

**Application for a Locally Adopted Energy Standards  
by the City and County of San Francisco  
In Accordance With Section 10-106 of the  
California Code of Regulations, Title 24, Part 1**

July 31, 2008

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## **1.0 Executive Summary**

The City and County of San Francisco has researched and reviewed the feasibility and cost-effectiveness of building permit applicants exceeding the 2005 Building Energy Efficiency Standards to meet minimum energy-efficiency requirements of LEED and GreenPoint Rated. The final language of the San Francisco Green Building Ordinance (included as Section 6 in this application) was approved and adopted by the San Francisco Board of Supervisors on July 29<sup>th</sup>. The City and County of San Francisco would appreciate approval by the California Energy Commission at the earliest possible date, or no later than the proposed effective date of October 30, 2008.

Gabel Associates, LLC has been retained to assist in developing this application to the Commission. The proposed local energy efficiency standards and implementation within the green building ordinance have been designed with several key criteria in mind.

- Wherever possible, consistency with the structure, format and calculation methods of the 2005 Title 24 Building Energy Efficiency Standards;
- Meeting the local energy compliance requirements as defined by the Ordinance which exceed the current Title 24 standards; and,
- The provision of flexibility for building permit applicants in meeting the Ordinance by the performance approach using building and appliance energy measures.

This application to the California Energy Commission conforms to the requirements laid out in Section 10-106 of the California Code of Regulations, Title 24, Part 1, *LOCALLY ADOPTED ENERGY STANDARDS*. The proposed Ordinance shall take effect only after the Commission has reviewed and formally approved the proposed local energy standards as meeting all requirements of Section 10-106, and the Ordinance has been filed with the Building Standards Commission.

Although the time line of the Ordinance spans the 2005 and 2008 Building Energy Efficiency Standards, it makes it clear that a permit applicant must always meet or exceed the set of Building Energy Efficiency Standards in effect on the date that permit documents are filed with the building department.

An application to the Commission similar to this one will be submitted well in advance of the effective date of the 2008 standards (July, 2009) to demonstrate that the San Francisco Green Building Ordinance is cost-effective under those standards. This application covers only that period of time that the Ordinance is effect while the 2005 standards are also in effect.

Occupancy Type	General Requirements	Minimum Energy Requirements
<p>"Small Residential" <sup>1</sup>: 4 or fewer apartments and &lt; 75' height</p>	<p>90 days after effective date: Green Point Rating, no GPR point goal 1/1/09: 25 GPR points 1/1/10: 50 GPR points 1/1/12: 75 GPR points</p>	<p><b>Starting 1/1/10:</b> GreenPoint Rated minimum <b>15% Better Than Title 24 <sup>1</sup></b></p>
<p>"Mid-size Multifamily Residential" <sup>1</sup>: 5+ apartments and &lt; 75' height</p>	<p>90 days after effective date: Green Point Rating, no GPR point goal 1/1/09: 25 GPR points 1/1/10: 50 GPR points 1/1/12: 75 GPR points</p>	<p><b>Starting 1/1/10:</b> GreenPoint Rated minimum <b>15% Better Than Title 24 <sup>1</sup></b></p>
<p>"High-rise Residential": = or &gt; 75' height</p>	<p>90 days after effective date: LEED Certified 1/1/10 and after: LEED Silver</p>	<p><b>Starting 90 days after effective date:</b> LEED minimum, <b>14% Better Than Baseline using ECB method</b> (or equivalent energy performance defined by the local jurisdiction)</p>
<p>"Mid-size Commercial": &gt; 5,000 SF and &lt; 25,000 SF; and &lt; 75' height</p>	<p>1/1/09: LEED Checklist, no point goal 1/1/10: 5 LEED Credits achieved 1/1/11: 6 LEED Credits achieved 1/1/12 and after: 7 LEED Credits achieved 1/1/12: on-site renewable or purchase green energy credits</p>	<p><u>No energy requirement.</u> LEED energy points may be used to achieve the LEED E&amp;A Credit</p>
<p>"New Large Commercial Buildings": &gt; 25,000 SF</p>	<p>90 days after effective date: LEED Certified 1/1/09: LEED Silver 1/1/12: LEED Gold 1/1/12: on-site renewable or purchase green energy credits</p>	<p><b>Starting 90 days after effective date:</b> LEED minimum, <b>14% Better Than Baseline using ECB method</b> (or equivalent energy performance defined by the local jurisdiction)</p>
<p>"New Large Commercial Interiors and Major Alterations": &gt; 25,000 SF</p>	<p>90 days after effective date: LEED Certified 1/1/09: LEED Silver 1/1/12: LEED Gold</p>	<p><u>No energy requirement.</u></p>

*Note 1: Any residential building which contains 4 or more habitable stories and 3 or more dwelling units must meet the state's High-rise Residential Building Energy Efficiency Standards and meet the LEED minimum energy requirement or equivalent*

**Statement per Section 10-106(b)3.** The main features of the Ordinance are summarized in the above table (previous page). The Ordinance is expected to take effect on or around October 30<sup>th</sup>, 90 days after the Mayor has signed it. The first minimum energy efficiency requirements that exceed Title 24 take effect on or around January 30<sup>th</sup> 2009.

## 2.0 Impacts of the New Ordinance

The energy performance impacts of the Ordinance have been evaluated using five case studies which collectively reflect the broad range of building types covered by the Ordinance.

- Single family house
- 5-Story High-rise residential building w/ 30 dwelling units
- 15-Story High-rise residential building w/ 120 dwelling units
- 5-Story Office (nonresidential) building
- 15-Story Office (nonresidential) building

### 2.1 Single Family House

The following methodology and assumptions are used in evaluating the impact of the Ordinance on single family homes.

**House Design.** A 2,577 square foot three-story house actually submitted for permit to the City in the past two years is used as the prototype house. The house has 13.8% glazing area (i.e., total glass area to total conditioned floor area) has been modeled in two different ways to just meet Title 24; and four different ways to determine the cost-effectiveness of the proposed Ordinance. The four comparative designs have energy measures added to meet the proposed Ordinance which requires that low-rise residential buildings exceed Title 24 by 15%. The additional (i.e., incremental) energy measures are evaluated to determine a payback period which includes their cumulative first cost and annual energy cost saving as explained in a later section.

#### **(A) 2,577 sq.ft. 3-story home, assuming all generic (not NFRC-rated) dual wood windows:**

- R-30 attic roof insulation
- R-19 exterior walls
- 68% of building footprint slab-on-grade, 32% of footprint R-19 raised floor
- Generic dual pane wood windows, no NFRC ratings
- 28.8 sq.ft. dual wood skylights, no NFRC ratings
- Furnace: 80% AFUE
- R-4.2 ducts in the attic
- 50 gallon gas water heater, Energy Factor=0.58; extra pipe insulation to kitchen

#### **(B) 2,577 sq.ft. 3-story home as in (A) above assuming the following different measures:**

- R-19 exterior walls 1<sup>st</sup> floor, R-13 exterior walls 2<sup>nd</sup> and 3<sup>rd</sup> floors
- Low-E wood windows, NFRC-rated
- 50 gallon gas water heater, Energy Factor=0.62; no extra pipe insulation

### **Low-rise Residential Energy Measures Needed to Meet the City's Ordinance.**

The following energy features have been modified from the Title 24 set of measures so that the house design uses 15% less TDV energy than the corresponding Title 24 base case design, (A) or (B). The incremental first cost to provide that measure in comparison with the equivalent base case measure is listed to the right.

The incremental energy improvements specified above to meet the proposed Ordinance requirements are variables selected by designer, builder or owner. There are a number of considerations in choosing the final mix of energy measures including first cost, aesthetics, maintenance and replacement.

