
Residential Low Rise	14

Title 24	
T24 Mandatory	T24 Prescriptive
≤ 15 watts – 40 LPW 15-40 watts 50 LPW >40 watts 60 LPW (With exceptions)	Not Applicable

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Mix of 60 LPW screw-in CFL and dimmable incandescent	Replace CFLs w/ 69 LPW recessed fixture with 4-pin triple tube	Not Applicable	Not Applicable
0.702 watts/sqft	0.648 watts/sqft		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$90/fixture	Not Applicable	Not Applicable

Lighting – Prototypes 10 and 15

Applicable to the following prototypes:	Prototype #
Retail/Residential Mixed Use High-rise (Residential only)	10
Residential High-rise	15

Title 24	
T24 Mandatory	T24 Prescriptive
Not Applicable	1.0 watts/sqft Residential

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Mix of 60 LPW screw-in CFL and dimmable incandescent	Replace CFLs w/ 69 LPW recessed fixture with 4-pin triple tube	Not Applicable	Not Applicable
0.626 watts/sqft	0.586 watts/sqft		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$90/fixture	Not Applicable	Not Applicable

Lighting – Prototype 1

Applicable to the following prototype:	Prototype #
Freestanding Full-Service Restaurant Building	1

Title 24	
T24 Mandatory	T24 Prescriptive
None	1.1 watts/sqft

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Fluorescent	Not Applicable	Not Applicable	Not Applicable
1.1 w/sf			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Lighting – Prototypes 7 and 8

Applicable to the following prototypes:	Prototype #
Hotel – Large	7
Hotel – Small	8

Title 24	
T24 Mandatory	T24 Prescriptive
None	1.4 watts/sqft

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Mix of 60 LPW screw-in CFL and dimmable incandescent	Replace CFLs w/ 69 LPW recessed fixture with 4-pin triple tube		Not Applicable
1.4 w/sf	1.19 w/sf		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$90.00/fixture	Not Applicable	Not Applicable

Lighting – Prototypes 2, 3, and 9-11

Applicable to the following prototypes:	Prototype #
Multi-tenant Retail Shop Building	2
Major Retailer	3
Retail/Commercial Mixed Use Building (Retail Only)	9
Retail/Residential Mixed Use High-rise (Retail only)	10
Retail/Residential Mixed Use Low-Rise (Retail only)	11

Title 24	
T24 Mandatory	T24 Prescriptive
None	1.5 watts/sf

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Typical T8 fluorescent	Not Applicable	Not Applicable	Not Applicable
1.50 watts/sf			

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
Not Applicable	Not Applicable	Not Applicable

Lighting – Prototype 12

Applicable to the following prototype:	Prototype #
Civic/Commercial Mixed Use	12

Title 24	
T24 Mandatory	T24 Prescriptive
None	1.3 watts/sf

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Typical T8 fluorescent	Ambient lighting via T8 ceiling-mounted, plus under-cabinet T8 task lighting (Note 1)	Not Applicable	Not Applicable
1.3 watts/sf	1.02 watts/sqft		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$90.0/sqft	Not Applicable	Not Applicable

Lighting – Prototypes 4-6, 9, and 12

Applicable to the following prototypes:	Prototype #
Office Building – Low-rise	4
Office Building – Mid-rise	5
Office Building – High-rise	6
Retail/Commercial Mixed Use Building (Commercial only)	9
Civic/Commercial Mixed Use (Commercial only)	12

Title 24	
T24 Mandatory	T24 Prescriptive
None	1.1 watts/sqft

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
Typical T8 fluorescent	Ambient lighting via T8 ceiling-mounted, plus under-cabinet T8 task lighting (Note 1)	Not Applicable	Not Applicable
1.10 watts/sqft	Offices: 0.90 watts/sqft		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.0/sqft	Not Applicable	Not Applicable

Note 1: Reference the New Building Institute Inc. Advanced Lighting Guidelines for strategies to minimize total connected lighting power load.

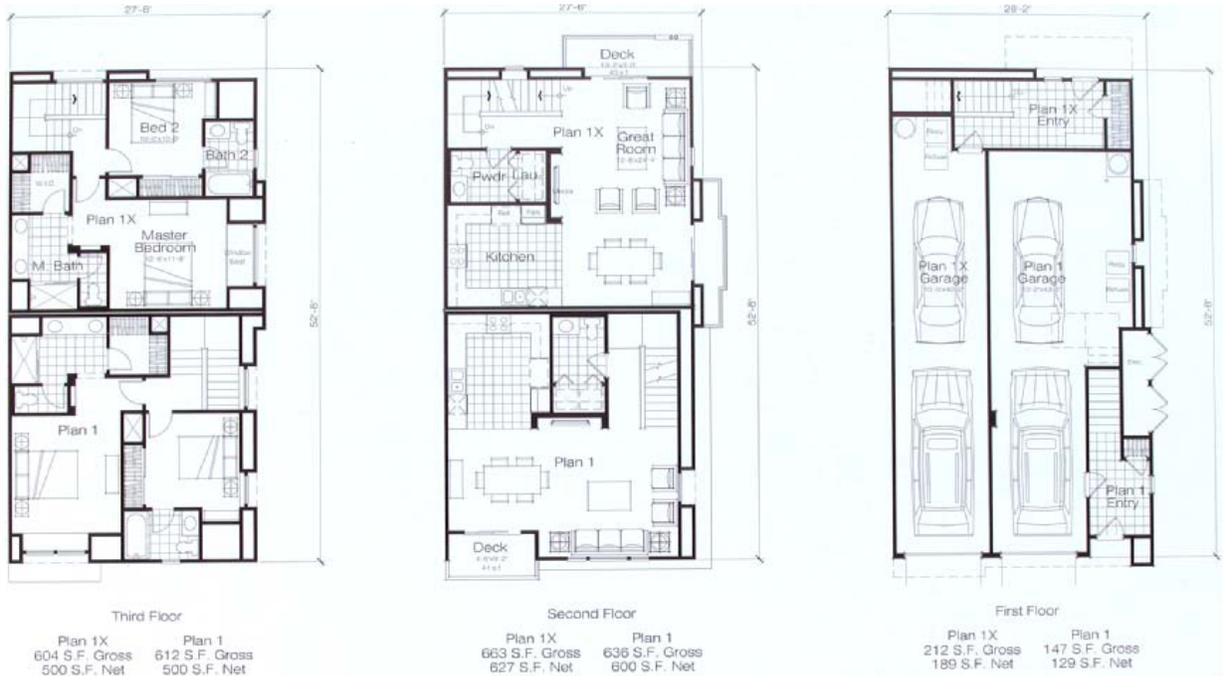
Lighting – Parking Garage

Title 24	
T24 Mandatory	T24 Prescriptive
NA	0.4 watts/sqft

Modeling Scenarios			
Proposed Baseline	Alternative 1	Alternative 2	Alternative 3
76 LPW T12 fluorescent pendant mounted troffer	85 LPW T5 SHO fluorescent pendant mounted troffer	NA	NA
0.4 watts/sqft	0.36 watts/sqft		

