CA Statewide Codes and Standards Program
Title 24 Local Energy Efficiency Ordinances

Title:
Climate Zone 15
Energy Cost-Effectiveness Study

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1.0 Executive Summary

Public Resources Code Section 25402.1(h)2 and Section 10-106 of the Building Energy Efficiency Standards (Standards) establish a process which allows local adoption of energy standards that are more stringent than the statewide Standards. This process allows local governments to adopt and enforce energy standards before the statewide Standards effective date, require additional energy conservation measures, and/or set more stringent energy budgets. Because these energy standards "reach" beyond the minimum requirements of Title 24, Part 6 of the California Building Code, they are commonly referred to as Reach Codes when adopted as a collective set by a local jurisdiction.

The process for adopting a Reach Code requires that local governments apply to the California Energy Commission (CEC) for approval. The applicant jurisdiction must document the supporting analysis for determining that the proposed Reach Code Standards will save more energy than the current statewide Standards. The applicant jurisdiction must also prepare a **Cost Effectiveness Study** that provides the basis of the local government's determination that the proposed Reach Code Standards are cost-effective. Once the CEC staff has verified that the local Reach Code Standards will require buildings to use no more energy than the current statewide Standards and that the documentation requirements in Section 10-106 are met, the application is brought before the full California Energy Commission for approval.

This Cost Effectiveness Study was prepared for Climate Zone 15 which encompasses over 100 cities and towns within Imperial, San Diego, Riverside and San Bernardino counties (see Appendix "A" for list of local jurisdictions). The 2008 Building Energy Efficiency Standards, effective January 1, 2010, have been used as the baseline used in calculating the energy performance of efficiency measures summarized in this study.

2.0 Methodology and Assumptions

The energy performance impacts of exceeding the performance requirements of the 2008 Title 24 Building Energy Efficiency Standards (2008 Standards) have been evaluated in Climate Zone 15 using the following residential and nonresidential prototypical building types:

Small Single Family House 2-story 2,025 sf	**Large Single Family House** 2-story 4,500 sf
Low-rise Multi-family Apartments 8 dwelling units/2-story 8,442 sf	**High-rise Multi-family Apartments** 40 dwelling units/4-story 36,800 sf
Low-rise Office Building 1-story 10,580 sf	**High-rise Office Building** 5-story 52,900 sf

Methodology

The methodology used in the case studies is based on a design process for each of the proposed prototypical building types that first meets the minimum requirements and then exceeds the 2008 Standards by 15%. The process includes the following major stages:

Stage 1: Minimum Compliance with 2008 Standards:

Each prototype building design is tested for minimum compliance with the 2008 Standards, and the mix of energy measures are adjusted using common construction options so the building first just meets the Standards. The set of energy measures chosen represent a reasonable combination which reflects how designers, builders and developers are likely to achieve a specified level of performance using a relatively low first incremental (additional) cost

Stage 2: Incremental Cost for Exceeding 2008 Standards by 15%:

Starting with that set of measures which is minimally compliant with the 2008 Standards, various energy measures are upgraded so that the building just exceeds the 2008 Standards by 15%. The design choices by the consultant authoring this study are based on many years of experience with architects, builders, mechanical engineers; and general knowledge of the relative acceptance and preferences of many measures, as well as their incremental costs. This approach tends to reflect how building energy performance is typically evaluated for code compliance and how it's used to select design energy efficiency measures. Note that lowest simple payback with respect to building site energy is not the primary focus of selecting measures; but rather the requisite reduction of Title 24 Time Dependent Valuation(TDV) energy at a reasonable

incremental cost consistent with other non-monetary but important design considerations. A minimum and maximum range of incremental costs of added energy efficiency measures is established by a variety of research means. A construction cost estimator, Building Advisory LLC, was contracted to conduct research to obtain current measure cost information for several energy measures; and Gabel Associates performed its own additional research to establish first cost data.

Stage 3 Cost Effectiveness Determination:

Energy savings in kWh and therms is calculated from the Title 24 simulation results to establish the annual energy cost savings and CO2-equivalent reductions in greenhouse gases. A simple payback analysis in years is calculated by dividing the incremental cost for exceeding the 2008 Standards by the estimated annual energy cost savings.

Assumptions

Annual Energy Cost Savings

1. Annual site electricity (kWh) and natural gas (therms) saved for low-rise residential buildings are calculated using the state-approved energy compliance software for the 2008 Building Energy Efficiency Standards, Micropas 8; and for high-rise residential and nonresidential buildings using the state-approved 2008 energy compliance software EnergyPro v5.0.

2. Average residential utility rates of $0.159/kWh for electricity and $0.94/therm for natural gas in current constant dollars; nonresidential rates are time-of-use rate schedules modeled explicitly in the DOE-2.1E computer simulation: Southern California Edison GS-1 schedule for electricity and Southern California Gas GN-10 schedule for natural gas.

3. No change (i.e., no inflation or deflation) of utility rates in constant dollars

4. No increase in summer temperatures from global climate change

Simple Payback Analysis

1. No external cost of global climate change -- and corresponding value of additional investment in energy efficiency and CO_2 reduction – is included

2. The cost of money (e.g., opportunity cost) invested in the incremental cost of energy efficiency measures is not included.

3.0 Minimum Compliance with 2008 Standards

The following energy design descriptions of the following building prototypes just meet the 2008 Standards in Climate Zone 15.

Small Single Family House

- 2,025 square feet
- 2-story
- 20.2% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-15 Walls
R-19 Raised Floor over Garage/Open at 2nd Floor
R-0 Slab on Grade
Quality Insulation Installation (HERS)
Super Low E Vinyl Windows, U=0.36, SHGC=0.23
Furnace: 80% AFUE
Air Conditioner: 13 SEER, 11 EER (HERS)
Air Conditioner: Refrigerant Charge (HERS)
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
50 Gallon Gas Water Heater: EF=0.62

Large Single Family House

- 4,500 square feet
- 2-story
- 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-38 Roof w/ Radiant Barrier
R-21 Walls
R-30 Raised Floor
Quality Insulation Installation (HERS)
Super Low E Vinyl Windows, U=0.36, SHGC=0.23
(2) Furnaces: 80% AFUE
(2) Air Conditioners: 13 SEER, 11 EER (HERS)
(2) Air Conditioners: Refrigerant Charge (HERS)
R-6 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(2) 50 Gallon Gas Water Heaters: EF=0.62

Low-rise Multi-family Apartments

- 8,442 square feet
- 8 units/2-story
- 12.5% glazing/floor area ratio

R-38 Roof w/ Radiant Barrier
R-19 Walls R-0 Slab on Grade Quality Insulation Installation (HERS) Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (8) Furnaces: 80% AFUE (8) Air Conditioners: 13 SEER, 11 EER (HERS) R-8 Attic Ducts Reduced Duct Leakage/Testing (HERS) (8) 40 Gallon Gas Water Heaters: EF=0.63