#### **(A1) 2,577 sq.ft.**

• Reduced duct leakage [HERS]: total incremental cost:	\$ 450 - 600
• R-6 duct insulation (from R-4.2)	\$ 150 - 250
• High performance skylights (from generic)	\$ 125 - 175
• Water heater EF=0.62 (from EF=0.58)	\$ 100 - 200
• Hot water pipe insulation (from kitchen-only to all)	\$ 150 - 200
• R-38 roof (from R-30)	\$ 175 - 200
• R-30 raised floor (from R-19)	\$ 75 - 100
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 1,225 - 1,725</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.48 to 0.76 /sq.ft.</b>

#### **(A2) 2,577 sq.ft.**

• Reduced duct leakage [HERS]: total incremental cost	\$ 450 - 600
• Reduced building leakage [HERS]: total incremental cost	\$ 350 - 550
• <u>Quality insulation installation [HERS]: total incremental cost</u>	<u>\$ 400 - 600</u>
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 1,200 - 1,775</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.47 to 0.69 /sq.ft.</b>

#### **(B1) 2,577 sq.ft.**

• Reduced duct leakage [HERS]: total incremental cost	\$ 450 - 600
• Reduced building leakage, SLA=3.0: total incremental cost	\$ 350 - 550
• Water heater EF=0.80 (from EF=0.62)	\$ 750 - 900
• <u>Hot water pipe insulation to kitchen</u>	<u>\$ 100 - 150</u>
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 1,650 - 2,200</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.64 to 0.85 /sq.ft.</b>

#### **(B2) 2,577 sq.ft.**

• Reduced duct leakage [HERS]: total incremental cost:	\$ 450 - 600
• Quality insulation installation [HERS]: total incremental cost:	\$ 400 - 600
• R-6 duct insulation (from R-4.2):	\$ 150 - 250
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 1,100 - 1,450</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.43 to 0.56 /sq.ft.</b>

## 2.2 High-Rise 5-Story Residential Building

The following methodology and assumptions are used in evaluating the impact of the Ordinance on a five-story multi-family building.

**40 Unit Apartment Building.** A five-story building, with the top four floors containing 40 apartments with a total conditioned floor area of 42,320 square foot has been modeled in two ways to determine the cost-effectiveness of the proposed San Francisco Ordinance. The total glazing area for this building is a Window Wall Ratio (WWR) of 34.2%, typical of this occupancy type.

Two different sets of Title 24 energy measures are used as the base case for comparison with sets of energy measures developed to just meet the minimum energy requirements of the proposed ordinance which requires that high-rise residential buildings exceed the 2005 Title 24 standards by 15%. The incremental energy measures are evaluated to determine a payback period including cumulative first cost and cumulative annual energy cost saving as explained in that section.

### **(A) 42,320 SF 5-story apartment building which just meet Title 24:**

- R-30 attic roof (no cool roof or radiant barrier)
- R-19 in metal frame exterior walls
- Un-insulated (R-0) raised slab floor over parking garage;
- Dual vinyl NFRC-rated Low-E windows: U-factor=0.37, SHGC=0.37, w/ no exterior shading modeled
- Split heat pump for each dwelling unit: HSPF=7.8, SEER=13.0/EER=10.1
- TXV, EER verification [HERS verification required]
- Reduced duct leakage and testing [HERS verification required]
- R-6.0 duct insulation in attic
- Central domestic hot water boiler, 82.7% AFUE; re-circulating system w/ timer and temperature controls

### **(B) 42,320 SF 5-story apartment building with no cooling which just meet Title 24:**

*Same as (A) above except with the following differences:*

- Dual metal NFRC-rated Low-E windows: U=0.65, SHGC=0.48 w/ no exterior shading modeled
- Heating only: fan coil units, space heating hot water from central boiler, 80.4% AFUE

### **High-rise Residential Energy Measures Needed to Meet the City's Ordinance.**

Incremental energy measures to meet the Ordinance have been evaluated for the above 5-story apartment building. The following energy features have been modified from the Title 24 measures so that these buildings use at least 15% less TDV energy than the corresponding base case design, (A) or (B). The incremental first cost to provide that measure in comparison with the equivalent base case measure is listed to the right.

#### **(A1) 42,320 sq.ft. w/ condensing boiler, R-8 raised slab**

• Low-E2 windows: U-factor=0.37, SHGC=0.27 7,080 sf @ \$1.35 - \$1.50/sf	\$ 9,550 - 10,600
• R-8 spray-on insulation under raised slab 10,580 sf @ \$2.00 - \$2.50/sf	\$ 21,150 - 26,450
• 92% AFUE boiler for DHW & condensate drain	\$ 3,000 - 5,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 33,700 - 42,050</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.80 to 0.99 /sq.ft.</b>

#### **(A2) 42,320 sq.ft. w/ higher heat pump efficiencies**

• Low-E2 windows: U-factor=0.37, SHGC=0.27 7,080 sf @ \$1.35 - \$1.50/sf	\$ 9,550 - 10,600
• Split heat pumps: HSPF=9.0, SEER=14.0/EER=12.0 40 units @\$400 - \$500	\$ 16,000 - 20,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 25,550 - 30,600</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.60 to 0.72 /sq.ft.</b>

#### **(B1) 42,320 sq.ft.: w/ vinyl windows, condensing boiler, R-8 raised slab**

• Vinyl Low-E windows: U-factor=0.37, SHGC=0.27 @\$0.50/sf 7,080 sf @ \$0 - \$1.00/sf	\$ 0 - 7,100
• R-8 spray-on insulation under raised slab 10,580 sf @ \$2.00 - \$2.50/sf	\$ 21,150 - 26,450
• 92% AFUE boiler for DHW & condensate drain	\$ 3,000 - 5,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 24,150 - 38,550</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.57 to 0.91 /sq.ft.</b>

#### **(B2) 42,320 sq.ft.: with high performance windows**

• Metal Low-E2 windows: U-factor=0.37, SHGC=0.27 7,080 sf @ \$1.35 - \$1.50/sf	\$ 9,550 - 10,600
• R-8 spray-on insulation under raised slab 10,580 sf @ \$2.00 - \$2.50/sf	\$ 21,150 - 26,450
• 92% AFUE boiler for DHW & condensate drain	\$ 3,000 - 5,000
• 92% AFUE boilers for space heating & condensate drain	\$ 6,000 - 10,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 39,700 - 52,050</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.94 to 1.23 /sq.ft.</b>

## 2.3 High-Rise 15-Story Residential Family Building

The following methodology and assumptions are used in evaluating the impact of the Ordinance on a 15-story multi-family building.

**120 Unit Apartment Building.** A 15-story building, with a total conditioned floor area of 158,700 square foot has been modeled in two ways to determine the cost-effectiveness of the proposed Ordinance. The total glazing area for this building is a Window Wall Ratio (WWR) of 35.2%, typical of this occupancy type.

Two different sets of Title 24 energy measures are used as the base case for comparison with sets of energy measures developed to just meet the minimum energy requirements of the proposed ordinance which requires that high-rise residential buildings exceed the LEED v2.2 baseline building by 14%, or, alternatively, that the permit applicant exceed the 2005 Title 24 standards by 15%. The incremental energy measures are evaluated to determine a payback period including cumulative first cost and cumulative annual energy cost saving as explained in that section.

### **(A) 158,700 SF 15-story apartment building which just meet Title 24:**

- R-30 attic roof (no cool roof or radiant barrier)
- R-19 in metal frame exterior walls
- Un-insulated (R-0) raised slab floor over parking garage;
- Dual vinyl NFRC-rated Low-E windows: U-factor=0.33, SHGC=0.33, w/ no exterior shading modeled
- Fan coils and hydronic heat pumps for each dwelling unit: COP=4.5, EER=13.5
- Central domestic hot water boiler, 92.2% AFUE; re-circulating system w/ timer and temperature controls
- 92.2% AFUE boilers for space heating; variable speed pump
- Cooling tower w/ variable speed fan
- All pump and fan motors NEMA Premium Efficiency

### **(B) 158,700 SF 15-story apartment building which just meet Title 24:**

*Same as (A) above except with the following differences:*

- Fan coils and hydronic heat pumps for each dwelling unit: COP=4.2, EER=12.0
- Central domestic hot water boiler, 82.7% AFUE
- Dual vinyl NFRC-rated Low-E2 windows: U=0.33, SHGC=0.23

**High-rise Residential Energy Measures Needed to Meet the City’s Ordinance.**

Incremental energy measures to meet the Ordinance have been evaluated for the above 15-story apartment building. The following energy features have been modified from the Title 24 measures so that these buildings use at least 15% less TDV energy than the corresponding base case design, (A) or (B). The incremental first cost to provide that measure in comparison with the equivalent base case measure is listed to the right.