Alternative Incremental Costs (Alt X – Baseline)		
Alternative 1	Alternative 2	Alternative 3
\$0.069/sqft	NA	NA

Lighting – Low-rise Residential Floor Plans 1 and 1x



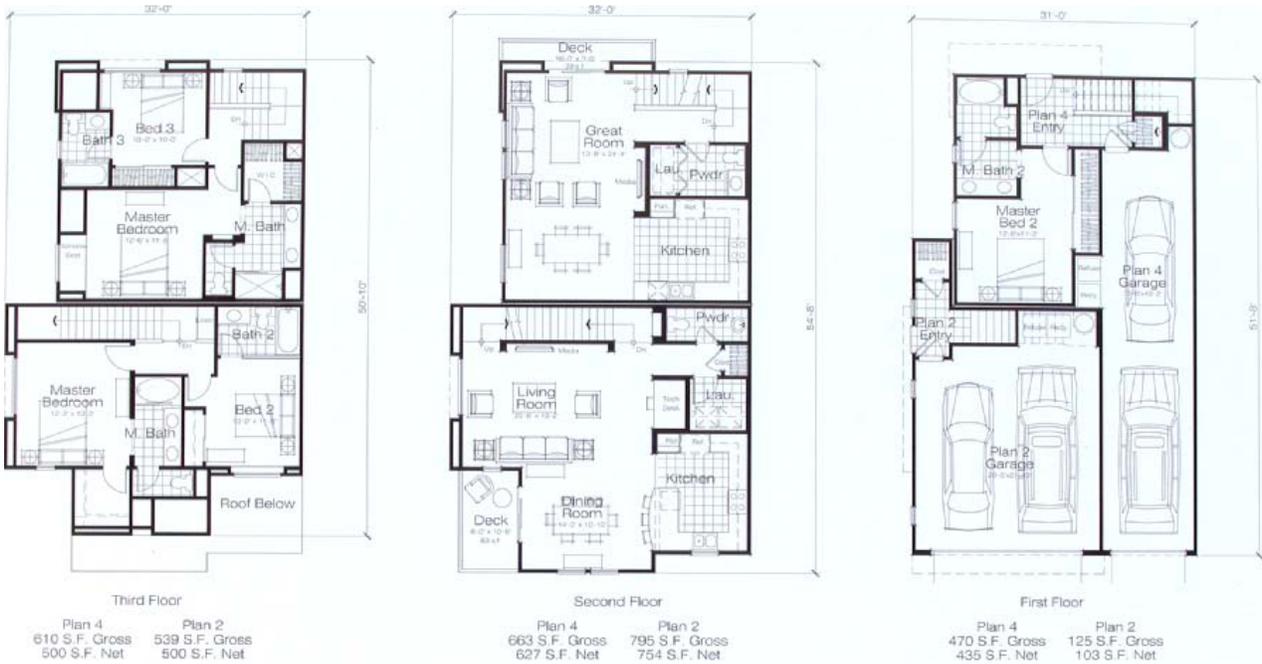
Plan1	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	174	14.1%	6090	>40	35	174	649	1.00	0.141	40	0.125
Entryway	6	90	7.3%	541	>40	60	9	34	0.10	0.007	69	0.006
Hallway/closet	13.25	239	19.5%	3170	>40	35	91	338	0.38	0.074	40	0.065
Bedroom	10.5	290	23.5%	3040	>40	60	51	189	0.18	0.041	69	0.036
Kitchen	35	79	6.4%	2765	>40	35	79	295	1.00	0.064	40	0.057
Kitchen Counters	41.25	47	3.8%	1918	>40	10	192	716	4.13	0.156	10	0.156
Living Room	10.5	209	17.0%	2197	>40	60	37	137	0.18	0.030	69	0.026
Dining Room	13	102	8.3%	1328	>40	10	133	495	1.30	0.108	10	0.108
Garage	17.5	554	45.0%	9693	>40	60	162	603	0.29	0.131	69	0.114
		1230								0.753		0.694

Townhouse floor plan 1, Baseline and Alternative weighted lighting load watts/sqft

Plan1x	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	182	14.1%	6383	>40	35	182	681	1.00	0.141	40	0.125
Entryway	6	118	9.1%	707	>40	60	12	44	0.10	0.009	69	0.008
Hallway/closet	13.25	233	18.0%	3091	>40	35	88	329	0.38	0.068	40	0.061
Bedroom	10.5	300	23.2%	3154	>40	60	53	196	0.18	0.041	69	0.035
Kitchen	35	79	6.1%	2752	>40	35	79	293	1.00	0.061	40	0.054
Kitchen Counters	41.25	47	3.6%	1918	>40	10	192	716	4.13	0.148	10	0.148
Living Room	10.5	203	15.7%	2128	>40	60	35	132	0.18	0.027	69	0.024
Dining Room	13	131	10.1%	1698	>40	10	170	634	1.30	0.131	10	0.131
Garage	17.5	452	35.0%	7908	>40	60	132	492	0.29	0.102	69	0.089
		1292								0.729		0.675

Townhouse floor plan 1X, Baseline and Alternative weighted lighting load watts/sqft