High-rise Multifamily Apartments

- 36,800 sf,
- 40 units
- 4-story
- Window to Wall Ratio = 35.2%

Energy Efficiency Measures to Meet Title 24
R-19 Metal Roof w/ R-10 (2") rigid insulation; cool roof Reflectance = 0.55 Emittance = 0.75
R-19 in Metal Frame Walls
R-4 (1.25" K-13 spray-on) Raised Slab over parking garage
Dual Metal Windows: default U-factor=0.70, SHGC=0.79
4-pipe fan coil, 80% AFUE boiler, 100-ton scroll air cooled chiller 0.79 KW/ton
Central DHW boiler: 80% AFUE and recirculating system w/ timer-temperature controls

Low-rise Office Building

- Single Story
- 10,580 sf,
- Window to Wall Ratio = 37.1%

Energy Efficiency Measures to Meet Title 24
R-19 under Metal Deck + R-10 (2" rigid); with Cool Roof Reflectance = 0.55, Emittance = 0.75
R-19 in Metal Frame Walls
R-0 (un-insulated) slab-on-grade 1st floor
Metal windows: Default glazing U=0.71, COG SHGC=0.54
Lighting = 0.858 w/sf: Open Office Areas: (60) 2-lamp T8 fixtures @58w each; (24) 18w recessed CFLs no lighting controls. Small Offices: (48) 2-lamp T8 fixtures; (40) 18w recessed CFLs, on/off lighting controls. Support Areas: (32) 18w recessed CFLs; (48) 13w CFL wall sconces; no controls.
(4) 10-ton DX units EER=11.0; 80% AFUE furnaces; standard efficiency fan motors; fixed temp. integrated air economizers
R-10 duct insulation w/ ducts on roof, HERS verified duct leakage
(1) Tank Gas Water Heaters EF=0.58

High-rise Office Building

- 5-story
- 52,900 sf,
- Window to Wall Ratio = 39.4%

Energy Efficiency Measures to Meet Title 24
R-30 under Metal/Conc. Deck, cool roof Reflectance=0.55, Emittance = 0.75
R-19 in Metal Frame Walls
R-0 (un-insulated) slab-on-grade 1st floor
Metal windows: COG u=0.30, COG SHGC=0.54
Lighting = 0.858 w/sf: Open Office Areas: (300) 2-lamp T8 fixtures @58w each; no lighting controls; (120) 18w recessed CFLs no lighting controls. Small Offices: (280) 2-lamp T8 58w fixtures on/off lighting controls; (200) 18w recessed CFLs no lighting on/off lighting controls. Support Areas: (160) 18w recessed CFLs no lighting controls; (240) 13w CFL wall sconces; no lighting controls.
(1) Built Up VAV system with (1) 200 ton recipricating chiller 1.2 kW/ton and 82% AFUE boiler, standard efficiency variable speed fan motors; 30% VAV boxes, reheat on perimeter zones with hot water using 82% AFUE boiler
R-8 duct insulation w/ ducts in conditioned
82% AFUE boiler for domestic hot water use

3.0 Incremental Cost to Exceed 2008 Standards by 15%

The following tables list the energy features and/or equipment included in the 2008 Standards base design, the efficient measure options, and an estimate of the incremental cost for each measure included **to improve the building performance to use 15% less TDV energy than the corresponding Title 24 base case design**.

Small Single Family House

- 2,025 square feet
- 2-story
- 20.2% glazing/floor area ratio

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 2,025 SF, Option 1 **2025 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	$ -	$ -	$ -
R-21 Walls (from R-15): 2,550 sf @ $0.45 to $0.70/sf	Upgrade	$ 1,148	$ 1,785	$ 1,467
R-19 Raised Floor over Garage/Open at 2nd Floor	-	$ -	$ -	$ -
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
Furnace: 80% AFUE	-	$ -	$ -	$ -
Air Conditioner: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER (HERS))	Upgrade	$ 500	$ 1,500	$ 1,000
Air Conditioner: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-8 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
50 Gallon Gas Water Heater: EF=0.62	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 1,648**	**$ 3,285**	**$ 2,467**
Total Incremental Cost per Square Foot:		**$ 0.81**	**$ 1.62**	**$ 1.22**

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 2,025 SF, Option 2 **2025 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 1,443 sf @ 0.15 to 0.20/sf	Upgrade	$ 216	$ 289	$ 253
R-19 Walls (from R-15): 2,550 sf @ $0.35 to $0.55/sf	Upgrade	$ 893	$ 1,403	$ 1,148
R-30 Raised Floor over Garage/Open at 2nd Floor (from R-19): 448 sf @ $0.25 to $0.35	Upgrade	$ 112	$ 157	$ 134
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
Furnace: 80% AFUE	-	$ -	$ -	$ -
Air Conditioner: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER (HERS))	Upgrade	$ 500	$ 1,500	$ 1,000
Air Conditioner: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-8 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
50 Gallon Gas Water Heater: EF=0.63 (from EF=0.62)	Upgrade	$ -	$ 50	$ 25
Total Incremental Cost of Energy Efficiency Measures:		**$ 1,721**	**$ 3,398**	**$ 2,560**
Total Incremental Cost per Square Foot:		**$ 0.85**	**$ 1.68**	**$ 1.26**

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 2,025 SF, Option 3 **2025 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 1,443 sf @ 0.15 to 0.20/sf	Upgrade	$ 216	$ 289	$ 253
R-21 Walls (from R-15): 2,550 sf @ $0.45 to $0.70/sf	Upgrade	$ 1,148	$ 1,785	$ 1,467
R-19 Raised Floor over Garage/Open at 2nd Floor	-	$ -	$ -	$ -
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Steep Sloped Cool Roof, Refl=0.30, Em=0.85 (from Refl=0.08, Em=0.85): 1,443 sf @ 0.35 to 0.50/sf	Upgrade	$ 505	$ 722	$ 613
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
Furnace: 80% AFUE	-	$ -	$ -	$ -
Air Conditioner: 13 SEER, 11 EER (HERS)	-	$ -	$ -	$ -
Air Conditioner: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-8 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
Instantaneous Gas Water Heater: RE=0.80 (from 50 Gal Gas: EF=0.62)	Upgrade	$ 900	$ 1,500	$ 1,200
Total Incremental Cost of Energy Efficiency Measures:		**$ 2,770**	**$ 4,295**	**$ 3,532**
Total Incremental Cost per Square Foot:		**$ 1.37**	**$ 2.12**	**$ 1.74**