**(A1) 158,700 sq.ft. w/ Low-E2 windows, solar PV system**

• Low-E2 windows: U-factor=0.33, SHGC=0.23 26,550 sf @ \$1.35 - \$1.50/sf	\$ 35,850 - 39,850
• 5 KW solar PV system (net cost w/ all tax incentives @ \$6,000 – \$6,500/KW)	\$ 30,000 - 32,500
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 65,850 - 72,350</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.41 to 0.46 /sq.ft.</b>

**(A2) 158,700 sq.ft. w/ more insulation, cool roof, Low-E2 windows**

• Low-E2 windows: U-factor=0.33, SHGC=0.23 26,550 sf @ \$1.35 - \$1.50/sf	\$ 35,850 - 39,850
• R-21 walls, 48,800 sf @\$0.06 - \$0.08/sf	\$ 2,900 - 3,900
• R-38 roof, 10,580 sf @\$0.15 – \$0.20/sf	\$ 1,600 - 2,100
• Cool roof (reflectance=0.70, emittance=0.75) 10,580 sf @ \$0.30 - \$0.45/sf	\$ 3,200 - 4,800
• R-6 spray-on insulation under raised slab 10,580 sf @ \$1.75 - \$2.25/sf	\$ 18,500 - 23,800
• 5% Net Solar Fraction solar hot water collector system	\$ 15,000 - 20,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 77,050 - 94,450</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.49 to 0.60 /sq.ft.</b>

**(B1) 158,700 sq.ft. w/ better HPs & boiler, solar PV system**

• Central DHW boiler: 92.2% AFUE & condensate drain	\$ 3,000 - 5,000
• Better heat pumps: COP=4.5, EER=13.5 120 units @\$400 - \$500	\$ 48,000 - 60,000
• 8 KW solar PV system (net cost w/ all tax incentives @ \$6,000 – \$6,500/KW)	\$ 48,000 - 52,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$ 99,000- 117,000</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$ 0.62 to 0.74 /sq.ft.</b>

**(B2) 158,700 sq.ft. w/ more insulation, better equipment, solar PV**

• Central DHW boiler: 92.2% AFUE & condensate drain	\$ 3,000 - 5,000
• Better heat pumps: COP=4.8, EER=13.5 120 units @\$450 - \$550	\$ 54,000 - 66,000
• R-21 walls, 48,800 sf @\$0.06 - \$0.08/sf	\$ 2,900 - 3,900
• R-38 roof, 10,580 sf @\$0.15 – \$0.20/sf	\$ 1,600 - 2,100
• Cool roof (reflectance=0.70, emittance=0.75) 10,580 sf @ \$0.30 - \$0.45/sf	\$ 3,200 - 4,800
• R-6 spray-on insulation under raised slab 10,580 sf @ \$1.75 - \$2.25/sf	\$ 18,500 - 23,800
• 46% Net Solar Fraction solar hot water collector system	\$135,000 - 180,000
• 8 KW solar PV system (net cost w/ all tax incentives @\$6,000 – \$6,500/KW)	\$ 48,000 - 52,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$266,200 – 313,800</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$1.68 to \$1.98 /sq.ft.</b>

## 2.4 Nonresidential 5-Story Office Building

The following methodology and assumptions are used in evaluating the impact of the Ordinance on a five-story nonresidential building.

**5-Story Office Building.** A five-story office building with a total conditioned floor area of 52,900 square foot has been modeled in two ways to determine the cost-effectiveness of the proposed Ordinance. The total glazing area for this building is a Window Wall Ratio (WWR) of 33.0%, typical of this occupancy type.

Two different sets of Title 24 energy measures are used as the base case for comparison with sets of energy measures developed to just meet the minimum energy requirements of the proposed ordinance which requires that high-rise residential buildings exceed the 2005 Title 24 standards by 15%. The incremental energy measures are evaluated to determine a payback period including cumulative first cost and cumulative annual energy cost saving as explained in that section.

### **(A) 52,900 SF 5-story office building which just meet Title 24:**

- R-30 attic roof (no cool roof or radiant barrier)
- R-19 in metal frame exterior walls
- Un-insulated (R-0) raised slab floor over parking garage;
- Dual metal NFRC-rated Low-E windows: U-factor=0.50, SHGC=0.54, w/ no exterior shading modeled
- 25-ton packaged VAV units, gas heating/electric cooling, 80.0% AFUE, 10.4 EER, one air handling/floor, VAV boxes w/ 30% minimum airflow and hot water reheat
- Central service hot water boiler, 82% AFUE
- Installed lighting power density is 1.072 watts/sq.ft.; Allowed LPD=1.10 watts/sq.ft.
- 720 2-lamp 4' T8 fixtures, default 62 input watts/fixture (87% of total installed watts)
- 260 26w compact fluorescent fixtures (13% of total installed watts)
- No lighting controls

### **(B) 52,900 SF 5-story office building with no cooling which just meet Title 24:**

*Same as (A) above except with the following differences:*

- Dual metal NFRC-rated Low-E windows: U-factor=0.50, SHGC=0.38 (better shading performance than above)
- Installed lighting power density is 1.19 watts/sq.ft.; Allowed LPD=1.10 watts/sq.ft.
- 720 2-lamp 4' T8 fixtures, default 62 input watts/fixture (77% of total installed watts)
- 500 26w compact fluorescent fixtures (23% of total installed watts)

**Nonresidential Energy Measures Needed to Meet the City’s Ordinance.**

Incremental energy measures to meet the Ordinance have been evaluated for the above 5-story office building. The following energy features have been modified from the Title 24 measures so that these buildings use at least 15% less TDV energy than the corresponding base case design, (A) or (B). The incremental first cost to provide that measure in comparison with the equivalent base case measure is listed to the right.

**(A1) 52,900 sq.ft. w/ high-efficiency lighting fixtures and controls**

- 720 2-lamp 4' T8 fixtures with high efficiency instant start \$ 21,600 - 28,800  
ballasts and premium T8 lamps, 52 input watts  
@\$30.00 - \$40.00/fixture; Installed LPD=0.865  
(w/ occ. sensors)
  - 180 occupant sensors controlling 2-lamp T8 fixtures. \$ 11,700 - 15,300  
@\$65.00 - \$85.00 each
  - Metal NFRC-rated windows: U-factor=0.50, SHGC=0.38 \$ 14,250 - 23,750  
9,496 sf @\$1.50 - 2.50/sq.ft.
- 
- Total incremental cost of Ordinance energy measure: \$ 47,550 - 67,850**  
**Incremental cost in \$/sq.ft.: \$0.90 to 1.28 /sq.ft.**

**(B1) 52,900 sq.ft. w/ high-efficiency (and fewer) lighting fixtures**

- 680 2-lamp 4' T8 fixtures with high efficiency instant start \$ 20,400 - 27,200  
ballasts and premium T8 lamps, 52 input watts  
@\$30.00 - \$40.00/fixture; Installed LPD=0.865  
(w/ occ. sensors)
  - 180 occupant sensors controlling 2-lamp T8 fixtures. \$ 11,700 - 15,300  
@\$65.00 - \$85.00 each
  - Reduction of 5% of T8 lighting fixtures from base case design \$ 0 0
- 
- Total incremental cost of Ordinance energy measure: \$ 32,100 - 42,500**  
**Incremental cost in \$/sq.ft.: \$0.61 to 0.80 /sq.ft.**

## 2.5 Nonresidential 15-Story Office Building

The following methodology and assumptions are used in evaluating the impact of the Ordinance on a 15-story nonresidential building.

**15-Story Office Building.** A fifteen-story office building with a total conditioned floor area of 172,500 square foot has been modeled in two ways to determine the cost-effectiveness of the proposed Ordinance. The total glazing area for this building is a Window Wall Ratio (WWR) of 34.8%, typical of this occupancy type.

Two different sets of Title 24 energy measures are used as the base case for comparison with sets of energy measures developed to just meet the minimum energy requirements of the proposed ordinance which requires that high-rise residential buildings exceed the 2005 Title 24 standards by 15%. The incremental energy measures are evaluated to determine a payback period including cumulative first cost and cumulative annual energy cost saving as explained in that section.