Lighting – Low-rise Residential Floor Plans 2 and 4



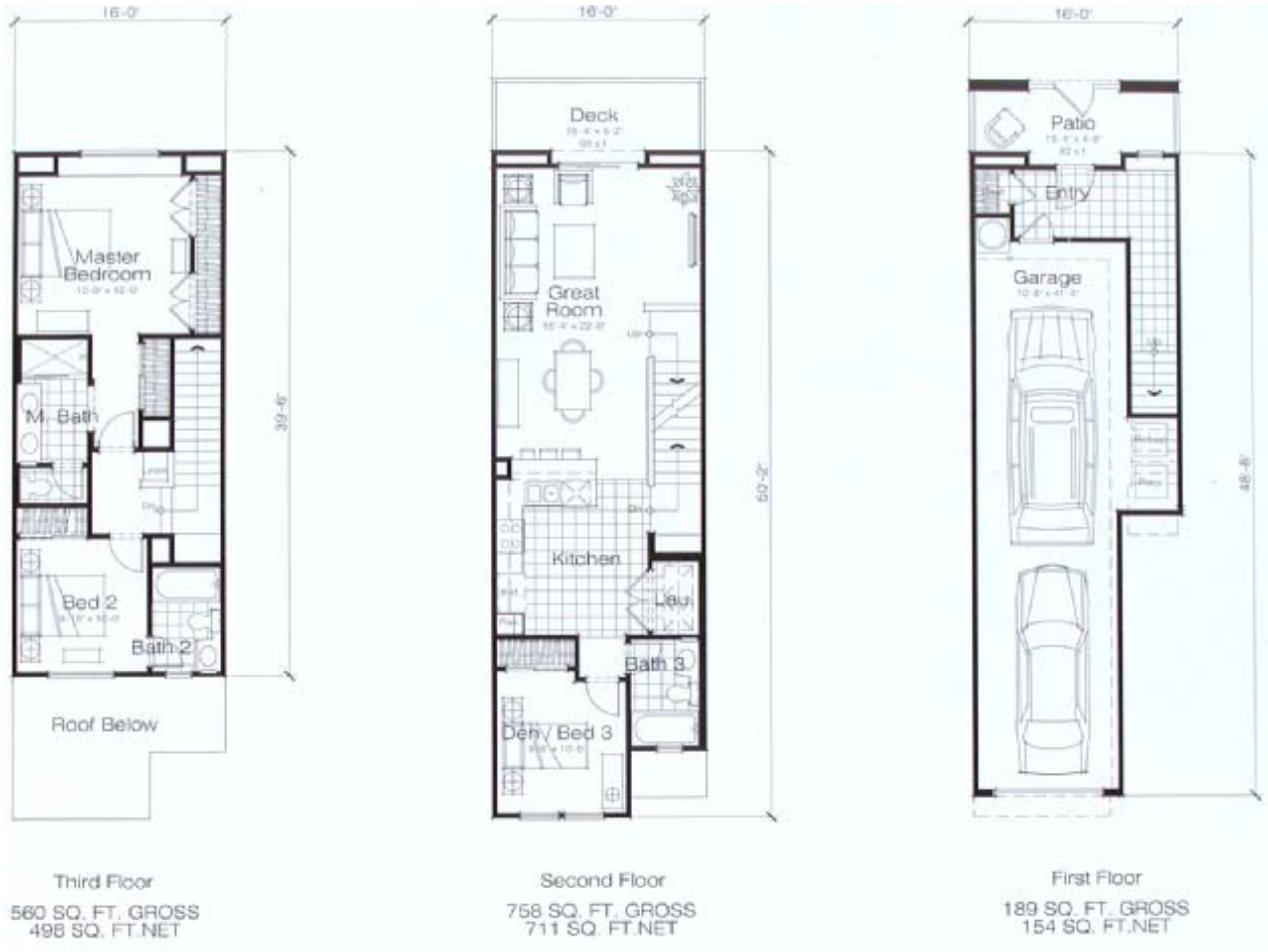
Plan2	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	138	10.4%	4843	>40	35	138	516	1.00	0.104	40	0.092
Entryway	6	53	3.9%	315	>40	60	5	20	0.10	0.004	69	0.003
Hallway/closet	13.25	306	22.9%	4055	>40	35	116	432	0.38	0.087	40	0.077
Bedroom	10.5	277	20.7%	2906	>40	60	48	181	0.18	0.036	69	0.032
Kitchen	35	61	4.6%	2131	>40	35	61	227	1.00	0.046	40	0.040
Kitchen Counters	41.25	58	4.3%	2387	>40	10	239	891	4.13	0.179	10	0.179
Living Room	10.5	287	21.5%	3009	>40	60	50	187	0.18	0.038	69	0.033
Dining Room	13	155	11.6%	2015	>40	10	201	752	1.30	0.151	10	0.151
Garage	17.5	463	34.7%	8103	>40	60	135	504	0.29	0.101	69	0.088
		1334								0.745		0.695

Townhouse floor plan 2, Baseline and Alternative weighted lighting load watts/sqft

Plan4	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	260	17.1%	9109	>40	35	260	971	1.00	0.171	40	0.151
Entryway	6	90	5.9%	540	>40	60	9	34	0.10	0.006	69	0.005
Hallway/closet	13.25	243	15.9%	3220	>40	35	92	343	0.38	0.060	40	0.053
Bedroom	10.5	465	30.5%	4878	>40	60	81	303	0.18	0.053	69	0.046
Kitchen	35	82	5.4%	2859	>40	35	82	305	1.00	0.054	40	0.047
Kitchen Counters	41.25	47	3.0%	1918	>40	10	192	716	4.13	0.126	10	0.126
Living Room	10.5	202	13.2%	2116	>40	60	35	132	0.18	0.023	69	0.020
Dining Room	13	138	9.0%	1788	>40	10	179	667	1.30	0.117	10	0.117
Garage	17.5	460	30.1%	8041	>40	60	134	500	0.29	0.088	69	0.076
		1525								0.698		0.643

Townhouse floor plan 4, Baseline and Alternative weighted lighting load watts/sqft

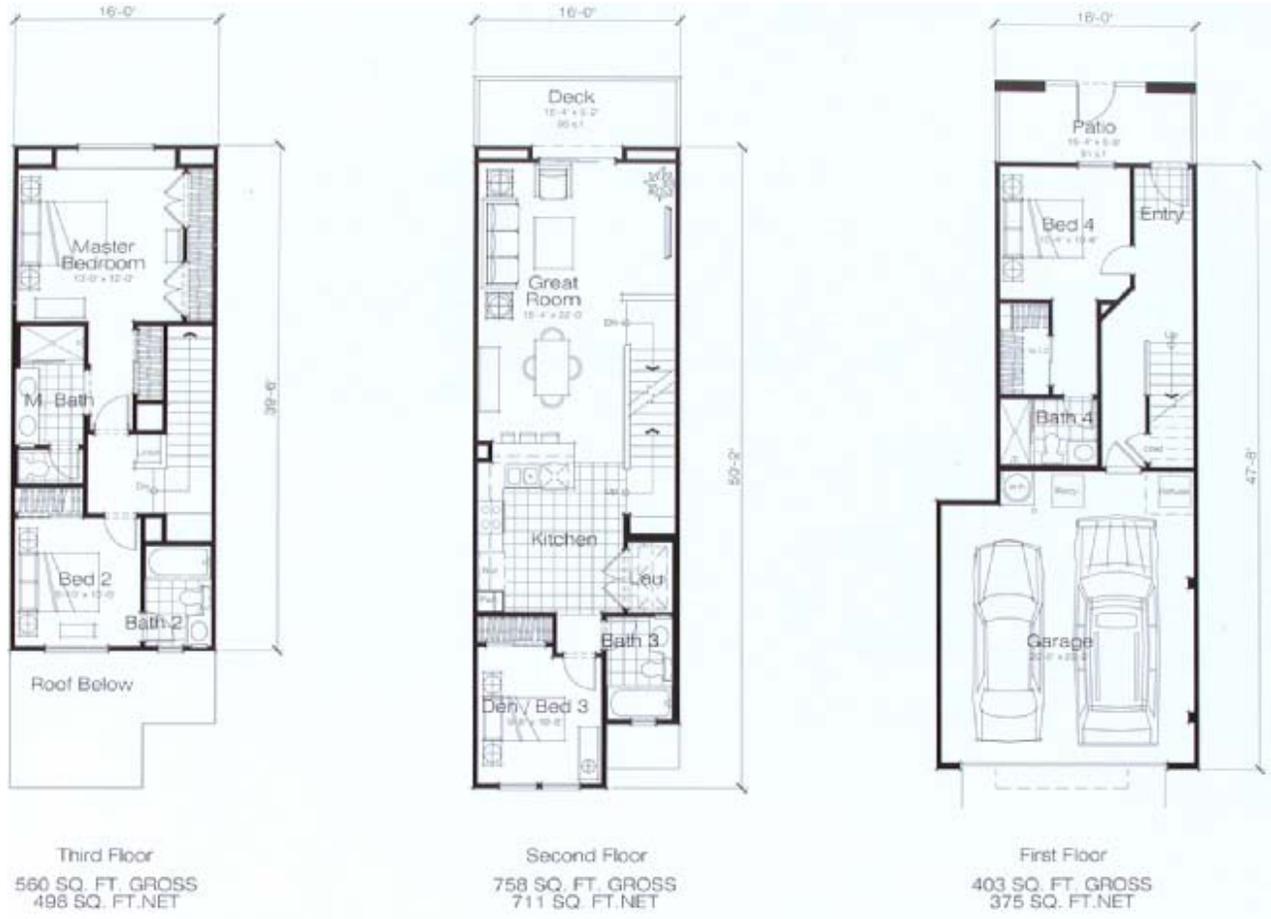
Lighting – Low-rise Residential Floor Plan 3