Large Single Family House

- 4,500 square feet
- 2-story
- 22.0% glazing/floor area ratio

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 4,500 SF, Option 1 **4500 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-49 Roof w/ Radiant Barrier (from R-38 w/ Radiant Barrier): 2,700 sf @ $0.30 to 0.45/sf	Upgrade	$ 810	$ 1,215	$ 1,013
R-21 Walls	-	$ -	$ -	$ -
R-38 Raised Floor (from R-30): 2,700 sf @ $0.10 to $0.15	Upgrade	$ 270	$ 405	$ 338
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Steep Sloped Cool Roof, Refl=0.30, Em=0.85 (from Refl=0.08, Em=0.85): 2,700 sf @ 0.35 to 0.50/sf	Upgrade	$ 945	$ 1,350	$ 1,148
Housewrap: 2,518 sf @ $0.50 to $0.75/sf	Upgrade	$ 1,259	$ 1,889	$ 1,574
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
(2) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(2) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	$ 1,000	$ 3,000	$ 2,000
(2) Air Conditioners: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-8 Attic Ducts (from R-6)	Upgrade	$ 450	$ 650	$ 550
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(2) 50 Gallon Gas Water Heaters: EF=0.63 (from EF=0.62)	Upgrade	$ -	$ 100	$ 50
Total Incremental Cost of Energy Efficiency Measures:		**$ 4,734**	**$ 8,609**	**$ 6,671**
Total Incremental Cost per Square Foot:		**$ 1.05**	**$ 1.91**	**$ 1.48**

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 4,500 SF, Option 2 **4500 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate Min	Max	Avg
R-49 Roof w/ Radiant Barrier (from R-38 w/ Radiant Barrier): 2,700 sf @ $0.30 to 0.45/sf	Upgrade	$ 810	$ 1,215	$ 1,013
R-21 Walls	-	$ -	$ -	$ -
R-38 Raised Floor (from R-30): 2,700 sf @ $0.10 to $0.15	Upgrade	$ 270	$ 405	$ 338
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
(2) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(2) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	$ 1,000	$ 3,000	$ 2,000
(2) Air Conditioners: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-8 Attic Ducts (from R-6)	Upgrade	$ 450	$ 650	$ 550
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(2) Instantaneous Gas Water Heater: RE=0.80 (from 50 Gal Gas: EF=0.62)	Upgrade	$ 1,800	$ 3,000	$ 2,400
Pipe Insulation	Upgrade	$ 300	$ 400	$ 350
Total Incremental Cost of Energy Efficiency Measures:		**$ 4,630**	**$ 8,670**	**$ 6,650**
Total Incremental Cost per Square Foot:		**$ 1.03**	**$ 1.93**	**$ 1.48**

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 4,500 SF, Option 3 **4500 sf** **Climate Zone 15**

Energy Efficiency Measures	Change	Incremental Cost Estimate		
R-38 Roof w/ Radiant Barrier	-	$ -	$ -	$ -
R-21 Walls	-	$ -	$ -	$ -
R-38 Raised Floor (from R-30): 2,700 sf @ $0.10 to $0.15	Upgrade	$ 270	$ 405	$ 338
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Steep Sloped Cool Roof, Refl=0.30, Em=0.85 (from Refl=0.08, Em=0.85): 2,700 sf @ 0.35 to 0.50/sf	Upgrade	$ 945	$ 1,350	$ 1,148
Super Low E Vinyl Windows, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
(2) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(2) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	$ 1,000	$ 3,000	$ 2,000
(2) Air Conditioners: Refrig. Charge (HERS)	-	$ -	$ -	$ -
R-6 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(2) Instantaneous Gas Water Heater: RE=0.80 (from 50 Gal Gas: EF=0.62)	Upgrade	$ 1,800	$ 3,000	$ 2,400
Pipe Insulation	Upgrade	$ 300	$ 400	$ 350
Total Incremental Cost of Energy Efficiency Measures:		**$ 4,315**	**$ 8,155**	**$ 6,235**
Total Incremental Cost per Square Foot:		**$ 0.96**	**$ 1.81**	**$ 1.39**

Low-rise Multi-family Apartments

- 8,442 square feet
- 8 units/2-story
- 12.5% glazing/floor area ratio

Incremental Cost Estimate to Exceed Title 24 by 15%

Multi-Family Prototype: 8,442 SF, Option 1 **8442 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	$ -	$ -	$ -
R-21 Walls (from R-19): 10,146 sf @ $0.14 to $0.16/sf	Upgrade	$ 1,420	$ 1,623	$ 1,522
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Steep Sloped Cool Roof, Refl=0.30, Em=0.85 (from Refl=0.08, Em=0.85): 4,221 sf @ 0.35 to 0.50/sf	Upgrade	$ 1,477	$ 2,111	$ 1,794
Super Low E Vinyl, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
(8) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(8) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	$ 4,000	$ 12,000	$ 8,000
(8) Air Conditioners: Refrig. Charge (HERS)	Upgrade	$ 1,200	$ 1,600	$ 1,400
R-8 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(8) 40 Gallon Gas Water Heaters: EF=0.63	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 8,098**	**$ 17,334**	**$ 12,716**
Total Incremental Cost per Square Foot:		**$ 0.96**	**$ 2.05**	**$ 1.51**

Incremental Cost Estimate to Exceed Title 24 by 15%

Multi-Family Prototype: 8,442 SF, Option 2 **8442 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier (from R-38 w/Radiant Barrier): 4,221 sf @ 0.15 to 0.20/sf	Downgrade	$ (844)	$ (633)	$ (739)
R-21 Walls (from R-19): 10,146 sf @ $0.14 to $0.16/sf	Upgrade	$ 1,420	$ 1,623	$ 1,522
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Steep Sloped Cool Roof, Refl=0.30, Em=0.85 (from Refl=0.08, Em=0.85): 4,221 sf @ 0.35 to 0.50/sf	Upgrade	$ 1,477	$ 2,111	$ 1,794
Super Low E Vinyl, U=0.36, SHGC=0.23	-	$ -	$ -	$ -
(8) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(8) Air Conditioners: 13 SEER, 11 EER (HERS)	-	$ -	$ -	$ -
(8) Air Conditioners: Refrig. Charge (HERS)	Upgrade	$ 1,200	$ 1,600	$ 1,400
R-8 Attic Ducts	-	$ -	$ -	$ -
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(8) Instantaneous Gas Water Heater: RE=0.80 (from 40 Gal Gas: EF=0.63)	Upgrade	$ 7,200	$ 11,600	$ 9,400
Total Incremental Cost of Energy Efficiency Measures:		**$ 10,454**	**$ 16,301**	**$ 13,377**
Total Incremental Cost per Square Foot:		**$ 1.24**	**$ 1.93**	**$ 1.58**

Incremental Cost Estimate to Exceed Title 24 by 15%
Multi-Family Prototype: 8,442 SF, Option 3 **8442 sf** **Climate Zone 15**

