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Application for:

City of Los Altos Locally Adopted Energy Standards

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## Ordinance Summary

The City of Los Altos is updating its *Green Building Regulations Ordinance* (“Ordinance”) to conserve natural resources through sustainable design and construction practices. In the Ordinance, residential and non-residential new construction, as defined in the Ordinance, shall be 15% more energy efficient than required by Title 24, Part 6.

The Ordinance was designed with multiple considerations. These include:

- Consistency with the currently adopted methods of the 2008 Title 24 Building Energy Efficiency Standards:
- Meeting the intent of the Ordinance by demonstrating that the level of energy consumption of new buildings is 15% less than the TDV energy allowed for an equivalent building:
- Enforcement, Support and Training: The City of Los Altos Building Division continues staff and general public education of Title 24, Part 6 by utilizing the services of local Certified Energy Plans Examiners, consultants and instructors to provide periodic training.

This application to the California Energy Commission follows the requirements specified in Section 10-106 of the California Code of Regulations, Title 24, Part 1, **LOCALLY ADOPTED ENERGY STANDARDS**. The Ordinance is enforceable only after the Commission has reviewed and formally approved the proposed local energy standards n meeting all requirements of Section 10-106.

**Statement per Section 10-106(b)3.** The updated Ordinance will require all new residential buildings as well as non-residential buildings be designed to consume 15% less TDV energy than permitted by Title 24, Part 6.

## Development of the Ordinance

**Prototype Residential Building.** For the purpose of this study, a prototype building was developed with a total conditioned floor area of 2,500 sf. The prototype building establishes the features of a typical custom residential design.

The prototype building is a 2 story structure with a raised floor over a crawl space and 9' ceilings with attic space. Sixty five percent of the total area is on the 1<sup>st</sup> floor and thirty five percent is on the 2<sup>nd</sup> floor. There is 21% as vertical sliding windows (6% on the front elevation, 8% on the rear elevation, 3.5% on the left and right elevations); and 1.3% as horizontal skylight for a total of 22.3% fenestration of the conditioned floor area. Space heating is provided by two forced air furnaces, one serving the lower floor and one serving the upper floor. A large 75 gallon storage tank water heater serves the whole house. The prototype house description is based on a survey of previously submitted projects to the City of Los Altos.

The same prototype building with the same relative 1<sup>st</sup> and 2<sup>nd</sup> floor areas and fenestration percentages has also been developed for 3,000 sf; 4,000 sf; 5,000 sf; and 6,000 sf buildings. Each of the prototype buildings has been analyzed with the State certified version of EnergyPro v5.0 to establish what the energy budget is for each of these sized homes under the 2008 Building Energy Efficiency Standards in Climate Zone 4.

**Prototype Non-Residential Building.** For the purpose of this study, a prototype commercial retail building as well as an office building were developed with a total conditioned floor area of 5,000 square feet each.

The prototype retail building is a single story structure with a slab on grade floor, and 9.5' T-Bar grid type ceiling. The exterior side walls are concrete masonry units (CMU). The front and rear walls are wood framed with metallic fenestration assemblies. The general lighting consists of fluorescent fixtures. The mechanical system is a packaged rooftop mounted unit. The water heating is achieved with a small electric tank style water heater. The prototype office building is a 2 story structure with a slab on grade ground floor and 10' T-Bar grid type ceilings. The exterior side walls are built of concrete masonry units (CMU). The front and rear walls are wood framed with metallic fenestration assemblies. The lighting, mechanical and water heating features are similar to the retail building. The prototype Non-Residential buildings were analyzed as complete buildings with the State certified version of EnergyPro v5.0 to establish the energy budget under the 2008 Building Energy Efficiency Standards in Climate Zone 4.

**Prototype Multi Family Building.** For the purpose of this study, a prototype 4 unit multi family building was developed with a total conditioned floor area of 4,874 square feet. The prototype building is a 2 story structure with a raised floor. The ceilings are 9' with attic space. The area of the first floor represents 49% of the total conditioned space. There is 16.5% of the conditioned floor area as horizontal sliding fenestration. An additional 0.5% of skylights have been modeled. Space heating for each unit is designed as a single HVAC system with an 80% AFUE furnace and a 13 SEER air conditioning unit. A 50 gallon storage tank water heater serves each unit. This prototype building is based on a survey of previously submitted projects to the City of Los Altos.

## Analysis of Impact on Residential Buildings

The following assumptions were used in the determination of the impact on Single Family residential buildings.