Plan3	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	141	10.4%	4944	>40	35	141	527	1.00	0.104	40	0.092
Entryway	6	112	8.2%	670	>40	60	11	42	0.10	0.008	69	0.007
Hallway/closet	13.25	302	22.2%	4002	>40	35	114	427	0.38	0.084	40	0.074
Bedroom	10.5	371	27.2%	3898	>40	60	65	242	0.18	0.048	69	0.041
Kitchen	35	98	7.2%	3421	>40	35	98	365	1.00	0.072	40	0.064
Kitchen Counters	41.25	35	2.5%	1423	>40	10	142	531	4.13	0.104	10	0.104
Living Room	10.5	155	11.4%	1628	>40	60	27	101	0.18	0.020	69	0.017
Dining Room	13	150	11.0%	1944	>40	10	194	725	1.30	0.143	10	0.143
Garage	17.5	487	35.8%	8530	>40	60	142	530	0.29	0.104	69	0.091
		1363								0.686		0.633

Townhouse floor plan 3, Baseline and Alternative weighted lighting load watts/sqft

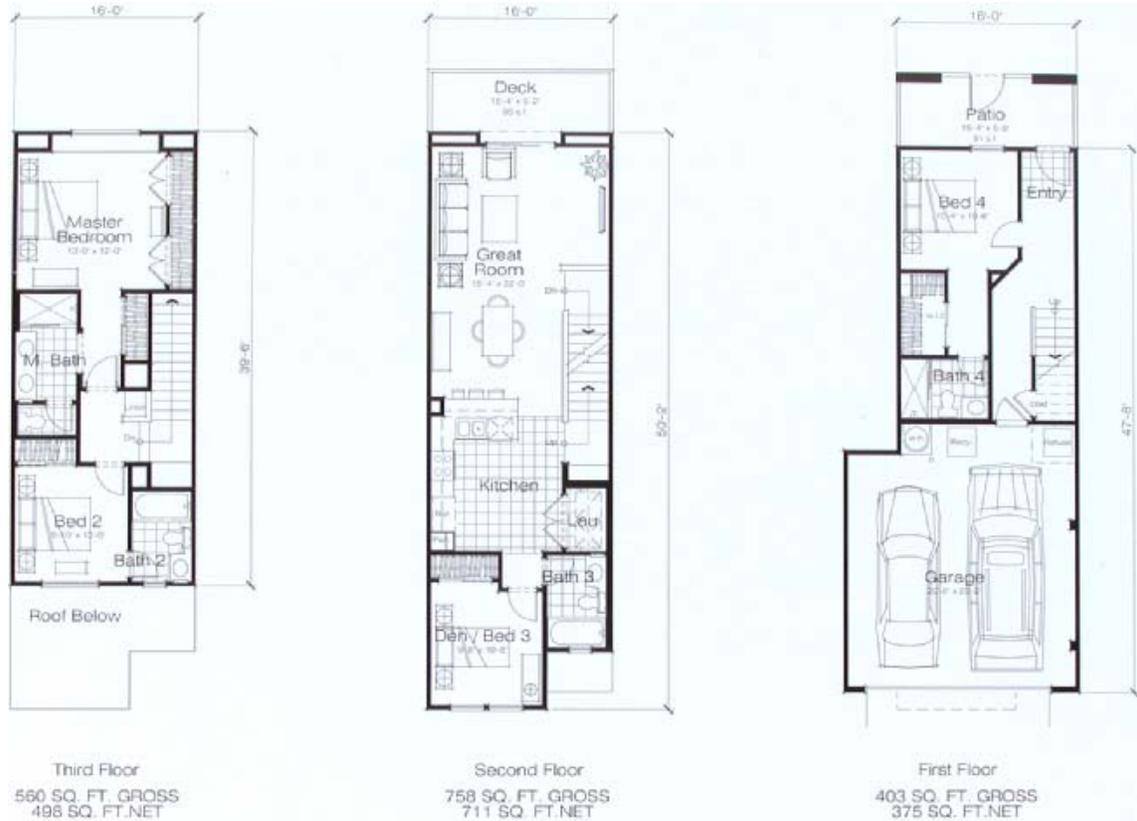
Lighting – Low-rise Residential Floor Plan 5



Plan5	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	180	11.4%	6300	>40	35	180	672	1.00	0.114	40	0.101
Entryway	6	47	3.0%	284	>40	60	5	18	0.10	0.003	69	0.003
Hallway/closet	13.25	405	25.5%	5366	>40	35	153	572	0.38	0.097	40	0.086
Bedroom	10.5	506	31.9%	5312	>40	60	89	330	0.18	0.056	69	0.049
Kitchen	35	108	6.8%	3789	>40	35	108	404	1.00	0.068	40	0.060
Kitchen Counters	41.25	35	2.2%	1423	>40	10	142	531	4.13	0.090	10	0.090
Living Room	10.5	155	9.8%	1628	>40	60	27	101	0.18	0.017	69	0.015
Dining Room	13	150	9.4%	1944	>40	10	194	725	1.30	0.123	10	0.123
Garage	17.5	441	27.8%	7711	>40	60	129	480	0.29	0.081	69	0.070
		1585								0.648		0.596