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	$ -	$ -	$ -
R-21 Walls (from R-19): 10,146 sf @ $0.14 to $0.16/sf	Upgrade	$ 1,420	$ 1,623	$ 1,522
R-0 Slab on Grade	-	$ -	$ -	$ -
Quality Insulation Installation (HERS)	-	$ -	$ -	$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30 (from Super Low E Vinyl, U=0.36, SHGC=0.23): 1055 sf @ $1.40 - $1.75 / sf	Downgrade	$ (1,846)	$ (1,477)	$ (1,662)
(8) Furnaces: 80% AFUE	-	$ -	$ -	$ -
(8) Air Conditioners: 16.5 SEER, 13 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	$ 6,000	$ 16,000	$ 11,000
(8) Air Conditioners: Refrig. Charge (HERS)	Upgrade	$ 1,200	$ 1,600	$ 1,400
R-6 Attic Ducts (from R-8)	Downgrade	$ (1,500)	$ (1,000)	$ (1,250)
Reduced Duct Leakage/Testing (HERS)	-	$ -	$ -	$ -
(8) 40 Gallon Gas Water Heaters: EF=0.63	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 5,274**	**$ 16,746**	**$ 11,010**
Total Incremental Cost per Square Foot:		**$ 0.62**	**$ 1.98**	**$ 1.30**

High-rise Multifamily Apartments

- 36,800 sf,
- 40 units/4-story
- Window to Wall Ratio = 35.2%

Incremental Cost Estimate to Exceed Title 24 by 15%
High-rise Residential Prototype: 36,800 SF, Option 1 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-19 Metal Roof w/ R-10 (2") rigid insulation; cool roof Reflectance = 0.55 Emittance = 0.75	-			
R-19 in Metal Frame Walls	-			
R-4 (1.25" K-13 spray-on) Raised Slab over parking garage	-			
Dual Metal Windows: **COG U-factor=0.3, COG SHGC=0.38** 6,240 sf @ $2.00 to $3.50/sf	Upgrade	$ 15,600	$ 24,960	$ 20,280
4-pipe fan coil, **92% AFUE** boiler, 100-ton scroll air cooled chiller 0.79 KW/ton	Upgrade	$ 1,500	$ 3,000	$ 2,250
Central DHW boiler: **92% AFUE** and recirculating system w/ timer-temperature controls	Upgrade	$ 1,500	$ 3,000	$ 2,250
Total Incremental Cost of Energy Efficiency Measures:		**$ 18,600**	**$ 30,960**	**$ 24,780**
Total Incremental Cost per Square Foot:		**$ 0.51**	**$ 0.84**	**$ 0.67**

Incremental Cost Estimate to Exceed Title 24 by 15%
High-rise Residential Prototype: 36,800 SF, Option 2 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 Metal Roof w/ R-10 (2") rigid insulation; cool roof Reflectance = 0.55 Emittance = 0.75	-			
R-19 in Metal Frame Walls	-			
R-4 (1.25" K-13 spray-on) Raised Slab over parking garage	-			
Dual Non-Metal Windows: COG U-factor=0.3, COG SHGC=0.38, 6,240 sf @ $3.50 to $5.00/sf	Upgrade	$ 21,840	$ 31,200	$ 26,520
4-pipe fan coil, 80% AFUE boiler, 100-ton scroll air cooled chiller 0.79 KW/ton	-			
Central DHW boiler: 80% AFUE and recirculating system w/ timer-temperature controls	-			
Total Incremental Cost of Energy Efficiency Measures:		**$ 21,840**	**$ 31,200**	**$ 26,520**
Total Incremental Cost per Square Foot:		**$ 0.59**	**$ 0.85**	**$ 0.72**

Incremental Cost Estimate to Exceed Title 24 by 15%
High-rise Residential Prototype: 36,800 SF, Option 3 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 Metal Roof w/ **R-15 (3") rigid insulation**; cool roof Reflectance = 0.55 Emittance = 0.75, 9,200 sf @ $1.10 - $1.50/sf	Upgrade	$ 10,120	$ 13,800	$ 11,960
R-19 in Metal Frame Walls	-			
R-4 (1.25" K-13 spray-on) Raised Slab over parking garage	-			
Dual Metal Windows: **COG U-factor=0.3, COG SHGC=0.38** 6,240 sf @ $2.00 to $3.50/sf	Upgrade	$ 15,600	$ 24,960	$ 20,280
4-pipe fan coil, 80% AFUE boiler, 100-ton scroll air cooled chiller 0.79 KW/ton	-			
Central DHW boiler: 80% AFUE and recirculating system w/ timer-temperature controls	-			
Total Incremental Cost of Energy Efficiency Measures:		**$ 25,720**	**$ 38,760**	**$ 32,240**
Total Incremental Cost per Square Foot:		**$ 0.70**	**$ 1.05**	**$ 0.88**

Incremental Cost Estimate to Exceed Title 24 by 15%

High-rise Residential Prototype: 36,800 SF, Option 4 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 Metal Roof w/ **R-20 (4") rigid insulation**; cool roof Reflectance = 0.55 Emittance = 0.75, 9,200 sf @ $2.20 - $3.00/sf	Upgrade	$ 20,240	$ 27,600	$ 23,920
R-19 in Metal Frame Walls	-			
R-4 (1.25" K-13 spray-on) Raised Slab over parking garage	-			
Dual Metal Windows: Default U-factor=0.79, **COG SHGC=0.54** 6,240 sf @ $1.50 to $2.50/sf	Upgrade	$ 9,360	$ 15,600	$ 12,480
4-pipe fan coil, **92% AFUE** boiler, 100-ton scroll air cooled chiller 0.79 KW/ton	Upgrade	$ 1,500	$ 3,000	$ 2,250
Central DHW boiler: **92% AFUE** and recirculating system w/ timer-temperature controls	Upgrade	$ 1,500	$ 3,000	$ 2,250
Total Incremental Cost of Energy Efficiency Measures:		**$ 32,600**	**$ 49,200**	**$ 40,900**
Total Incremental Cost per Square Foot:		**$ 0.89**	**$ 1.34**	**$ 1.11**