### 2,500 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .30 U-factor and .30 SHGC
- 75 gallon DHW .57 EF

### 2,500 Square Foot – 2 Story – 15% Compliance

- ❖ 22.3% Total fenestration area
- ❖ 2 HVAC Systems
  - 91% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
  - Quality Insulation Installation (HERS)
- ❖ R-19 Raised Floors
- ❖ R-13 Exterior Walls
- ❖ R-38 Roof / Ceiling with Radiant Barrier
- ❖ Non metallic fenestration .30 U-factor and .30 SHGC
- ❖ 75 gallon DHW .57 EF with pipe insulation to kitchen

### 3,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .30 U-factor and .30 SHGC
- 75 gallon DHW .57 EF

### 3,000 Square Foot – 2 Story – 15% Compliance

- ❖ 22.3% Total fenestration area
- ❖ 2 HVAC Systems
  - 90% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
  - Quality Insulation Installation (HERS)
- ❖ R-19 Raised Floors
- ❖ R-13 Exterior Walls
- ❖ R-38 Roof / Ceiling with Radiant Barrier
- ❖ Non metallic fenestration .30 U-factor and .30 SHGC
- ❖ 75 gallon DHW .57 EF with pipe insulation to kitchen

#### 4,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .30 U-factor and .30 SHGC
- 75 gallon DHW .57 EF

#### 4,000 Square Foot – 2 Story – 15% Compliance

- ❖ 22.3% Total fenestration area
- ❖ 2 HVAC Systems
  - 90% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
  - Quality Insulation Installation (HERS)
- ❖ R-19 Raised Floors
- ❖ R-13 Exterior Walls
- ❖ R-38 Roof / Ceiling with Radiant Barrier
- ❖ Non metallic fenestration .30 U-factor and .30 SHGC
- ❖ 75 gallon DHW .57 EF with pipe insulation to kitchen

### 5,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .30 U-factor and .30 SHGC
- 75 gallon DHW .57 EF

### 5,000 Square Foot – 2 Story – 15% Compliance

- ❖ 22.3% Total fenestration area
- ❖ 2 HVAC Systems
  - 90% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
  - Quality Insulation Installation (HERS)
- ❖ R-19 Raised Floors
- ❖ R-13 Exterior Walls
- ❖ R-38 Roof / Ceiling with Radiant Barrier
- ❖ Non metallic fenestration .30 U-factor and .30 SHGC
- ❖ 75 gallon DHW .57 EF with pipe insulation to kitchen

### 6,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .30 U-factor and .30 SHGC
- 75 gallon DHW .57 EF

### 6,000 Square Foot – 2 Story – 15% Compliance

- ❖ 22.3% Total fenestration area
- ❖ 2 HVAC Systems
  - 90% AFUE Furnaces
  - 13 SEER Air Conditioning
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
- ❖ R-19 Raised Floors
- ❖ R-13 Exterior Walls
- ❖ R-38 Roof / Ceiling with Radiant Barrier
- ❖ Non metallic fenestration .30 U-factor and .30 SHGC
- ❖ 75 gallon DHW .57 EF with pipe insulation to kitchen

## Analysis of Impact on Non Residential Buildings

The following assumptions were used in the determination of the impact on Non Residential Buildings.

### 5,000 Square Foot Retail – Single Story – Base

- 8.3% Fenestration of total wall area
- 2 HVAC Systems
  - 80% AFUE Packaged Unit
  - 13 SEER
  - R-6 Duct Insulation
- Slab on grade
- R-13 Front and rear walls
- 8" Solid filled CMU side walls
- R-19 Roof / Ceiling Insulation with cool roofing
- Dual glazed, Metal framed fenestration .71 U-factor and .60 SHGC
- 3,500 Watts of general lighting
- 3,510 Watts of spot lighting
- 1,125 Watts of display lighting
- 74 Watts of restroom lighting
- 20 gallon electric DHW

### 5,000 Square Foot Retail – Single Story – 15% Compliance

- 8.3% Fenestration of total wall area
- 2 HVAC Systems
  - 80% AFUE Packaged Unit
  - 13 SEER
  - R-6 Duct Insulation
- Slab on grade
- R-13 Front and rear walls
- 8" Solid filled CMU side walls with R-13 Insulation
- R-30 Roof / Ceiling Insulation with cool roofing
- Dual glazed, Metal framed fenestration .71 U-Factor and .60 SHGC
- 2,800 Watts of general lighting
- 2,430 Watts of spot lighting
- 1,125 Watts of display lighting
- 74 Watts of restroom lighting
- 20 gallon electric DHW

### 5,000 Square Foot Office – 2 Story – Base

- 8% Fenestration of total wall area
- 2 HVAC Systems
  - 80% AFUE Packaged unit
  - 13 SEER
  - R-6 Duct Insulation
- Slab on grade
- R-13 Front and rear framed walls
- 8" Solid filled CMU side walls
- R-19 Roof Insulation with cool roofing
- Dual Glazed metal framed fenestration .71 U-factor and .60 SHGC
- 2,800 Watts of general lighting
- 1,620 Watts of spot lighting
- 148 Watts of restroom lighting
- 20 gallon electric DHW

### 5,000 Square Foot Office – 2 Story – 15% Compliance

- 8% Fenestration of total wall area
- 2 HVAC Systems
  - 80% AFUE Packaged unit
  - 13 SEER
  - R-6 Duct Insulation
- Slab on grade
- R-13 Front and rear framed walls
- 8" Solid filled CMU side walls with R-13 Insulation
- R-19 Roof Insulation with cool roofing
- Dual Glazed metal framed fenestration .71 U-factor and .60 SHGC
- 2,800 Watts of general lighting
- 1,620 Watts of spot lighting
- 148 Watts of restroom lighting
- 20 gallon electric DHW

## Analysis of Impact on Multi Family Buildings

The following assumptions were used in the determination of the impact on Multi Family buildings.