Townhouse floor plan 5, Baseline and Alternative weighted lighting load watts/sqft

Lighting – High-rise Residential Floor Plans 1 and 3



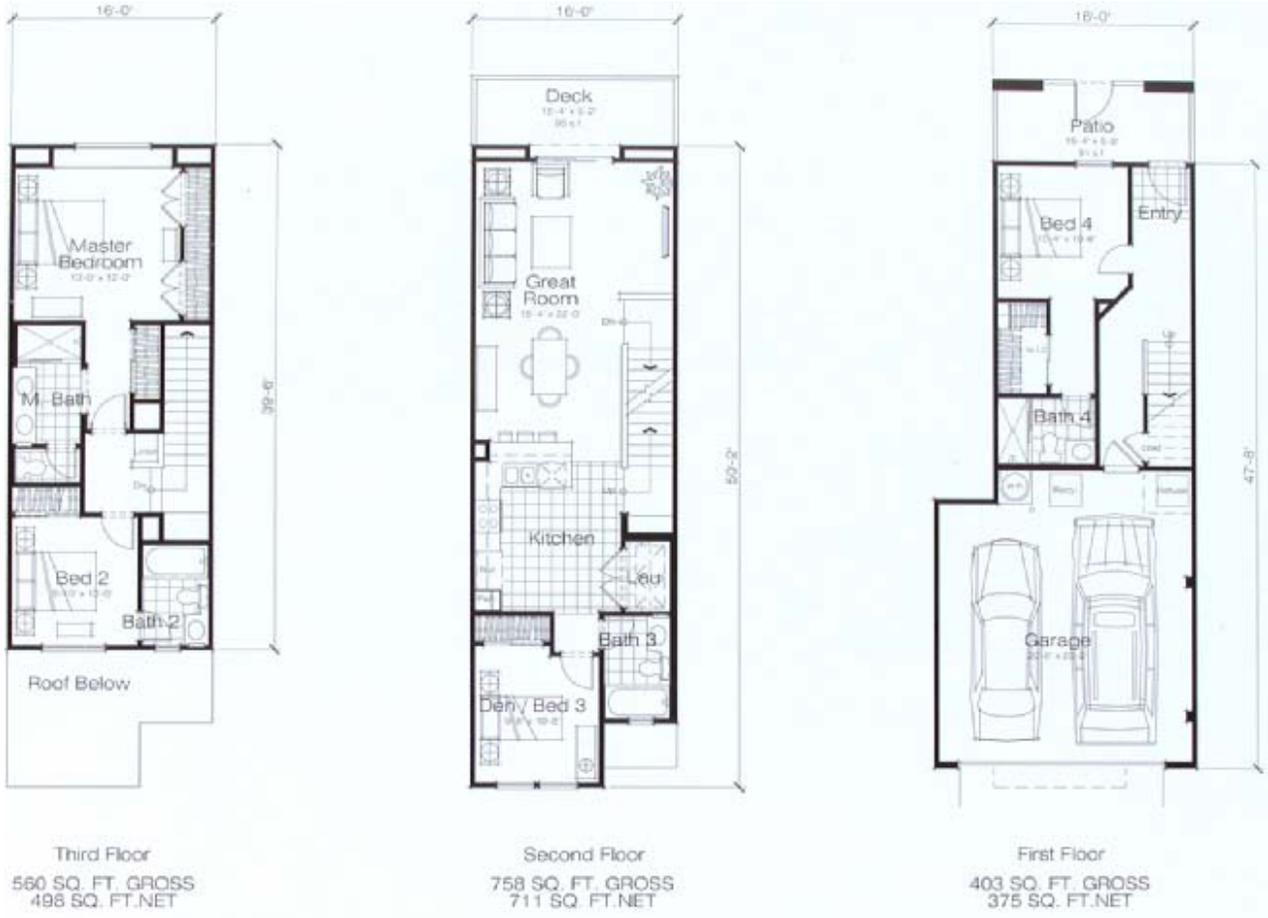
Plan1	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	132	13.6%	4620	>40	35	132	493	1.00	0.136	40	0.120
Entryway	6	36	3.7%	216	>40	60	4	13	0.10	0.004	69	0.003
Hallway/closet	13.25	163	16.8%	2156	>40	35	62	230	0.38	0.063	40	0.056
Bedroom	10.5	300	30.8%	3145	>40	60	52	196	0.18	0.054	69	0.047
Kitchen	35	50	5.1%	1750	>40	35	50	187	1.00	0.051	40	0.046
Kitchen Counters	41.25	45	4.6%	1856	>40	10	186	693	4.13	0.191	10	0.191
Living Room	10.5	156	16.1%	1638	>40	60	27	102	0.18	0.028	69	0.024
Dining Room	13	90	9.3%	1170	>40	10	117	437	1.30	0.120	10	0.120
		971								0.648		0.608

High-rise floor plan 1, Baseline and Alternative weighted lighting load watts/sqft

Plan3	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	148	13.1%	5189	>40	35	148	553	1.00	0.131	40	0.116
Entryway	6	49	4.3%	293	>40	60	5	18	0.10	0.004	69	0.004
Hallway/closet	13.25	193	17.1%	2554	>40	35	73	272	0.38	0.065	40	0.057
Bedroom	10.5	312	27.6%	3276	>40	60	55	204	0.18	0.048	69	0.042
Kitchen	35	67	5.9%	2336	>40	35	67	249	1.00	0.059	40	0.052
Kitchen Counters	41.25	47	4.2%	1939	>40	10	194	723	4.13	0.172	10	0.172
Living Room	10.5	181	16.1%	1903	>40	60	32	118	0.18	0.028	69	0.024
Dining Room	13	132	11.7%	1713	>40	10	171	639	1.30	0.152	10	0.152
		1129								0.659		0.620

High-rise floor plan 3, Baseline and Alternative weighted lighting load watts/sqft