Low-rise Office Building

- Single Story
- 10,580 sf,
- Window to Wall Ratio = 37.1%

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 10,580 SF, Option 1 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 under Metal Deck + R-10 (2" rigid); with Cool Roof Reflectance = 0.55, Emittance = 0.75	-	$ -	$ -	$ -
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: **COG U=0.30,** COG SHGC=0.54 3,200 sf @ $1.50 to $2.50/sf	Upgrade	$ 4,800	$ 8,000	$ 6,400
Lighting = 0.678 w/sf: **Open Office Areas: (32) HO 2-lamp T8 fixtures @74w each;** no lighting controls; (24) 18w recessed CFLs. Small Offices: (56) 2-lamp T8 fixtures, **(28) multi-level ocupancy sensors on T8s @ $75 to $100 each;**; (40) 18w recessed CFLs **w/ multi-level occupancy sensors on CFLs @ $75 to $100 each.** Support Areas: (32) 18w recessed CFLs; (48) 13w CFL wall sconces; no controls. Net saving of $36 to $40 per new fixture in open offices because of a total reduction of 46% of T8 fixtures in these areas.	Upgrade	$ 948	$ 1,520	$ 1,234
(4) 10-ton DX units EER=11.0; 80% AFUE furnaces; standard efficiency fan motors; fixed temp. integrated air economizers	-	$ -	$ -	$ -
R-10 duct insulation w/ ducts on roof, HERS verified duct leakage	-	$ -	$ -	$ -
(1) **Tankless Gas Water Heater EF=0.84**	Upgrade	$ 1,800	$ 2,400	$ 2,100
Total Incremental Cost of Energy Efficiency Measures:		**$ 7,548**	**$ 11,920**	**$ 9,734**
Total Incremental Cost per Square Foot:		**$ 0.71**	**$ 1.13**	**$ 0.92**

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 10,580 SF, Option 2 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 under Metal Deck + **R-15 (3" rigid);** with Cool Roof Reflectance = 0.55, Emittance = 0.75	Upgrade	$ 11,638	$ 15,870	$ 13,754
R-19 in Metal Frame Walls	-			
R-0 (un-insulated) slab-on-grade 1st floor	-			
Metal windows: **COG U=0.30,** COG SHGC=0.54 3,200 sf @ $1.50 to $2.50/sf	Upgrade	$ 4,800	$ 8,000	$ 6,400
Lighting = 0.678 w/sf: **Open Office Areas: (32) HO 2-lamp T8 fixtures @74w each;** no lighting controls; (24) 18w recessed CFLs. Small Offices: (56) 2-lamp T8 fixtures, **(28) multi-level ocupancy sensors on T8s @ $75 to $100 each;**; (40) 18w recessed CFLs **w/ multi-level occupancy sensors on CFLs @ $75 to $100 each.** Support Areas: (32) 18w recessed CFLs; (48) 13w CFL wall sconces; no controls. Net saving of $36 to $40 per new fixture in open offices because of a total reduction of 46% of T8 fixtures in these areas.	Upgrade	$ 948	$ 1,520	$ 1,234
(3) 15-ton DX units EER=12.0; 92% AFUE furnaces; premium efficiency fan motors; fixed temp. integrated air economizers	Upgrade	$ 7,500	$ 9,500	$ 8,500
R-10 duct insulation w/ ducts on roof, HERS verified duct leakage	-	$ -	$ -	$ -
(1) Tank Gas Water Heaters EF=0.58	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 24,886**	**$ 34,890**	**$ 29,888**
Total Incremental Cost per Square Foot:		**$ 2.35**	**$ 3.30**	**$ 2.82**

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 10,580 SF, Option 3 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-19 under Metal Deck + **R-20 (4" rigid)**; Cool Roof Reflectance =0.55, Emittance = 0.75; 10,580 sf @ $2.20 to $3.00/sf	Upgrade	$ 23,276	$ 31,740	$ 27,508
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: **COG U=0.30,** COG SHGC=0.54 3,200 sf @ $1.50 to $2.50/sf	Upgrade	$ 4,800	$ 8,000	$ 6,400
Lighting = 0.783 w/sf: Open Office Areas: (60) 2-lamp T8 fixtures @58w each; no lighting controls; (24) 18w recessed CFLs. Small Offices: (56) 2-lamp T8 fixtures, **(28) multi-level ocupancy sensors on T8s @ $75 to $100 each;**; (40) 18w recessed CFLs Support Areas: (32) 18w recessed CFLs; (48) 13w CFL wall sconces; no controls.	Upgrade	$ 2,100	$ 2,800	$ 2,450
(3) 15-ton DX units EER=12.0; 92% AFUE furnaces; premium efficiency fan motors; fixed temp. integrated air economizers	Upgrade	$ 7,500	$ 9,500	$ 8,500
R-10 duct insulation w/ ducts on roof, HERS verified duct leakage	-			
(1) **Tankless Gas Water Heater EF=0.84**	Upgrade	$ 1,800	$ 2,400	$ 2,100
Total Incremental Cost of Energy Efficiency Measures:		**$ 39,476**	**$ 54,440**	**$ 46,958**
Total Incremental Cost per Square Foot:		**$ 3.73**	**$ 5.15**	**$ 4.44**

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 10,580 SF, Option 4 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-19 under Metal Deck + R-10 (2" rigid); with Cool Roof Reflectance = 0.55, Emittance = 0.75	-	$ -	$ -	$ -
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: **COG U=0.30, COG SHGC=0.38** 3,200 sf @ $2.50 to $3.50/sf	Upgrade	$ 8,000	$ 11,200	$ 9,600
Lighting = 0.678 w/sf: **Open Office Areas: (32) HO 2-lamp T8 fixtures @74w each;** no lighting controls; (24) 18w recessed CFLs. Small Offices: (56) 2-lamp T8 fixtures, **(28) multi-level ocupancy sensors on T8s @ $75 to $100 each;**; (40) 18w recessed CFLs **w/ multi-level occupancy sensors on CFLs @ $75 to $100 each.** Support Areas: (32) 18w recessed CFLs; (48) 13w CFL wall sconces; no controls. Net saving of $36 to $40	Upgrade	$ 948	$ 1,520	$ 1,234
(3) 15-ton DX units EER=12.0; 92% AFUE furnaces; standard efficiency fan motors**;** fixed temp. integrated air economizers	Upgrade	$ 7,200	$ 9,050	$ 8,125
R-10 duct insulation w/ ducts on roof, HERS verified duct leakage	-			
(1) Tank Gas Water Heaters EF=0.58	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 16,148**	**$ 21,770**	**$ 18,959**
Total Incremental Cost per Square Foot:		**$ 1.53**	**$ 2.06**	**$ 1.79**