### 4,874 Square Foot Multi Family Building – Base

- 17% Total fenestration area
- 4 Individual HVAC Systems
  - 80% AFUE Furnaces
  - 13 SEER Air Conditioners
  - R-6 Duct Insulation
  - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .40 U-factor and .35 SHGC
- 50 gallon DHW .57 EF

### 4,874 Square Foot Multi Family Building – 15% Compliance

- 17% Total fenestration area
- 4 Individual HVAC Systems
  - 90% AFUE Furnaces
  - 13 SEER Air Conditioners
  - R-6 Duct Insulation
  - Duct leakage verification (HERS)
  - Quality Insulation Installation (HERS)
- R-19 Raised Floors
- R-13 Exterior Walls
- R-38 Roof / Ceiling with Radiant Barrier
- Non metallic fenestration .35 U-factor and .35 SHGC
- 50 gallon DHW .57 EF

Summary of measures and Cost Analysis

*Summary and cost of proposed energy efficient measures assumed for analysis*

Building Size	Energy Efficient Measure	Cost
Res. 2,500 sf	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Quality Insulation Installation (HERS)</li> <li>• Increased insulation R-value</li> <li>• Pipe insulation to kitchen</li> </ul>	\$800 \$400 \$250 \$600 \$250
Res. 3,000 sf	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Quality Insulation Installation (HERS)</li> <li>• Increased insulation R-value</li> <li>• Pipe insulation to kitchen</li> </ul>	\$800 \$400 \$250 \$600 \$250
Res. 4,000 sf	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Quality Insulation Installation (HERS)</li> <li>• Increased insulation R-value</li> </ul>	\$800 \$400 \$250 \$700
Res. 5,000 sf	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Quality Insulation Installation (HERS)</li> <li>• Increased insulation R-value</li> </ul>	\$800 \$400 \$250 \$700
Res. 6,000 sf	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Increased insulation R-value</li> </ul>	\$800 \$400 \$800
Non Res. Retail	<ul style="list-style-type: none"> <li>• Added insulation to CMU</li> <li>• Reduced amount of lighting</li> <li>• Increased R-value attic insulation</li> </ul>	\$1,000 <\$700> \$1,200
Non Res. Office	<ul style="list-style-type: none"> <li>• Added insulation to CMU</li> <li>• Added Cool Roof requirement</li> </ul>	\$1,000 \$750
Multi Family	<ul style="list-style-type: none"> <li>• Increased furnace efficiency</li> <li>• Increased window efficiency</li> <li>• Duct leakage testing (HERS)</li> <li>• Quality Insulation Installation (HERS)</li> <li>• Increased insulation R-value</li> </ul>	\$1,600 \$1,200 \$1,600 \$1,000 \$800

## Cost Effectiveness

The cost effectiveness of the increased efficiency required by the Ordinance is calculated for the buildings analyzed above. The total cost of the measures needed to meet the Ordinance is divided by the annual energy cost savings to determine the cost effectiveness of the additional energy efficiency measures. An average residential utility rate of \$0.17 kWh for electricity and \$1.40 for natural gas and an average commercial utility rate of \$0.15 kWh for electricity and \$1.30 for natural gas were used for the purposes of this study.

### *Yearly energy and cost savings from the Ordinance*

Building Size	Electricity Savings (kWh/yr)	Nat. Gas Savings (therms/yr)	Electricity Cost Savings	Nat. Gas Cost Savings	Total Yearly Cost Savings
Res. 2,500 sf	187	73	\$32	\$102	\$134
Res. 3,000 sf	235	77	\$40	\$108	\$148
Res. 4,000 sf	249	74	\$42	\$104	\$146
Res. 5,000 sf	306	86	\$52	\$120	\$172
Res. 6,000 sf	354	88	\$60	\$123	\$183
Non Res. Retail 5,000 sf	27,677	<480>	\$4,152	<\$624>	\$3,528
Non Res. Office 5,000 sf	2472	667	\$371	\$867	\$1,238
Multi Family	505	147	\$86	\$206	\$292

### *Simple payback for modeled energy efficiency measures for Ordinance compliance*

Building Size	Additional cost of energy efficient measures	Annual energy cost savings	Simple Payback (Years)
Res. 2,500 sf	\$2,300	\$134	17.16
Res. 3,000 sf	\$2,300	\$148	15.54
Res. 4,000 sf	\$2,150	\$146	14.72
Res. 5,000 sf	\$2,150	\$172	12.50
Res. 6,000 sf	\$2,000	\$183	10.92
Non Res. Retail	\$1,500	\$3,528	0.43
Non Res. Office	\$1,750	\$1,238	1.41
Multi Family	\$6,200	\$292	21.23