### **(A) 172,500 SF 15-story office building which just meets Title 24:**

- R-30 attic roof (no cool roof or radiant barrier)
- R-19 in metal frame exterior walls
- Un-insulated (R-0) raised slab floor over parking garage;
- Dual metal generic Low-E windows: default U-factor=0.61, SHGC=0.73, w/ no exterior shading modeled
- Central plant with fan coil induction system: (2) 300 ton centrifugal chillers, 0.50 KW/ton, (2) 300 ton cooling towers;
- Central service hot water boiler, 82% AFUE
- Installed lighting power density is 1.156 watts/sq.ft.; Allowed LPD=1.10 watts/sq.ft.
- 2,650 2-lamp 4' T8 fixtures, default 62 input watts/fixture (82% of total installed watts)
- 1,350 26w compact fluorescent fixtures (18% of total installed watts)
- No lighting controls

### **(B) 172,500 SF 15-story office which just meets Title 24:**

*Same as (A) above except with the following differences:*

- Dual metal NFRC-rated Low-E windows: U-factor=0.60, SHGC=0.58
- Installed lighting power density is 1.273 watts/sq.ft.; Allowed LPD=1.10 watts/sq.ft.
- 2,914 2-lamp 4' T8 fixtures, default 62 input watts/fixture (82% of total installed watts)
- 1,500 26w compact fluorescent fixtures (18% of total installed watts)

**Nonresidential Energy Measures Needed to Meet the City’s Ordinance.**

Incremental energy measures to meet the Ordinance have been evaluated for the above 15-story office building. The following energy features have been modified from the Title 24 measures so that these buildings use at least 15% less TDV energy than the corresponding base case design, (A) or (B). The incremental first cost to provide that measure in comparison with the equivalent base case measure is listed to the right.

**(A1) 172,500 sq.ft. w/ high-efficiency lighting fixtures and controls**

• 2,650 2-lamp 4’ T8 fixtures with high efficiency instant start ballasts and premium T8 lamps, 52 input watts @ \$30.00 - \$40.00/fixture; Installed LPD=0.922 (w/ occupant sensors)	\$ 79,500 - 106,000
• 662 occupant sensors controlling 2-lamp T8 fixtures. @ \$65.00 - \$85.00 each	\$ 43,000 - 56,300
• Metal NFRC-rated windows: U-factor=0.50, SHGC=0.38 31,392 sf @ \$4.00 - 6.00/sq.ft.	\$125,600 - 188,500
• Downsizing chillers by 80 tons @ \$1500 - \$1800/ton avoided cost	(-)\$144,000 - (-)120,000
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$104,100 - 230,800</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$0.60 to 1.34 /sq.ft.</b>

**(B1) 172,500 sq.ft. w/ high-efficiency lighting fixtures and controls**

• 2,914 2-lamp 4’ T8 fixtures with high efficiency instant start ballasts and premium T8 lamps, 52 input watts @ \$30.00 - \$40.00/fixture; Installed LPD=1.016 (w/ occupant sensors)	\$ 87,500 - 116,600
• 728 occupant sensors controlling 2-lamp T8 fixtures. @ \$65.00 - \$85.00 each	\$ 45,200 - 61,900
• Metal NFRC-rated windows: U-factor=0.50, SHGC=0.38 31,392 sf @ \$4.00 - 6.00/sq.ft.	\$125,600 - 188,500
<b>Total incremental cost of Ordinance energy measure:</b>	<b>\$258,300 - 367,000</b>
<b>Incremental cost in \$/sq.ft.:</b>	<b>\$1.50 to 2.13 /sq.ft.</b>

### **3.0 Cost Effectiveness**

Tables 3-1a through 3-5a in this section, “*Summary of Energy Savings from San Francisco Energy Measures*”, are based upon:

- Incremental site electricity (kWh) and natural gas (therms) saved per year as calculated using the state-approved energy compliance software for the 2005 Building Energy Efficiency Standards, EnergyPro Version 4.4
- Average utility rates of \$0.163/kWh for electricity and \$1.30/therm for natural gas in current constant dollars
- The assumption of no change (i.e., no inflation or deflation) of utility rates in constant dollars over time
- The assumption of no increase in summer temperatures, even though recent scientific studies suggest that global climate change will increase temperatures in the Western U.S. which in turn will increase air conditioning energy use

Tables 3-1b through 3-5b, “*Summary of Simple Payback for San Francisco Energy Measures*”, include a cost-effectiveness analysis of the Ordinance with respect to each building occupancy type and design; and assumes:

- No external cost of global climate change -- and corresponding value of additional investment in energy efficiency and CO2 reduction – is included
- The cost of money invested in the incremental cost of energy measures is not included.

### 3.1 Single Family House

The cost effectiveness of meeting the requirements of the Ordinance is calculated for the home design analyzed two different ways above. This reflects the different ways that architects, builders and home owners might choose to meet the basic Title 24 requirements depending on preferences which often put window selection first. The total incremental first cost needed to meet the Ordinance is divided by the incremental annual energy cost saving to establish the Simple Payback for the additional energy features.

*Table 3-1a: Summary of Energy Savings from San Francisco Energy Measures*

<b>Building Description</b>	<b>Site Electricity Savings (KWh/yr)</b>	<b>Site Gas Savings (therms/yr)</b>	<b>Electricity Cost Savings (\$)</b>	<b>Nat. Gas Cost Savings (\$)</b>	<b>Total Annual Cost Savings (\$)</b>
<b>2,577 sf (A1)</b>	128	83	\$21	\$108	\$129
<b>2,577 sf (A2)</b>	90	107	\$15	\$139	\$154
<b>2,577 sf (B1)</b>	44	105	\$7	\$137	\$144
<b>2,577 sf (B2)</b>	63	103	\$10	\$134	\$144

*Table 3-1b: Summary of Simple Payback for San Francisco Energy Measures*

<b>Building Description</b>	<b>Average Incremental First Cost (\$) <sup>1</sup></b>	<b>Annual Energy Cost Savings (\$)</b>	<b>Average Simple Payback (years)</b>
<b>2,577 sf (A1)</b>	<b>\$1,475</b>	<b>\$129</b>	<b>11.5</b>
<b>2,577 sf (A2)</b>	<b>\$1,488</b>	<b>\$154</b>	<b>9.7</b>
<b>2,577 sf (B1)</b>	<b>\$1,925</b>	<b>\$144</b>	<b>13.4</b>
<b>2,577 sf (B2)</b>	<b>\$1,275</b>	<b>\$144</b>	<b>8.8</b>

Note 1: The average incremental first cost, Section 2.1, as compared with the Title 24 base case design.

Based on this case study, the Ordinance increases the cost of this type of construction by approximately \$0.45 to \$0.85 per square foot. If the overall total cost of new construction is in the range of \$400 to \$500 per square foot, for example, the Ordinance will increase the cost by approximately one- to two-tenths of one percent (0.1% to 0.2%).

### 3.2 High-Rise 5-Story Residential Building

Table 3-2a: Summary of Energy Savings from San Francisco Energy Measures

Building Description	Site Electricity Savings (KWh/yr)	Site Gas Savings (therms/yr)	Electricity Cost Savings (\$)	Nat. Gas Cost Savings (\$)	Total Annual Cost Savings (\$)
42,320 sf (A1)	13074	556	\$2,131	\$723	\$2,854
42,320 sf (A2)	14907	0	\$2,430	\$0	\$2,430
42,320 sf (B1)	16685	1845	\$2,720	\$2,399	\$5,118
42,320 sf (B2)	16489	1184	\$2,688	\$1,539	\$4,227

Table 3-2b: Summary of Simple Payback for San Francisco Energy Measures

Building Description	Average Incremental First Cost (\$) <sup>1</sup>	Annual Energy Cost Savings (\$)	Average Simple Payback (years)
42,320 sf (A1)	\$37,875	\$2,854	13.3
42,320 sf (A2)	\$28,075	\$2,430	11.6
42,320 sf (B1)	\$31,350	\$5,118	6.1
42,320 sf (B2)	\$45,875	\$4,227	10.9

Note 1: The average incremental first cost, Section 2.2, as compared with the Title 24 base case design.