High-rise Office Building

- 5-story
- 52,900 sf,
- Window to Wall Ratio = 39.4%

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 52,900 SF, Option 1 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-30 under Metal/Conc. Deck, cool roof Reflectance=0.55, Emittance = 0.75	-	$ -	$ -	$ -
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: COG U=0.30, **COG SHGC=0.27**; 16,000 sf @ $2.50 to $3.50/sf	Upgrade	$ 40,000	$ 56,000	$ 48,000
Lighting = 0.678 w/sf: Open Office Areas: **(160) HO 2-lamp T8 fixtures @74w each**; no lighting controls; (120) 18w recessed CFLs no lighting controls. Small Offices: (140) 2-lamp T8 fixtures **multi-level occupancy sensors on T8s @ $75 to $100 each**; (200) 18w recessed CFLs on/off lighting controls. Support Areas: (160) 18w recessed CFLs no lighting controls; (240) 13w CFL wall sconces; no lighting controls. Net saving of $36 to $40 per new fixture in open offices because of a total reduction of 46% of T8 fixtures in these areas	Upgrade	$ 4,740	$ 7,600	$ 6,170
(1) Built Up VAV system with (1) 200 ton recipricating chiller 1.2 kW/ton and 82% AFUE boiler, standard efficiency variable speed fan motors; 20% VAV boxes, reheat on perimeter zones with hot water using 82% AFUE boiler	-	$ -	$ -	$ -
R-8 duct insulation w/ ducts in conditioned	-	$ -	$ -	$ -
82% AFUE boiler for domestic hot water use	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 44,740**	**$ 63,600**	**$ 54,170**
Total Incremental Cost per Square Foot:		**$ 0.85**	**$ 1.20**	**$ 1.02**

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 52,900 SF, Option 2 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-30 under Metal/Conc. Deck, **no cool roof** 10,580 sf @$0.35 to $0.50/sf	Downgrade	$ (3,703)	$ (5,290)	$ (4,497)
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: COG U=0.30, **COG SHGC=0.38**; 16,000 sf @ $1.75 to $2.75/sf	Upgrade	$ 28,000	$ 44,000	$ 36,000
Lighting = 0.678 w/sf: Open Office Areas: **(160) HO 2-lamp T8 fixtures @74w each**; no lighting controls; (120) 18w recessed CFLs no lighting controls. Small Offices: (140) 2-lamp T8 fixtures **multi-level occupancy sensors on T8s @ $75 to $100 each**; (200) 18w recessed CFLs on/off lighting controls. Support Areas: (160) 18w recessed CFLs no lighting controls; (240) 13w CFL wall sconces; no lighting controls. Net saving of $36 to $40 per new fixture in open offices because of a total reduction of 46% of T8 fixtures in these areas	Upgrade	$ 4,740	$ 7,600	$ 6,170
(1) Built Up VAV system with (1) 200 ton recipricating chiller 1.2 kW/ton and 82% AFUE boiler, **standard efficiency** variable speed fan motors; **20% VAV boxes**, reheat on perimeter zones with hot water using 82% AFUE boiler $0.65 to $0.90/sf	Upgrade	$ 34,135	$ 47,110	$ 40,623
R-8 duct insulation w/ ducts in conditioned	-	$ -	$ -	$ -
82% AFUE boiler for domestic hot water use	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 63,172**	**$ 93,420**	**$ 78,296**
Total Incremental Cost per Square Foot:		**$ 1.19**	**$ 1.77**	**$ 1.48**

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 52,900 SF, Option 3 **Climate Zone 15**

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate Min	Max	Avg
R-30 under Metal/Conc. Deck, **no cool roof** 10,580 sf @$0.35 to $0.50/sf	Downgrade	$ (3,703)	$ (5,290)	$ (4,497)
R-19 in Metal Frame Walls	-	$ -	$ -	$ -
R-0 (un-insulated) slab-on-grade 1st floor	-	$ -	$ -	$ -
Metal windows: COG U=0.30, **COG SHGC=0.31**; 16,000 sf @ $2.00 to $3.00/sf	Upgrade	$ 32,000	$ 48,000	$ 40,000
Lighting = 0.753 w/sf: Open Office Areas: **(160) HO 2-lamp T8 fixtures @74w each**; no lighting controls; (120) 18w recessed CFLs no lighting controls. Small Offices: (140) 2-lamp T8 fixtures on/off occupancy sensors on T8s; (200) 18w recessed CFLs on/off lighting controls. Support Areas: (160) 18w recessed CFLs no lighting controls; (240) 13w CFL wall sconces; no lighting controls. Net saving of $148.50 to $294.00 per new fixture in open offices because of a total reduction of 46% of T8 fixtures in these areas, and no multi-level occupancy sensors	Upgrade	$ (47,050)	$ (23,760)	$ (35,405)
(1) Built Up VAV system with (1) 200 ton recipricating chiller 1.2 kW/ton and 82% AFUE boiler, standard efficiency variable speed fan motors; **20% VAV boxes**, reheat on perimeter zones with hot water using 82% AFUE boiler $0.50 to $0.75/sf	Upgrade	$ 34,135	$ 47,110	$ 40,623
R-8 duct insulation w/ ducts in conditioned	-	$ -	$ -	$ -
82% AFUE boiler for domestic hot water use	-	$ -	$ -	$ -
Total Incremental Cost of Energy Efficiency Measures:		**$ 15,382**	**$ 66,060**	**$ 40,721**
Total Incremental Cost per Square Foot:		**$ 0.29**	**$ 1.25**	**$ 0.77**

5.0 Cost Effectiveness Determination

Regardless of the building design, occupancy profile and number of stories, the incremental improvement in overall annual energy performance of buildings in exceeding the 2008 Standards is determined to be cost-effective. However, each building's overall design, occupancy type and specific design choices may allow for a large range of incremental costs for exceeding 2008 Standards, estimated annual energy cost savings, and subsequent payback period.

Small Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
2,025 sf (Option 1)	1299	16	$2,467	$222	11.1
2,025 sf (Option 2)	1272	21	$2,560	$222	11.5
2,025 sf (Option 3)	1003	65	$3,533	$221	16.0
Averages:	1191	34	$2,853	$221	12.9

Annual Reduction in CO2-equivalent: ***932 lb./building-year***
0.46 lb./sq.ft.-year

Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
4,500 sf (Option 1)	2216	24	$6,672	$375	17.8
4,500 sf (Option 2)	1631	117	$6,650	$369	18.0
4,500 sf (Option 3)	1689	108	$6,235	$370	16.8
Averages:	1660	113	$6,443	$370	17.4

Annual Reduction in CO2-equivalent: ***1,797 lb./building-year***
0.40 lb./sq.ft.-year

Low-rise Multi-family Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
8-Unit, 8,442 sf (Option 1)	5427	7	$12,716	$869	14.6
8-Unit, 8,442 sf (Option 2)	3052	384	$13,378	$846	15.8
8-Unit, 8,442 sf (Option 3)	5163	20	$11,010	$840	13.1
Averages:	4547	137	$12,368	$852	14.5

Annual Reduction in CO2-equivalent: ***3,641 lb./building-year***
0.43 lb./sq.ft.-year