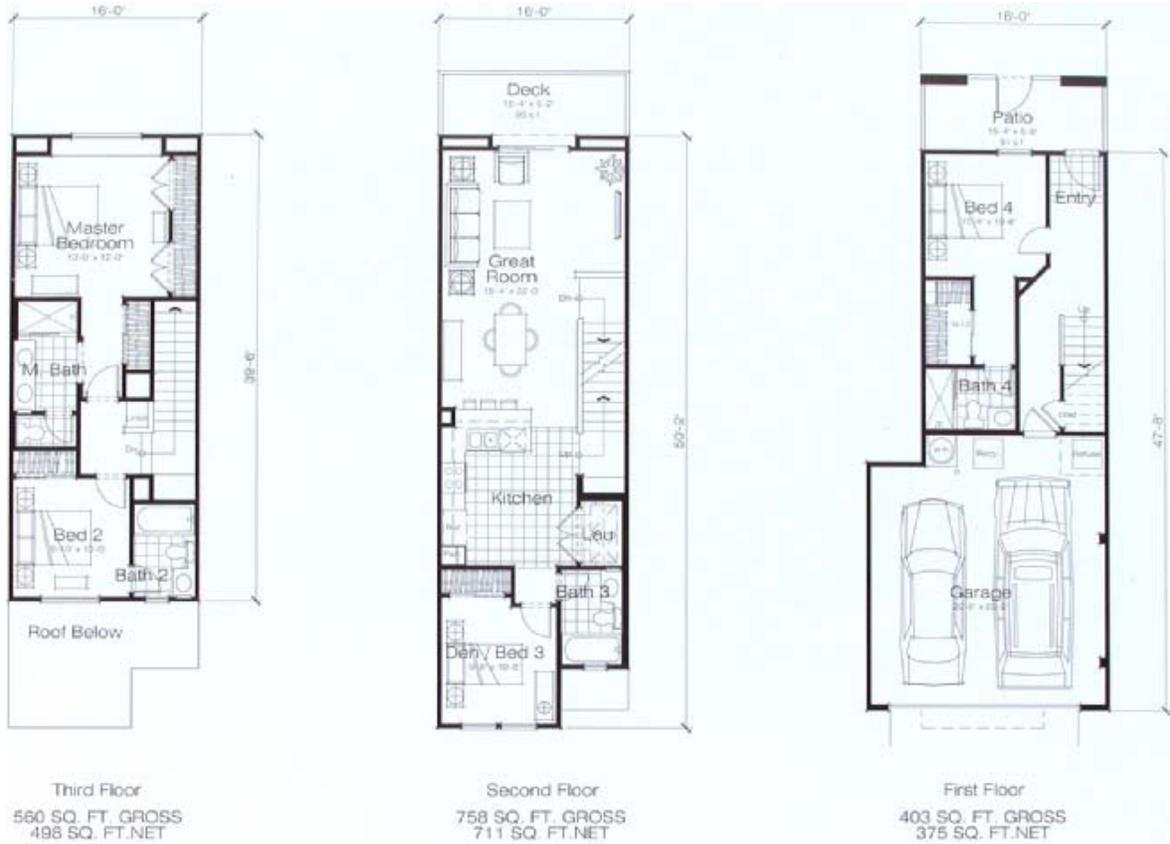
Lighting – High-rise Residential Floor Plan 2



Plan2	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	37	6.4%	1308	>40	35	37	139	1.00	0.064	40	0.057
Entryway	6	30	5.1%	178	>40	60	3	11	0.10	0.005	69	0.004
Hallway/closet	13.25	62	10.6%	818	>40	35	23	87	0.38	0.040	40	0.036
Bedroom	10.5	0	0.0%	0	>40	60	0	0	0.18	0.000	69	0.000
Kitchen	35	92	15.9%	3220	>40	35	92	343	1.00	0.159	40	0.140
Kitchen Counters	41.25	46	7.8%	1877	>40	10	188	700	4.13	0.323	10	0.323
Living Room	10.5	193	33.2%	2022	>40	60	34	126	0.18	0.058	69	0.050
Dining Room	13	122	20.9%	1580	>40	10	158	589	1.30	0.272	10	0.272
		580								0.922		0.884

High-rise floor plan 2, Baseline and Alternative weighted lighting load watts/sqft

Lighting – High-rise Residential Floor Plans 4 and 5



Plan4	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	160	13.1%	5591	>40	35	160	596	1.00	0.131	40	0.116
Entryway	6	36	2.9%	214	>40	60	4	13	0.10	0.003	69	0.003
Hallway/closet	13.25	188	15.4%	2490	>40	35	71	265	0.38	0.058	40	0.052
Bedroom	10.5	443	36.3%	4652	>40	60	78	289	0.18	0.063	69	0.055
Kitchen	35	50	4.1%	1750	>40	35	50	187	1.00	0.041	40	0.036
Kitchen Counters	41.25	50	4.1%	2063	>40	10	206	770	4.13	0.169	10	0.169
Living Room	10.5	182	14.9%	1914	>40	60	32	119	0.18	0.026	69	0.023
Dining Room	13	113	9.2%	1463	>40	10	146	546	1.30	0.120	10	0.120
		1221								0.611		0.573

High-rise floor plan 4, Baseline and Alternative weighted lighting load watts/sqft

Plan5	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	181	15.0%	6326	>40	35	181	674	1.00	0.150	40	0.133
Entryway	6	45	3.7%	270	>40	60	5	17	0.10	0.004	69	0.003
Hallway/closet	13.25	218	18.1%	2883	>40	35	82	307	0.38	0.068	40	0.061
Bedroom	10.5	323	26.8%	3395	>40	60	57	211	0.18	0.047	69	0.041
Kitchen	35	70	5.8%	2450	>40	35	70	261	1.00	0.058	40	0.051
Kitchen Counters	41.25	47	3.9%	1939	>40	10	194	723	4.13	0.161	10	0.161
Living Room	10.5	186	15.4%	1948	>40	60	32	121	0.18	0.027	69	0.023
Dining Room	13	136	11.3%	1768	>40	10	177	660	1.30	0.147	10	0.147
		1205								0.662		0.620

High-rise floor plan 5, Baseline and Alternative weighted lighting load watts/sqft

Lighting – High-rise Residential Floor Plan 6



Plan6	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	170	13.7%	5959	>40	35	170	635	1.00	0.137	40	0.122
Entryway	6	19	1.5%	115	>40	60	2	7	0.10	0.002	69	0.001
Hallway/closet	13.25	192	15.5%	2542	>40	35	73	271	0.38	0.059	40	0.052
Bedroom	10.5	377	30.4%	3959	>40	60	66	246	0.18	0.053	69	0.046
Kitchen	35	148	11.9%	5180	>40	35	148	552	1.00	0.119	40	0.106
Kitchen Counters	41.25	41	3.3%	1671	>40	10	167	623	4.13	0.135	10	0.135
Living Room	10.5	176	14.2%	1843	>40	60	31	115	0.18	0.025	69	0.022
Dining Room	13	117	9.4%	1521	>40	10	152	568	1.30	0.123	10	0.123
		1239								0.653		0.606

High-rise floor plan 6, Baseline and Alternative weighted lighting load watts/sqft