Based on this case study, the Ordinance increases the cost of this type of construction by approximately \$0.55 to \$1.25 per square foot, or approximately one- to three-tenths of one percent (0.1% to 0.3%).

### 3.3 High-rise (15-Story) Multi-Family Building

Table 3-3a: Summary of Energy Savings from San Francisco Energy Measures

Building Description	Site Electricity Savings (KWh/yr)	Site Gas Savings (therms/yr)	Electricity Cost Savings (\$)	Nat. Gas Cost Savings (\$)	Total Annual Cost Savings (\$)
158,700 sf (A1)	51289	-1784	\$8,360	-\$2,319	\$6,041
158,700 sf (A2)	40824	-185	\$6,654	-\$241	\$6,414
158,700 sf (B1)	40964	3297	\$6,677	\$4,286	\$10,963
158,700 sf (B2)	19850	7914	\$3,236	\$10,288	\$13,524

Table 3-3b: Summary of Simple Payback for San Francisco Energy Measures

Building Description	Average Incremental First Cost (\$) <sup>1</sup>	Annual Energy Cost Savings (\$)	Average Simple Payback (years)
158,700 sf (A1)	\$69,100	\$6,041	11.4
158,700 sf (A2)	\$85,750	\$6,414	13.4
158,700 sf (B1)	\$108,000	\$10,963	9.9
158,700 sf (B2)	\$290,000	\$13,524	21.4

Note 1: The average incremental first cost, Section 2.3, as compared with the Title 24 base case design.

Based on this data, the Ordinance increases the cost of this type of construction by approximately \$0.40 to \$2.00 per square foot, or approximately one-tenth to four-tenths of one percent (0.1% to 0.4%).

### 3.4 Nonresidential 5-Story Office Building

Table 3-4a: Summary of Energy Savings from San Francisco Energy Measures

Building Description	Site Electricity Savings (KWh/yr)	Site Gas Savings (therms/yr)	Electricity Cost Savings (\$)	Nat. Gas Cost Savings (\$)	Total Annual Cost Savings (\$)
52,900 sf (A1)	59456	-295	\$9,691	-\$384	\$9,308
52,900 sf (B1)	56680	1345	\$9,239	\$1,749	\$10,987

Table 3-4b: Summary of Simple Payback for San Francisco Energy Measures

Building Description	Average Incremental First Cost (\$) <sup>1</sup>	Annual Energy Cost Savings (\$)	Average Simple Payback (years)
52,900 sf (A1)	\$57,700	\$9,308	6.2
52,900 sf (B1)	\$37,300	\$10,987	3.4

Note 1: The average incremental first cost, Section 2.4, as compared with the Title 24 base case design.

Based on this data, the Ordinance increases the cost of this type of construction by approximately \$0.60 to \$1.30 per square foot, or approximately one-tenth to three-tenths of one percent (0.1% to 0.2%).

### 3.5 Nonresidential 15-Story Office Building

*Table 3-5a: Summary of Energy Savings from San Francisco Energy Measures*

<b>Building Description</b>	<b>Site Electricity Savings (KWh/yr)</b>	<b>Site Gas Savings (therms/yr)</b>	<b>Electricity Cost Savings (\$)</b>	<b>Nat. Gas Cost Savings (\$)</b>	<b>Total Annual Cost Savings (\$)</b>
<b>172,500 sf (A1)</b>	215556	-347	\$35,136	-\$451	\$34,685
<b>172,500 sf (B1)</b>	201396	-438	\$32,828	-\$569	\$32,258

*Table 3-5b: Summary of Simple Payback for San Francisco Energy Measures*

<b>Building Description</b>	<b>Average Incremental First Cost (\$)</b>	<b>Annual Energy Cost Savings (\$)</b>	<b>Average Simple Payback (years)</b>
<b>172,500 sf (A1)</b>	<b>\$167,450</b>	<b>\$34,685</b>	<b>4.8</b>
<b>172,500 sf (B1)</b>	<b>\$312,650</b>	<b>\$32,258</b>	<b>9.7</b>

Note 1: The average incremental first cost, Section 2.5, as compared with the Title 24 base case design.

Based on this data, the Ordinance increases the cost of this type of construction by approximately \$0.60 to \$2.15 per square foot, or approximately one-tenth to four-tenths of one percent (0.2% to 0.4%).

## **Conclusions**

Regardless of the building design, occupancy profile and number of stories, the incremental improvement in overall annual energy performance of buildings under the San Francisco Green Building Ordinance is cost-effective. However, each building's specific design, occupancy type and the design choices used to meet the state's energy code -- and then go beyond it to meet the Ordinance -- may allow for a large range of incremental first cost and payback. As is the case in just meeting the requirements of the state's Title 24 energy standards, a permit applicant complying with the energy requirements of the San Francisco Green Building Ordinance should carefully analyze building energy performance to reduce incremental first cost and reduce the payback for the required additional energy measures.

## **4.0 Credit for Solar PV Systems**

Once the minimum building energy performance requirements have been met through the applicable green building rating system (i.e., GreenPoint Rated or LEED, depending on the building occupancy), additional energy credit for on-site solar photovoltaic (PV) electricity generation is available.

The Ordinance defines the amount of credit for solar PV systems according to the latest version of the Commission's CECPV Calculator developed for the New Solar Homes Partnership (NSHP) program. The free download for permit applicants is at: [http://www.gosolarcalifornia.ca.gov/nshpcalculator/download\\_calculator.html](http://www.gosolarcalifornia.ca.gov/nshpcalculator/download_calculator.html)

The CF-1R-PV form, including all relevant PV system input assumptions and installation criteria, must be printed out and submitted to the building official as part of the other energy documentation. The installing contractor must meet all applicable installation criteria specified in the latest version of the state's guidebook: *New Solar Homes Partnership Guidebook, Second Edition (July, 2007) CEC #300-2007-008-CMF*.

*Note: The Ordinance makes clear that any building must meet the 2005 Building Energy Efficiency Standards without PV credit.*

## **5.0 Implementation Plan**

The implementation of the City and County of San Francisco energy ordinance for residential buildings (and no solar PV credit) is a simple verification that the performance CF-1R for low-rise residential buildings or the PERF-1 for high-rise residential buildings shows that the proposed building exceeds Title 24 by at least 15%. If the building is to receive additional energy points under GreenPoint Rated (GPR) beyond the minimum 30 points, then the amount by which the building exceeds the standards will be specified.

If a residential solar PV system is to receive credit, the additional CF-1R-PV form must be included with a one-page special compliance form available through the City and County.

For nonresidential buildings, LEED requirements apply. The Ordinance also grants authority to the local jurisdiction to establish an alternative “Energy Equivalence of Title 24 Performance with LEED v2.2 EAc1 Points” that the permit applicant may use instead of using the Energy Cost Budget method calculation that LEED requires. There will be a special compliance form which can be printed out from an Excel spreadsheet available from the City and County of San Francisco, or be filled in on a pre-printed form provided by the building department.

The City and County of San Francisco plan review will involve:

- (a) Verifying the occupancy type(s) and scope of work to determine whether and how the Ordinance applies;
- (b) Checking the drawings, specifications and regular Title 24 documentation under the 2005 Building Energy Efficiency Standards; and,
- (c) Checking any additional special compliance forms needed to demonstrate compliance with the Ordinance.

Field inspection will be essentially identical to working with the current standards, with the inclusion of the possible inspection of a solar PV system.

Gabel Associates will work in conjunction with the City and County of San Francisco to plan all aspects of the implementation, including training for the building department, local energy consultants and interested parties (e.g., designers and builders) who would like to learn more about how to meet the Ordinance’s energy requirements.