High-rise Multi-family Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
36,800 sf (Option 1)	23577	-150	$24,780	$3,608	6.9
36,800 sf (Option 2)	23675	-140	$26,520	$3,633	7.3
36,800 sf (Option 3)	24893	-227	$32,240	$3,745	8.6
36,800 sf (Option 4)	18495	663	$40,900	$3,564	11.5
Averages:	22660	37	$31,110	$3,637	8.6

Annual Reduction in CO2-equivalent: ***10,622 lb./building-year***
0.29 lb./sq.ft.-year

Low-rise Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
10,580 sf (Option 1)	22133	139	$9,734	$5,085	1.9
10,580 sf (Option 2)	25509	14	$29,888	$5,877	5.1
10,580 sf (Option 3)	22685	175	$46,958	$5,374	8.7
10,580 sf (Option 4)	27214	5	$18,959	$6,235	3.0
Averages:	24385	83	$26,385	$5,643	4.7

Annual Reduction in CO2-equivalent: ***11,942 lb./building-year***
1.13 lb./sq.ft.-year

High-rise Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback (Years)
52,900 sf Option 1	69474	-342	$54,170	$15,438	3.5
52,900 sf Option 2	128191	1948	$78,296	$29,631	2.6
52,900 sf Option 3	99272	2142	$40,721	$23,176	1.8
Averages:	98979	1249	$57,729	$22,748	2.6

Annual Reduction in CO2-equivalent: ***44,192 lb./building-year***
0.84 lb./sq.ft.-year

Appendix A:
Climate Zone 15 Cities

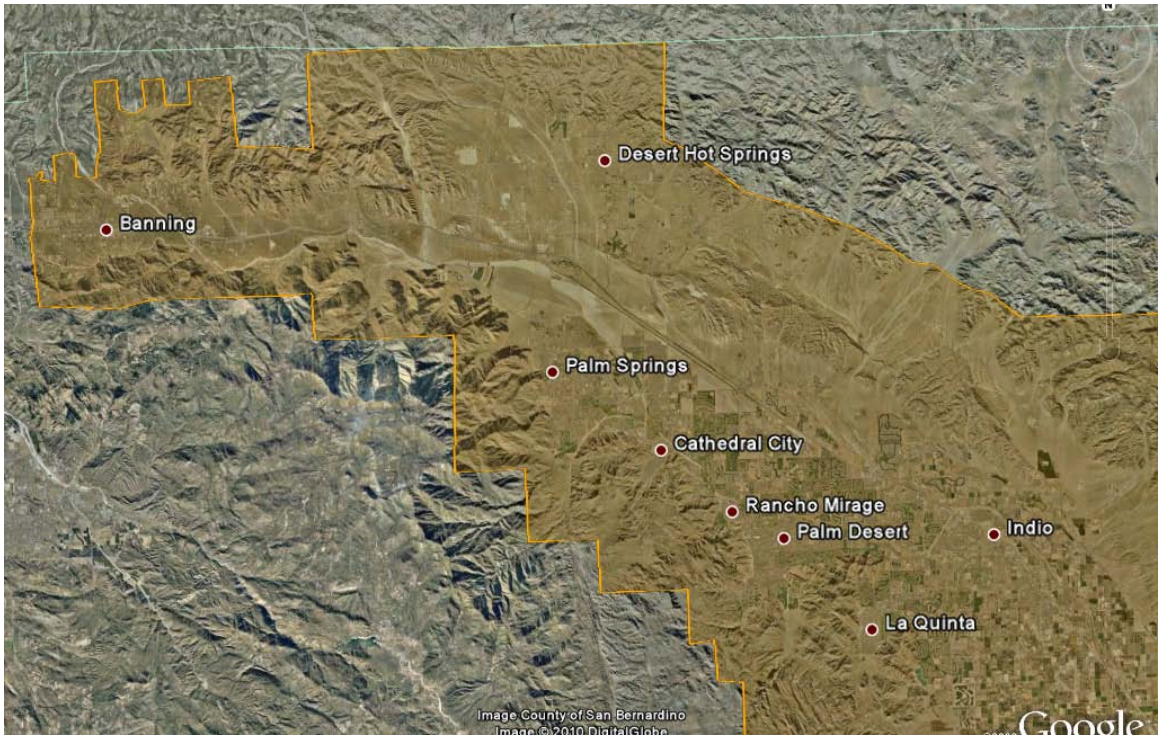
1 Acolita
2 Agua Caliente Springs
3 Aguanga
4 Alamo River
5 Amboy
6 Amos
7 Andrade
8 Araz Wash
9 Arroyo Salada
10 Bagdad
11 Banning
12 Bard
13 Big Maria Mountains
14 Black Meadow Landing
15 Blythe
16 Bombay Beach
17 Bonds Corner
18 Borrego
19 Borrego Springs
20 Box Canyon
21 Brawley
22 Bristol Lake
23 Cabazon
24 Cadiz
25 Cadiz Lake
26 Cadiz Valley
27 Calexico
28 Calipatria
29 Carrizo Wash
30 Cathedral City
31 Chambless
32 Chubbuck
33 Chuckwalla Valley
34 Clyde
35 Coachella
36 Coachella Valley
37 Colorado River
38 Coyote Wash
39 Cross Roads
40 Danby Lake
41 Deep Canyon
42 Desert Beach
43 Desert Center
44 Desert Hot Springs
45 Desert Shores
46 Dixieland
47 Dos Cabezas
48 Duguynos Canyon
49 Durmid
50 Earp
51 East Mesa
52 El Centro
53 Ferguson Lake
54 Ford Dry Lake
55 Frink
56 Glamis
57 Gold Rock Rch
58 Gordons Well
59 Grommet
60 Havasu Lake
61 Heber
62 Holtville
63 Imperial
64 Imperial Dam
65 Imperial Reservoir
66 Imperial Valley
67 Inca
68 Indian Wells
69 Indio
70 Iris

Climate Zone 15 Cities – con't

71	Jacumba Mountains	106	Pinkham Wash
72	Java	107	Pinto Wash
73	La Quinta	108	Pinto Wash
74	Laguna Dam	109	Piute Wash
75	Lake Havasu	110	Plaster City
76	Mammoth Wash	111	Quartz Peak
77	Martinez Canyon	112	Rancho Mirage
78	McCoy Wash	113	Rice
79	Mecca	114	Rice Valley
80	Mesaville	115	Ripley
81	Midland	116	Saltmarsh
82	Milligan	117	Salton City
83	Mount Signal	118	Salton Sea
84	Mountain Spring	119	Saltus
85	Needles	120	San Gorgonio Pass
86	Nicholls Warm Springs	121	San Gorgonio River
87	Niland	122	Superstition Mountain
88	North Palm Springs	123	Thermal
89	Oasis	124	Thousand Palms
90	Ocotillo	125	Tule Wash
91	Ocotillo Wells	126	U.S.N. Air Field El Centro
92	Ogilby	127	Unnamed Wash
93	Orita	128	Vidal
94	Palen Lake	129	Vidal Junction
95	Palen Mountains	130	Vidal Valley
96	Palm Canyon	131	Vidal Wash
97	Palm Desert	132	Vinagre Wash
98	Palm Desert Country	133	West Mesa
99	Palm Springs	134	Westmorland
100	Palm Wash	135	Whipple Mountains
101	Palo Verde	136	White Water
102	Palo Verde Valley	137	Wiest
103	Parker Dam	138	Winterhaven
104	Picacho	139	Wister
105	Picacho Wash	140	Yuha Desert

