

January 8, 2008

Application for:

City of Los Altos Locally Adopted Energy Standards

From:
James Walgren, Assistant City Manager
Los Altos Community Development Department
One North San Antonio Road
Los Altos, CA 94022
(650) 947-2750

Report prepared by:

Miles Hancock
Certified Energy Plans Examiner
City of Los Altos
1 N. San Antonio Road
Los Altos, CA 94022

Table of Contents

Ordinance Summary.....

Development of the Ordinance.....

Analysis of Impact.....

Summary of measures and cost analysis.....

Cost Effectiveness.....

Ordinance Summary

The City of Los Altos developed a *Green Building Regulations Ordinance* (“Ordinance”) to conserve natural resources through sustainable design and construction practices. In the proposed 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 has been designed with multiple considerations. These include:

- Consistency with the currently adopted methods of the 2005 Title 24 Building Energy Efficiency Standards;
- Meeting the intent of the proposed 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 has a building inspector on staff that is a Certified Energy Plans Examiner and a Certified HERS rater. This inspector is also an instructor at a local community college teaching the currently adopted Building Energy Efficiency Standards. He provides periodic training to the City of Los Altos staff for enforcement requirements as well as support and training for the local design and construction community. It is anticipated that he will provide additional support and training for the staff and community as needed to meet the requirements of this Ordinance.
- The City of Los Altos understands that the Ordinance will need to be resubmitted to the California Energy Commission for approval using the 2008 Building Energy Efficiency Standards which are anticipated to become effective in July of 2009.

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 proposed Ordinance is enforceable only after the Commission has reviewed and formally approved the proposed local energy standards in meeting all requirements of Section 10-106.

Statement per Section 10-106(b)3. The proposed Ordinance will require that 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 1st floor and thirty five percent is on the 2nd floor. There is 21% glazing 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; Ducts are in the crawl space of the 1st floor and in the attic of 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 1st and 2nd 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 v4.4 to establish what the energy budget is for each of these size homes under the 2005 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 v4.4 to establish the energy budget under the 2005 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 2 story structure with a raised floor over crawl space. 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 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-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .40 U-factor and .35 SHGC
- 75 gallon DHW, .57 EF – Non recirculating

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

- ◆ 22.3% Total fenestration area
- ◆ 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - Duct leakage testing (HERS)
 - High EER verification (HERS)
 - TXV verification (HERS)
- ◆ R-19 Raised Floors
- ◆ R-13 Exterior Walls
- ◆ R-30 Roof/Ceiling
- ◆ Milgard windows or equal .35 U-factor and .30 SHGC
- ◆ 75 gallon DHW, .57 EF – Non recirculating

3,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .40 U-factor and .35 SHGC
- 75 gallon DHW, .57 EF – Non recirculating

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

- ◆ 22.3% Total fenestration area
- ◆ 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - Duct leakage testing (HERS)
 - High EER verification (HERS)
 - TXV verification (HERS)
- ◆ R-19 Raised Floors
- ◆ R-13 Exterior Walls
- ◆ R-30 Roof/Ceiling
- ◆ Milgard windows or equal .35 U-factor and .30 SHGC
- ◆ 75 gallon DHW, .57 EF – Non recirculating

4,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .40 U-factor and .35 SHGC
- 75 gallon DHW, .57 EF – Non recirculating

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

- ◆ 22.3% Total fenestration area
- ◆ 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - Duct leakage testing (HERS)
- ◆ R-19 Raised Floors
- ◆ R-13 Exterior Walls
- ◆ R-30 Roof/Ceiling
- ◆ Milgard windows or equal .35 U-factor and .30 SHGC
- ◆ 75 gallon DHW, .57 EF – Non recirculating

5,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .40 U-factor and .35 SHGC
- 75 gallon DHW, .57 EF – Non recirculating

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

- ◆ 22.3% Total fenestration area
- ◆ 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioning
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - Duct leakage testing (HERS)
- ◆ R-19 Raised Floors
- ◆ R-13 Exterior Walls
- ◆ R-30 Roof/Ceiling
- ◆ Milgard windows or equal .35 U-factor and .30 SHGC
- ◆ 75 gallon DHW, .57 EF – Non recirculating

6,000 Square Foot – 2 Story – Base

- 22.3% Total fenestration area
- 2 HVAC Systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioner
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .40 U-factor and .35 SHGC
- 75 gallon DHW, .57 EF – Non recirculating

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

- ◆ 22.3% Total fenestration area
- ◆ 2 HVAC systems
 - 80% AFUE Furnaces
 - 13 SEER Air Conditioner
 - R-4.2 Duct insulation
 - 1 Crawl space location
 - 1 Attic location
 - Duct leakage testing (HERS)
- ◆ R-19 Raised Floors
- ◆ R-13 Exterior Walls
- ◆ R-30 Roof/Ceiling
- ◆ Milgard windows or equal .35 U-factor and .30 SHGC
- ◆ 75 gallon DHW, .57 EF – Non recirculating