## **6.0 Text of the San Francisco Ordinance**

**Ordinance amending the San Francisco Building Code by adding Chapter 13C to impose green building requirements on (1) newly constructed Group R occupancy buildings, (2) newly constructed commercial buildings of Group B or M occupancies that are 5,000 gross square feet or more, (3) new first-time build-outs of commercial interiors that are 25,000 gross square feet or more in buildings of Group B or M occupancies, and (4) major alterations that are 25,000 gross square feet or more in existing buildings of Group B, M, or R occupancies, where interior finishes are removed and significant upgrades to structural and mechanical, electrical and/or plumbing systems are proposed; exempting (1) City projects, which are subject to Chapter 7 of the San Francisco Environment Code, (2) any new building in which laboratory use of any occupancy classification is the primary use, and (3) any building undergoing renovation in which the area of renovation will be primarily for laboratory use of any occupancy classification, and to authorize the Director of Building Inspection to grant an exemption from some of the requirements on the grounds of hardship or infeasibility and require the Director to grant an exemption if compliance would compromise the historical integrity of an historic structure; imposing additional requirements on demolitions and credits for the reuse of historic structures; providing that the requirements become operative 90 days after adoption if the California Energy Commission has approved it by that time; adopting findings, including environmental findings, findings required by California Health and Safety Code Section 17958.5, and California Energy Code findings; and directing the Clerk of the Board of Supervisors to forward this ordinance to the California Building Standards Commission upon final passage.**

Be it ordained by the People of the City and County of San Francisco:

Section 1. The Board of Supervisors of the City and County of San Francisco hereby finds and declares as follows:

(a) CEQA Findings. The Planning Department has determined that the actions contemplated in this Ordinance are in compliance with the California Environmental Quality Act (California Public Resources Code section 21000 et seq.). Said determination is on file with the Clerk of the Board of Supervisors in File No.

\_\_\_\_\_ and is incorporated herein by reference.

(b) Findings Required by California Health & Safety Code Section 17958.5.

(i) San Francisco is located at the tip of a peninsula and is served by the electricity grid at a single point, the Martin Substation. This single point of service makes San Francisco uniquely vulnerable to supply disruptions. Making San Francisco's building stock more energy efficient will reduce San Francisco's energy consumption and decrease its vulnerability to supply disruptions.

(ii) The world's leading climate scientists have documented a clear global warming trend and the unmistakable impact of human activities on that trend. As a coastal city surrounded on three sides by water, San Francisco is extremely vulnerable to climate change caused by global warming and the associated rise in sea levels. Construction of more energy efficient buildings can help San Francisco reduce its share of the greenhouse gas emissions that are a significant contributor to global warming.

(iii) In 2002, in response to the global warming threat, the Board of Supervisors adopted unanimously Resolution No. 158-02, which, among other things, established for San Francisco a greenhouse gas emissions reduction target of 20 percent below 1990 levels by the year 2012 and called for continued actions toward achieving these goals.

In Resolution No. 158-02, the Board found that global warming and the associated rise in sea levels would be particularly devastating to San Francisco and that a Green Building Program, among other efforts, was a critical component in a local action plan for climate protection. The Board further found that greenhouse gas reduction activities

would contribute substantially to the achievement of many of the City's highest priority goals, including but not limited to: energy security and cost reduction, affordable housing, mobility and transportation choices, solid waste reduction and recycling, reliable and affordable water supply, urban and rural forest protection, sustainable economic development, and clean air.

(iv) In response to Board Resolution No. 158-02, San Francisco's Department of Environment and Public Utilities Commission published a Climate Action Plan for San Francisco in September 2004. The Plan states that in San Francisco, the impacts of climate change will be variable and widespread and identifies a number of specific serious impacts that global warming and the associated rise in sea levels would have on San Francisco's weather, water resources, physical landscape, ecosystem, human health, economy, and infrastructure.

(v) The City's Climate Action Plan found that energy use in buildings and facilities is responsible for approximately 50 percent of San Francisco's greenhouse gas emissions. In 1990, San Francisco's total energy consumption was about 5,000 gigawatt-hours of electricity and 300 million therms of natural gas. San Francisco's energy use resulted in a total of approximately 4.5 million tons of CO<sub>2</sub> emissions released into the atmosphere in 1990: 1.7 million tons of CO<sub>2</sub> was released by the City's 300,000 households, 1.5 million tons of CO<sub>2</sub> was released by the City's 32,000 businesses, 894,000 tons of CO<sub>2</sub> was released by the City's industrial sector, and 402,000 tons of CO<sub>2</sub> was released by the City's municipal buildings and facilities.

The Climate Action Plan states that the potential for CO<sub>2</sub> reductions through electricity and gas savings in San Francisco's buildings is tremendous and that key actions required to reach this potential include incorporating policies in both the private and public sectors such as designing new buildings beyond code and implementing energy efficient retrofit projects in existing buildings. Reducing electricity demand means in-city power plants run less, creating fewer emissions.

(vi) As a participant in the Cities of Climate Protection campaign sponsored by the International Council on Local Environmental Initiatives, San Francisco has joined with more than 500 cities around the world to inventory its emissions of greenhouses gases, set reduction targets, and take action to meet those targets.

(vii) In recent years, green building design, construction and operational techniques have become increasingly widespread. Many homeowners, businesses and building professionals have voluntarily sought to incorporate green building techniques into their projects. A number of local and national systems have been developed to serve as guides to green building practices. At the national level, the U.S. Green Building Council, developer of the Leadership in Energy and Environmental Design (LEED®) Green Rating System and LEED® Reference Guide, has become a leader in promoting and guiding green building. At the local level, Build It Green and StopWaste.Org have developed residential green building standards appropriate for smaller projects, and which over twenty Bay Area cities and counties have employed.

(viii) Starting in 2004, San Francisco has enacted legislation or adopted programs to mandate or encourage the use of green building standards in San Francisco and to reduce the City's impacts on the environment.

In 2004, the City enacted Chapter 7 of the San Francisco Environment Code, which, among other things, requires all new City construction and major renovation projects to achieve a LEED® Silver certification from the US Green Building Council. In 2006, the City adopted Ordinance No. 27-06 mandating the recycling of construction and demolition debris.

In 2006, the City adopted two programs to encourage the use of green building standards in the private sector. First, the San Francisco Building and Planning Departments developed criteria to reduce the cost of solar permits and streamline the permitting process. Solar permits now cost less than \$90 and can be issued over the counter, without the delays of in-house reviews. The Department of Building Inspection

has estimated that 90 percent of photovoltaic system applications meet the requirements for the streamlined permit process. Second, the San Francisco Department of Building Inspection, Planning Department, and Department of the Environment established a priority permitting process for LEED® Gold certified, or equivalent, building projects. Seventeen projects have presently been accepted.

(ix) In 2004, the City and County of San Francisco committed to the goals of diverting over 75 percent of its waste from landfill by the year 2010 and to achieve Zero Waste to landfill by 2020. These ambitious targets can only be realized through continued implementation and expansion of recycling and composting programs, increased construction and demolition debris recycling, and source reduction programs in the public and private sectors.

(x) In 2006, the State enacted the California Global Warming Solutions Act of 2006 (AB 32), which added Section 38501 et seq. to the California Health and Safety Code. This legislation requires, among other actions, that by January 1, 2008, the State Air Resources Board approve a statewide greenhouse gas emissions limit that is equivalent to the emissions level in 1990. This ordinance will further the State's efforts to reduce greenhouse gas emissions statewide by reducing San Francisco's emissions.

(xi) In 2007, Mayor Gavin Newsom established a Task Force on Green Building for the City and County of San Francisco comprised of ten members from San Francisco's ownership, developer, financial, architectural, engineering, and construction community. The mission of the Task Force was to advise and recommend to the City's policy makers mandates, incentives, education, and outreach in order to increase the number and improve the quality of green buildings in San Francisco and to assess the impacts of the Task Force's recommendations. The Task Force issued its Report and Recommendations in June 2007.

(xii) In its Report, the Green Building Task Force Report recommends that San Francisco take a leadership role in addressing environmental impacts, which include

consumption of natural resources, accelerated effects on climate change, and increased pollution. It further recommends that San Francisco look at a broad range of policies and programs to improve sustainability and recognize that construction activity for and operational energy used by buildings are primary contributors to man-made CO<sub>2</sub> production and have significant other impacts on air quality, landfill, transportation, energy consumption, resource use, and occupant health and productivity. The Task Force Report states that it is essential that sustainable practices become standards of the building industry.

(xiii) By implementing the recommendations of the Mayor's Task Force on Green Building, this ordinance continues San Francisco's efforts to address environmental impacts in order to improve the health and economic well being of the City's residents, workers and visitors, and to mitigate the effects of global warming on the City's weather, water resources, physical landscape, ecosystem, human health, economy, and infrastructure.