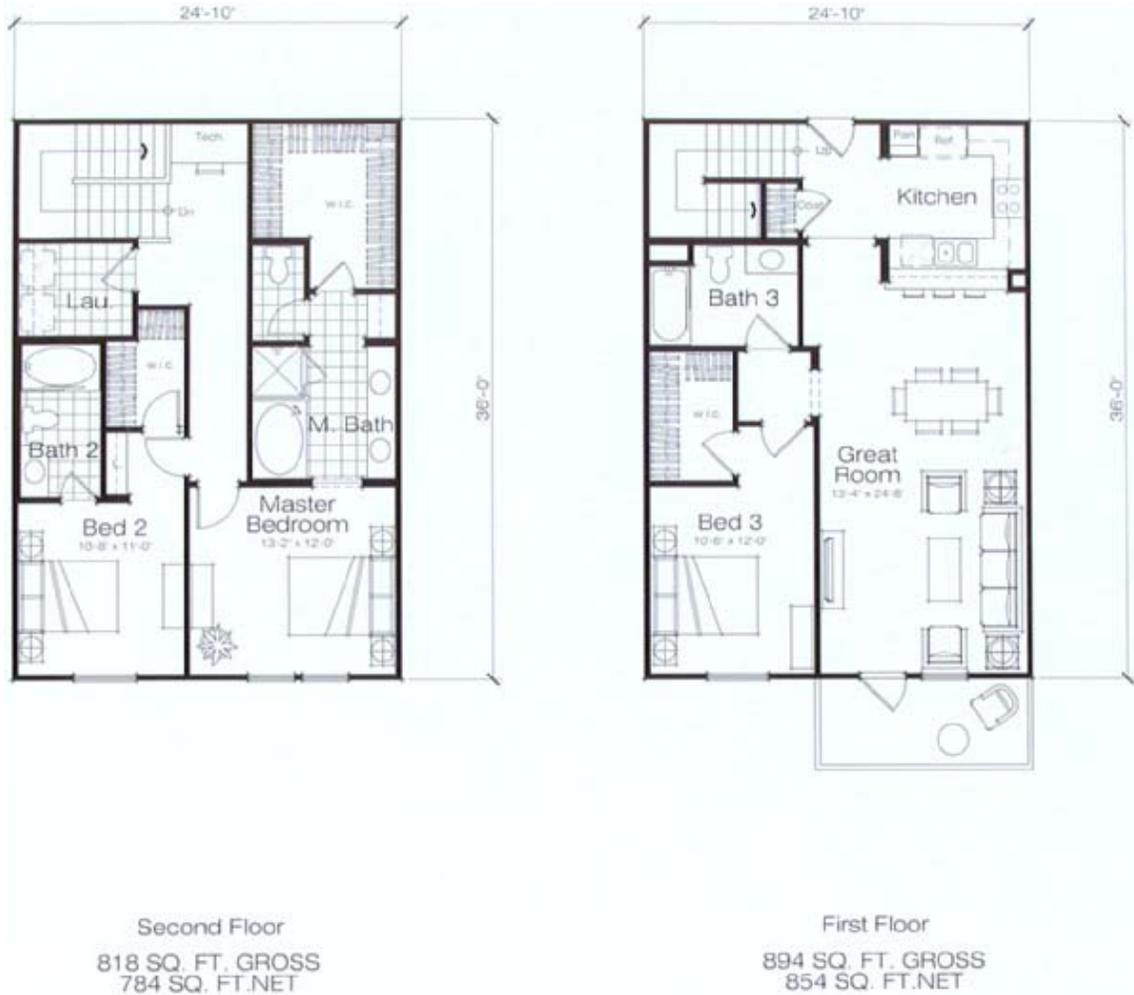
Lighting – High-rise Residential Floor Plan 7



Plan7	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	236	15.2%	8260	>40	35	236	881	1.00	0.152	40	0.135
Entryway	6	48	3.1%	288	>40	60	5	18	0.10	0.003	69	0.003
Hallway/closet	13.25	329	21.2%	4353	>40	35	124	464	0.38	0.080	40	0.071
Bedroom	10.5	510	32.9%	5351	>40	60	89	333	0.18	0.058	69	0.050
Kitchen	35	85	5.5%	2966	>40	35	85	316	1.00	0.055	40	0.049
Kitchen Counters	41.25	45	2.9%	1867	>40	10	187	696	4.13	0.121	10	0.121
Living Room	10.5	176	11.3%	1843	>40	60	31	115	0.18	0.020	69	0.017
Dining Room	13	120	7.8%	1563	>40	10	156	583	1.30	0.101	10	0.101
		1548								0.590		0.546

High-rise floor plan 7, Baseline and Alternative weighted lighting load watts/sqft

Lighting – High-rise Residential Floor Plan 8



Plan8	Lum/sf	SF	%	Lumens	Wattage	Proposed Baseline					Alternative 1	
						Lum/watt	Watts	Equiv Inc	Watts/SF	Weighted	Lum/watt	Weighted
Bath	35	221	13.7%	7739	>40	35	221	825	1.00	0.137	40	0.121
Entryway	6	32	2.0%	189	>40	60	3	12	0.10	0.002	69	0.002
Hallway/closet	13.25	497	30.8%	6586	>40	35	188	702	0.38	0.117	40	0.103
Bedroom	10.5	437	27.1%	4587	>40	60	76	285	0.18	0.047	69	0.041
Kitchen	35	45	2.8%	1584	>40	35	45	169	1.00	0.028	40	0.025
Kitchen Counters	41.25	42	2.6%	1743	>40	10	174	650	4.13	0.108	10	0.108
Living Room	10.5	173	10.7%	1820	>40	60	30	113	0.18	0.019	69	0.016
Dining Room	13	167	10.3%	2166	>40	10	217	808	1.30	0.134	10	0.134
		1614								0.592		0.551

High-rise floor plan 8, Baseline and Alternative weighted lighting load watts/sqft

On-site Power Generation

Photovoltaics

Parameter	Proposed Alternative
Power Output	12.86 watts/sf
Azimuth	South
Tilt	28 deg
Power Deg Coefficient	0.278 %/deg F
Rating Point Temp	77 deg F
Nominal Operating Temp	113 deg F
Inverter Efficiency	77%

Photovoltaics, alternative modeling scenarios

Panels	Sqft	kW	\$/kW***
8	112	1.44	\$11,748
10	140	1.80	\$10,390
16	224	2.88	\$8,464
20	280	3.60	\$7,930
30	420	5.40	\$7,427
40	560	7.20	\$6,911
50	700	9.00	\$6,831
60	840	10.88	\$6,577
70	980	12.60	\$6,416

Each modular solar panel is roughly 32.5" x 62"

***Photovoltaic Installed costs as shown include metering and switchgear. The cost does not include a \$2.55/watt PV Subsidy, which was applied to all systems. Additionally, PV is net-metered allowing generation of utility credits. Annual O&M cost = 0.12% of installed cost (before rebate)

Orientation/Tilt Energy Correction Factor						
Facing	0	15	30	45	60	90
South	0.89	0.97	1.00	0.97	0.88	0.56
SSE, SSW	0.89	0.97	0.99	0.96	0.87	0.57
SE, SW	0.89	0.95	0.96	0.93	0.85	0.59
ESE, WSW	0.89	0.92	0.91	0.87	0.79	0.57
E,W	0.89	0.88	0.84	0.78	0.70	0.51