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
 - 78% 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 insulation
- Dual glazed, Metal framed fenestration
- 4,650 Watts of general lighting
- 1,620 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
- ◆ 4.2% Fenestration to roof area
- ◆ 2 HVAC Systems
 - 78% 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-30 Roof insulation
- ◆ Dual glazed, Non metallic fenestration
- ◆ 3,813 Watts of general lighting
 - Photocontrol and occupant sensor for daylighting
- ◆ 1,620 Watts of spot lighting
- ◆ 1,125 Watts of display lighting
 - Spot and Display lighting controlled by dimmers
- ◆ 74 Watts of restroom lighting
 - Occupant sensor controls
- ◆ Instantaneous water heater for DHW, .84 efficient

5,000 Square Foot Office – 2 Story – Base

- 8% Fenestration of total wall area
- 2 HVAC Systems
 - 78% 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
- Dual glazed metal framed fenestration
- 3,720 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
 - 78% 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 furred with R-13 insulation
- ◆ R-19 Roof insulation
- ◆ Dual glazed metal framed fenestration
- ◆ 3,720 Watts of general lighting
 - Occupant sensor controlled
- ◆ 1,620 Watts of spot lighting
 - Occupant sensor controlled
- ◆ 148 Watts of restroom lighting
 - Occupant sensor controlled
- ◆ 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 Attic
 - No HERS Measures
- R-19 Raised Floors
- R-13 Exterior Walls
- R-30 Roof/Ceiling
- Non metallic fenestration .45 U-factor and .42 SHGC
- 50 gallon DHW .57 EF, Non recirculating

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

- ◆ 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
- ◆ Non metallic fenestration .45 U-factor and .42 SHGC
- ◆ Instantaneous water heater .84 efficiency

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"> • Duct leakage testing (HERS) • TXV/High EER verification (HERS) • Increased fenestration efficiency 	\$400 \$100 \$1,395
Res. 3,000 sf	<ul style="list-style-type: none"> • Duct leakage testing (HERS) • TXV/High EER verification (HERS) • Increased fenestration efficiency 	\$400 \$100 \$1,673
Res. 4,000 sf	<ul style="list-style-type: none"> • Duct leakage testing (HERS) • Increased fenestration efficiency 	\$400 \$2,230
Res. 5,000 sf	<ul style="list-style-type: none"> • Duct leakage testing (HERS) • Increased fenestration efficiency 	\$400 \$2,788
Res. 6,000 sf	<ul style="list-style-type: none"> • Duct leakage testing (HERS) • Increased fenestration efficiency 	\$400 \$3,345
Non Res. Retail 5,000 sf	<ul style="list-style-type: none"> • Skylight installation • Lighting modification • Instantaneous gas water heater 	\$10,800 \$2,500 \$1,500
Non Res. Office 5,000 sf	<ul style="list-style-type: none"> • Lighting modification • CMU Wall insulation 	\$2,500 \$6,000
Multi Family	<ul style="list-style-type: none"> • Instantaneous gas water heater (4) 	\$6,000

Design and modeling criteria:

A buildings orientation, design and installed components used to gain compliance with Title 24, Part 6 as well as the Ordinance may vary greatly. This report does not reflect all energy efficient measures that can be utilized to gain compliance with the Ordinance.

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 \$1.73 for natural gas and an average commercial utility rate of \$0.14 kWh for electricity and \$1.50 for natural gas were used for the purposes of this study.

Yearly energy and cost savings from 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	322	63	\$55	\$109	\$164
Res. 3,000 sf	389	75	\$66	\$124	\$190
Res. 4,000 sf	389	93	\$66	\$153	\$219
Res. 5,000 sf	460	111	\$78	\$183	\$261
Res. 6,000 sf	531	129	\$90	\$213	\$303
Non Res. Retail 5,000 sf	24,515	(597) (increase)	\$3,432	(\$896) (increase)	\$2,536
Non Res. Office 5,000 sf	6,076	929	\$851	\$1,394	\$2,245
Multi Family	0	339	\$0	\$586	\$586

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	\$1,895	\$164	11.55
Res. 3,000 sf	\$2,173	\$190	11.44
Res. 4,000 sf	\$2,630	\$219	12
Res. 5,000 sf	\$3,188	\$261	12.21
Res. 6,000 sf	\$3,745	\$303	12.36
Non Res. Retail 5,000 sf	\$14,800	\$2,536	5.84
Non Res. Office 5,000 sf	\$8,500	\$2,245	3.79
Multi Family	\$6000	\$586	10.24