Only a portion located within Climate Zone 15

Riverside
15
San Diego
Google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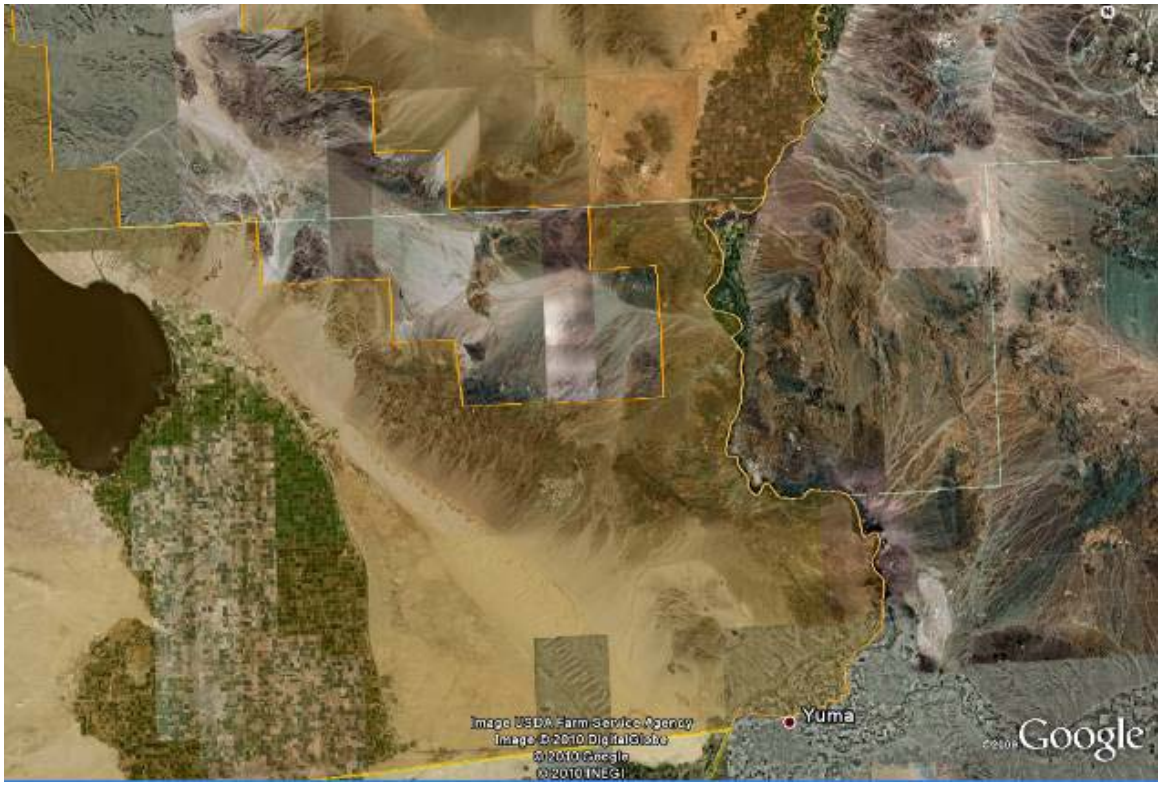
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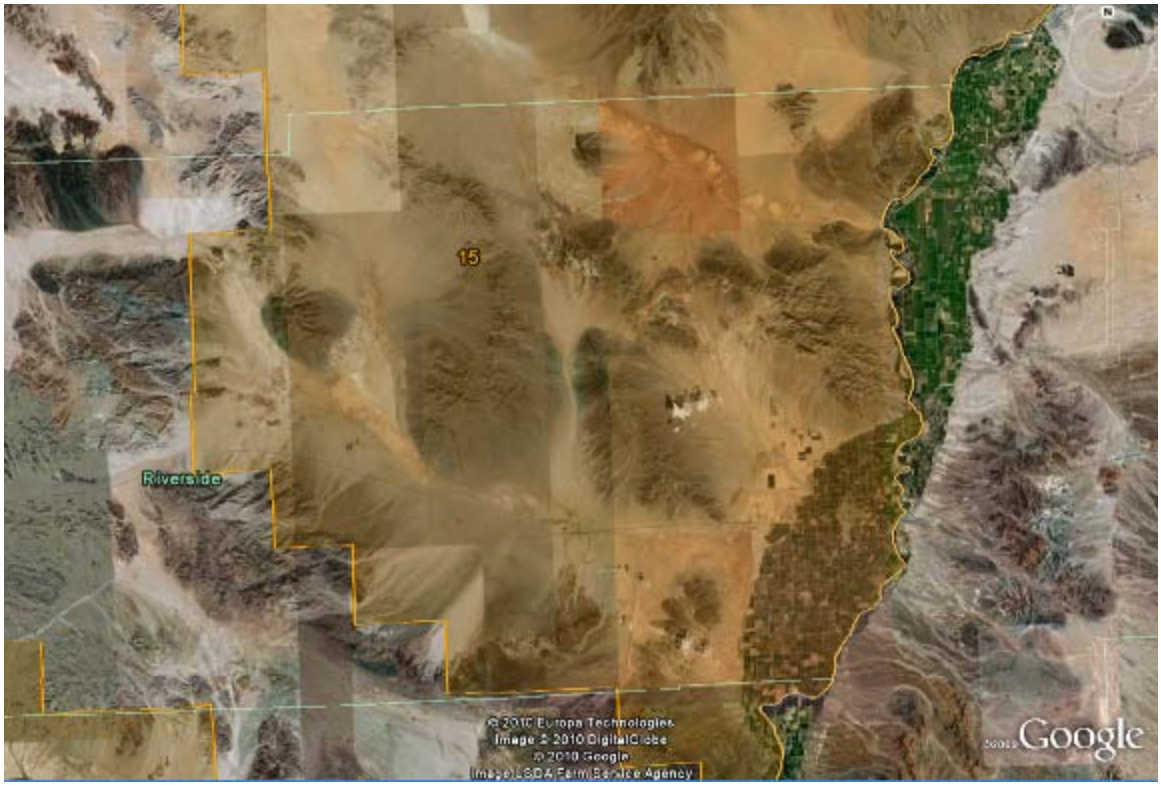
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