Some of the significant cumulative benefits this ordinance is very conservatively expected to achieve through 2012 are: reducing CO<sub>2</sub> emissions by 60,000 tons, saving 220,000 megawatt hours of power, saving 100 million gallons of drinking water, reducing wastewater and stormwater by 90 million gallons of water, reducing construction and demolition waste by 700 million pounds, increasing the valuations of recycled materials by \$200 million, reducing automobile trips by 540,000, and increasing green power generation by 37 thousand megawatt hours.

(xiv) Demolition of an existing building results in the loss of the energy and materials that were embodied in the original construction, and can result in the loss of a cultural resource as well. Demolition and new construction consumes still more energy and materials. Thus, a principle of green construction is that "the greenest building is the one that already exists." Preservationists have estimated that it takes decades for an energy-efficient new building to conserve the amount of energy lost in demolishing an

existing building, and that a green rehabilitation can greatly improve energy efficiency without compromising historic fabric and without the loss of embodied resources.

Preservation, rehabilitation, and reuse of existing structures should be encouraged.

(c) Findings required by Public Resources Code Section 25402.1(h)(2) and Section 10-106 of the California Code of Regulations, Title 24, Part 1, Locally Adopted Energy Standards (“Section 10-106”).

(i) Public Resources Code Section 25402.1(g) provides that the building department of every city, county, or city and county shall enforce Section 25402(a) and (b), Section 25402.1, and the rules and regulations of the California Energy Commission adopted pursuant thereto. Section 25402(a) requires the Commission to prescribe, by regulation, lighting, insulation climate control system, and other building design and construction standards that increase the efficiency in the use of energy for new residential and new nonresidential buildings. Section 25402(b) requires the Commission to prescribe, by regulation, performance-based energy conservation design standards for new residential and new nonresidential buildings.

(ii) Public Resources Code Section 25402.1(h)(2) and Section 10-106 authorize the adoption and enforcement of more stringent local energy standards, provided that the local jurisdiction makes a determination that the local standards are cost effective and will save more energy than the current Statewide standards and the local jurisdiction files an application for approval with the California Energy Commission together with documentation supporting the cost-effectiveness determination. A proposed ordinance may take effect only after the California Energy Commission has reviewed and formally approved the proposed local energy standards.

(iii) Based upon the findings of a study of this Ordinance performed by Gabel Associates LLC, the Board of Supervisors hereby determines that the Ordinance’s standards are cost effective and will save more energy than the current Statewide standards.

(iv) This Ordinance establishes increased minimum energy efficiency standards within the City and County of San Francisco for certain new construction, additions and alterations; and is intended to supplement the 2005 California Building Energy Efficiency Standards, as specified in California Code of Regulations, Title 24, Parts 1 and 6 ("2005 Standards. Compliance with the applicable California Building Energy Efficiency Standards is required even if the increased minimum energy efficiency standards specified in this Ordinance do not apply.

(v) On April 23, 2008, the California Energy Commission adopted California Building Energy Efficiency Standards, as specified in California Code of Regulations, Title 24, Parts 1 and 6, that are expected to go into effect on July 1, 2009 ("2008 Standards"). This will require the Board of Supervisors to make a determination that the local standards are cost effective and will save more energy than the 2008 Standards, file an application for reapproval of this Ordinance with the California Energy Commission together with documentation supporting the cost-effectiveness determination, and receive approval from the California Energy Commission prior to the effective date of the 2008 Standards in order for the Ordinance to remain in effect after July 1, 2009.

(vi) Given that the purpose of this Ordinance is to adopt stricter local energy efficiency standards for the construction of new buildings within the City and County of San Francisco, the Board of Supervisors recognizes that the adoption of new standards without additional education and training for City staff responsible for enforcement of the standards could diminish compliance and potentially undermine the efficacy of the Ordinance. Therefore, in order to ensure greater compliance and enforcement of the applicable green building standards, to better equip the staff of the Department of Building Inspection, and to provide a greater resource to the City's building community, the City and County of San Francisco will seek out additional education and training opportunities for staff in green building technologies, including in the areas of energy standards, building energy technology and energy code implementation.

Section 2. The San Francisco Building Code is hereby amended by adding Chapter 13C, to read as follows:

## Chapter 13C

### GREEN BUILDING REQUIREMENTS

#### SECTION 1301C - INTENT

The purpose of this chapter is to promote the health, safety and welfare of San Francisco residents, workers, and visitors by minimizing the use and waste of energy, water and other resources in the construction and operation of the City and County of San Francisco's building stock and by providing a healthy indoor environment. The green building practices required by this chapter will also further the goal of reducing the greenhouse gas emissions in the City and County of San Francisco to 20 percent below 1990 levels by the year 2012, as stated in Board of Supervisors Resolution No. 158-02 and the City's 2004 Climate Action Plan.

#### SECTION 1302C - DEFINITIONS

For the purposes of this chapter, certain terms are defined as follows:

DEMOLITION means, where the existing building is determined to be an historical resource under the California Environmental Quality Act, proposed removal of sufficient material from an existing building to meet the definition in Planning Code Section 1005(f), or, where the existing building is determined not to be an historical resource under the California Environmental Quality Act, proposed removal of sufficient material from an existing building to meet the definition in Planning Code Section 317(b)(2), whether the occupancy of the existing building is residential or commercial.

GREENPOINT RATED, GREENPOINTS and GREENPOINTS CHECKLIST mean the residential green building rating system and checklist and certification methodology of the non-profit organization Build It Green.

HIGH-RISE BUILDING means a building that meets the definition of "high-rise building" in Section 202 of this Code.

HIGH-RISE RESIDENTIAL BUILDING means a Group R occupancy residential building that is a high-rise building.

HISTORICAL RESOURCE is a property that meets the terms of the definitions in Section 21084.1 of the CEQA Statute (The California Environmental Quality Act [Public Resources Code Section 21084.1]) and Section 15064.5 of the CEQA Guidelines, as determined by the San Francisco Planning Department.

LARGE COMMERCIAL BUILDING means a commercial building or addition of Group B or M occupancy that is 25,000 gross square feet or more or is a high-rise building.

LEED® and LEED® Checklist mean the Leadership in Energy and Environment Design rating system, certification methodology, and checklist of the United States Green Building Council (USGBC).

MAJOR ALTERATIONS means alterations where interior finishes are removed and significant upgrades to structural and mechanical, electrical and/or plumbing systems are proposed where areas of such construction are 25,000 gross square feet or more in Group B, M or R occupancies of existing buildings.

MID-SIZE COMMERCIAL BUILDING means a commercial building of Group B or M occupancy that is 5,000 or more and less than 25,000 gross square feet, and is not a high-rise building.

MID-SIZE RESIDENTIAL BUILDING means a Group R occupancy residential building that has five or more dwelling units and is not a high-rise building.

NEW LARGE COMMERCIAL INTERIORS means first-time tenant improvements where areas of such construction are over 25,000 gross square feet or more in Group B or M occupancy areas of existing buildings.

SMALL RESIDENTIAL BUILDING means a Group R occupancy building that has four or fewer dwelling units and is not a high-rise building

#### SECTION 1303C – SCOPE

Projects in the City and County of San Francisco that are within the scope of this chapter are: (1) newly constructed Group R occupancy buildings, (2) newly constructed commercial buildings of Group B or M occupancies that are 5,000 gross square feet or more, (3) new first-time build-outs of commercial interiors that are 25,000 gross square feet or more in buildings of Group B or M occupancies, and (4) major alterations that are 25,000 gross square feet or more in existing buildings of Group B, M or R occupancies, where interior finishes are removed and significant upgrades to structural and mechanical, electrical and/or plumbing systems are proposed.

Exempt from this chapter are (1) City and County of San Francisco projects, which are subject to Chapter 7 of the San Francisco Environment Code, (2) any new building in which laboratory use of any occupancy classification is the primary use, and (3) any building undergoing renovation in which the area of renovation will be primarily for laboratory use of any occupancy classification.

All buildings within the scope of this chapter must meet or exceed the energy requirements contained in the 2005 California Building Energy Efficiency Standards, including California Code of Regulations, Title 24, Parts 1 and 6, or the version of those standards that is applicable at the time a permit application is filed. If the increased minimum energy efficiency standards specified in this chapter do not apply, a project must comply with the applicable California Building Energy Efficiency Standards.