Photovoltaics correction factors for orientation

Internal Combustion Engines in CHP Configuration

Installed cost \$/kW for IC engine based CHP system is defined by:

- $Y = (6067.1X^{-0.2885}) * 1.3$, where $X = \text{kW}$
- O&M cost for CHP system is \$0.01155/kWh
- CHP system maximum efficiencies are:
 - < 900 kW: Electric = 34%, Total = 76%
 - > 900 kW: Electric = 35%, Total = 77%
 - < 900 kW: Jacket water temp = 215 F, Exhaust temp = 900 F
 - > 900 kW: Jacket water temp = 235 F, Exhaust temp = 850 F
- CHP systems recover heat to domestic hot water, space heating, and in some cases, absorption cooling.
- CHP systems are configured to track electric load.
- CHP systems are configured to run during mid- and/or on-peak utility periods

Microturbines in CHP Configuration

Installed cost \$/kW for microturbine based CHP system is defined by:

- $Y = 2366.8X^{-0.136}$, where $X = \text{kW}$
- O&M cost for CHP system is \$0.0105/kWh
- CHP system maximum efficiencies are:
 - Electric = 28%, Total = 78%
- CHP systems recover heat to domestic hot water, space heating, and in some cases, absorption cooling.
- CHP systems are configured to track electric load.
- CHP systems are configured to run during mid- and/or on-peak utility periods

CHP Systems Equipment

Installed cost \$/RT for single effect absorption chillers is defined by:

< 300 RT: \$520/RT

300 to 500 RT: \$430/ RT

500 to 1000 RT: \$365/ RT

- Installed cost \$/RT for double effect absorption chillers is defined by:

\$625/RT

- Installed cost \$/RT for electric chillers is defined by:

< 500 RT: \$340/RT

500 to 1000 RT: \$350/RT

- O&M cost for absorption chillers is defined by:

$Y = 644.61X^{-0.8454}$, where $X = RT$

Thermal Storage

- Ice-on-coil system @ \$70/ton-hr applied to buildings with chillers only
- Charge during mid- and on-peak periods
- Serves 50% to 75% of the cooling capacity (optimized on a case-by-case basis)
- Starting efficiency equals baseline chiller efficiency. Ending efficiency equals approx. 40% lower.

Solar Thermal

Passive, glazed flat-plate collector system @ \$7,055 per unit applied to single-family town homes only (Prototype #13). System per dwelling includes two standard 3'x7' black chrome collector panels, 100 gallon hot water storage tank/heater, and all required piping, valves and fittings. Panel square footage is based on 20 sqft per first two family members plus 8 sqft for every additional person. Rough tank sizing is approximately 1.5 to 2.0 gallons per sqft of collector.

Parameter	Proposed Alternative
Collector Efficiency Curve Intercept %	0.7%
Collector Efficiency Curve Slope	0.7 Btu/hr-sqft-F
Solar Collector Loss Factor	12%
Hourly Storage Loss Factor	2%
Plane Surface Tilt Angle	18 deg
Plane Surface Azimuth Angle	180 deg

Utility Rates

Residential Utility Rates - Electric

SDG&E Residential Electric Rate Schedule DR

Season Schedule												
Months	1	2	3	4	5	6	7	8	9	10	11	12
Summer												
Winter												

Price Component	Cutoff (kWh)	Price	Units
Summer Energy "First"	11.80	0.13040	\$/kwh
Summer Energy "Up to"	15.34	0.15057	\$/kwh
Summer Energy "Up to"	23.60	0.22730	\$/kwh
Summer Energy "Up to"	35.40	0.23637	\$/kwh
Summer Energy "Over"	35.40	0.25220	\$/kwh
Winter Energy "First"	11.80	0.13040	\$/kwh
Winter Energy "Up to"	15.34	0.15057	\$/kwh
Winter Energy "Up to"	23.60	0.21187	\$/kwh
Winter Energy "Up to"	35.40	0.22069	\$/kwh
Winter Energy "Over"	35.40	0.23877	\$/kwh

Residential and Commercial Utility Rates – Natural Gas

SDG&E Residential Gas Rate Schedule GR

Season Schedule												
Months	1	2	3	4	5	6	7	8	9	10	11	12
Summer												
Winter												

Schedule GR	Price Component	Cutoff (Therms/day)	Price	Units
GR	Energy "First"	0.493	1.07601	\$/therm
GR	Energy "Over"	0.493	1.31619	\$/therm

Rate varies monthly. Rate above is as of 10/09/07

Commercial Utility Rates – Electric

SDG&E Commercial Electric Rate Schedule AL-TOU

Weekday Rate Schedule																								
Summer	1	2	3	4	5	6	7	8	9	10	11	12												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
On-Peak																								
Semi-Peak																								
Off-Peak																								

Weekday Rate Schedule																								
Winter	1	2	3	4	5	6	7	8	9	10	11	12												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
On-Peak																								
Semi-Peak																								
Off-Peak																								

Weekend Rate Schedule																								
Summer/ Winter	1	2	3	4	5	6	7	8	9	10	11	12												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
On-Peak																								
Semi-Peak																								
Off-Peak																								

Price Component	Price	Units
Service Fee	48.52	\$/mo
Non-Coincident Demand	10.8	\$/kW
Summer On-Peak Demand	4.87	\$/kW
Summer On-Peak Energy	0.15349	\$/kWh
Summer Semi-Peak Energy	0.09791	\$/kWh
Summer Off-Peak Energy	0.07441	\$/kWh
Winter On-Peak Demand	3.64	\$/kW
Winter On-Peak Energy	0.1531	\$/kWh
Winter Semi-Peak Energy	0.09791	\$/kWh
Winter Off-Peak Energy	0.07441	\$/kWh

Standby: \$5.55/kW Contract Demand

Electric Power Generation, CHP, and Residential Heating Emission Factors

Emission Conversion Factors			
	Mixed Fuels Central Power lb/MWh	Natural Gas Residential Heating lb/MMBtu	Natural Gas CHP lb/MMBtu
CO ₂	700.4	117.6	117.6
SO ₂	0.128	0.00059	0.00059
NO _x	0.342	0.092	0.015

Note; End use delivery efficiency of 92% is assumed for electricity and 98.4% for natural gas. CHP emission factors for natural gas engine with NSCR catalyst.

Energy Efficiency Measure Useful Life

Measure	Useful Life (yrs)
Wall Insulation	50
Roof Insulation	50
Cool Roof	15
Windows	20
Doors	20
Appliances	14
DHW Heater	14
Lighting	12
Photovoltaics	30
HVAC	18
CHP	20
Thermal Storage	18
Solar Thermal	30