#### SECTION 1304C – GREEN BUILDING REQUIREMENTS

1304.0 Applicability. The following green building requirements shall apply to all projects within the scope of this chapter. Wherever reference is made to the LEED® or GreenPoint Rated systems, a comparable equivalent rating system may be used if approved by the Director. The applicable LEED®, GreenPoint Rated or equivalent versions of performance standards for any applications subject to this chapter, regardless of application dates, are:

LEED® -CI v2.0 - LEED® for Commercial Interiors (June 2005)

LEED® -CS v2.0 - LEED® for Core and Shell (July 2006)

LEED® -NC v2.2 - LEED® for New Construction (July 2007)

GreenPoint Rated (GPR) – GPR v2007 (March 2007)

Wherever specific LEED® prerequisites or credits are cited, such references are to LEED® -NC v2.2. More recent LEED® and GreenPoint Rated versions may be used, provided the credits and points achieved are as or more stringent than LEED® -NC v2.2 or GPR v2007.

Wherever the LEED® or GreenPoint Rate systems include a minimum energy or other performance requirement, the permit applicant may choose to meet the minimum performance requirements with an alternative equivalent method approved by the Director.

1304C.0.1. Compliance. Compliance with any of these requirements may be verified and/or certified by any means, including third-party equivalent, as approved by the Director.

1304C.0.2. Solar electric systems. The installation of any solar photovoltaic energy system must meet all installation criteria the California Energy Commission's Guidebook "Eligibility Criteria and Conditions for Incentives for Solar Energy Systems." An energy credit from solar photovoltaic (PV) energy systems may be used to demonstrate compliance with the Ordinance's general compliance requirements. This credit is available if the solar PV energy system is capable of generating electricity from sunlight, supplying the electricity directly to the building, and the system is connected, through a reversible meter, to the utility grid. The methodology used to calculate the energy equivalent to the photovoltaic credit shall be the CECPV Calculator, using the most recent version prior to the permit application date, which may be found on the web site of the California Energy Commission.

1304C.0.3. Stormwater. Stormwater management shall meet the "Best Management Practices" and "Stormwater Design Guidelines" of the San Francisco Public

Utilities Commission, and shall meet or exceed the applicable LEED SS 6.1 and 6.2 guidelines.

1304C.0.4. Solid waste. Areas provided for recycling, composting and trash storage, collection and loading, including any chute systems, must be designed for equal convenience for all users to separate those three material streams, and must provide space to accommodate a sufficient quantity and type of containers to be compatible with current methods of collection.

1304C.0.5. Building demolition. Applications subject to this Section, whereby construction of a new building is proposed within five years of the demolition of a building on the site, where such demolition occurred after the effective date of this ordinance, shall be subject to the following requirements:

1304C.0.5.1. The sustainability requirements for new buildings pursuant to Sections 1304C.1, et seq. shall be increased as follows:

1304C.0.5.1.1. For projects attaining a LEED® certification and where the building demolished was an historical resource, the required points shall be increased by 10 percent of the total available in the required LEED® system. Where the building demolished was not an historical resource, the required points shall be increased by 10 percent of the total required of the applicable LEED certification requirements absent a demolition. For projects opting to be GreenPoint Rated, 25 additional points must be achieved, where the building demolished was an historical resource, or 20 additional points must be achieved where the building demolished was not an historical resource. The Director shall determine, on a case-by-case basis, increased requirements in similar proportions for projects achieving compliance using other green building rating systems.

For projects subject to 1304C.2.1, Mid-Size Commercial Buildings, and this Section 1304C.0.5, where the building demolished was not an historical resource, the following requirements apply:

The water use reduction required in 1304C.2.1.4 shall take effect on January 1, 2009, and permit applicants must submit documentation to verify that a minimum 30 percent reduction in the use of potable water was achieved. (LEED® WE3.2)

The enhanced commissioning required by Section 1304C.2.1.6 shall take effect January 1, 2010.

The energy generation or purchase required by Section 1304C.2.1.7 shall take effect January 1, 2011.

Effective January 1, 2012 permit applicants must submit documentation to verify achievement of one additional credit in accord with LEED® MR3, MR4, MR5, MR6, or MR7.

In addition to the above, where the building demolished was an historical resource, effective January 1, 2009 through January 1, 2011 permit applicants must submit documentation to verify achievement of one additional credit in accord with LEED® MR3, MR4, MR5, MR6, or MR7. Effective January 1, 2012, two additional credits in accord with LEED® MR3, MR4, MR5, MR6, or MR7 are required.

1304C.0.5.1.2. Except where the demolished building was determined to be an historical resource, if the occupant loads of the commercial portion of the replacement structure calculated in accord with Section 1004 of this Code and the number of dwellings in the residential portion are each tripled, for those buildings attaining LEED® certification, the required points shall be increased by 8 percent of the total points required absent a demolition. For such projects pursuant to demolitions opting to be GreenPoint Rated, 17 additional points must be achieved. Where occupant loads and residential density are quadrupled, the required points for projects attaining LEED® certification shall be increased by 6% of the total required absent a demolition, and for those opting to be GreenPoint Rated, 15 additional points must be achieved. The Director shall determine, on a case-by-case basis, appropriate increased requirements in similar proportions for projects achieving compliance using other green building rating systems.

1304C.0.6. On-site retention of historical features. For alterations of buildings determined to be historical resources, additional points or credits shall be granted for retention and in-situ reuse or restoration of certain character defining features, as follows:

SIGNIFICANT HISTORICAL ARCHITECTURAL FEATURES	PERCENT RETAINED *	LEED POINTS FOR RETENTION	GREENPOINTS FOR RETENTION
Windows @ principal façade(s)	At least 50	2	7
Windows @ principal façade(s)	At least 75	3	11
Windows @ principal façade(s)	100	4	15
Other windows	At least 50	1	3
Other windows	100	2	6
Exterior doors @ principal façade(s)	100	1	3
Siding or wall finish @ principal façade(s)	80	1	4
Trim & casing @ wall openings on principal façade(s)	100	1	3
Roof cornices or decorative eaves visible from right-of-way	100	1	3
Sub-cornices, belt courses, water tables, and running trim visible from right-of-way	80	1	3
Character-defining elements of significant interior spaces	At least 50	2	7
Character-defining elements of significant interior spaces	100	4	15
Other exterior ornamentation (e.g. cartouches, corbels, quoins, etc.) visible from right-of-way	80	1	3

\* Retention includes the rehabilitation and repair of character-defining features that conform to the Secretary of the Interior's Standards for the Treatment of Historic Properties.

1304C.0.7 Maintenance of required features. Any structure subject to this chapter shall maintain the green building features required herein, regardless of subsequent alterations, additions, or changes of use, unless subject to more stringent requirements.

1304C.1. Requirements for New Group R Occupancy Buildings.

1304C.1.1. Small Residential Buildings. Upon the operative date of this chapter, the permit applicant must submit a GreenPoints New Home Construction Checklist but no points are required to be achieved. Effective January 1, 2009, applicants must submit documentation demonstrating that a minimum of 25 GreenPoints from the checklist will be achieved. Effective January 1, 2010 through 2011, a new building must be GreenPoint Rated and applicants must submit documentation demonstrating that a minimum of 50 GreenPoints from the checklist will be achieved. Effective January 1, 2012, a new building must be GreenPoint Rated and applicants must submit documentation demonstrating that a minimum of 75 GreenPoints from the checklist will be achieved.

1304C.1.2. Midsize Residential Buildings. Upon the operative date of this chapter, permit applicants must submit a GreenPoints Multifamily Checklist but no points are required to be achieved. Effective January 1, 2009, applicants must submit documentation demonstrating that a minimum of 25 GreenPoints from the checklist will be achieved. Effective January 1, 2010, a new building must be GreenPoint Rated and applicants must submit documentation demonstrating that a minimum of 50 GreenPoints from the checklist will be achieved. Effective January 1, 2011, a new building must be GreenPoint Rated and applicants must submit documentation demonstrating that a minimum of 75 GreenPoints from the checklist will be achieved.

1304C.1.3. High-Rise Residential Buildings.

1304C.1.3.1. Rating requirement. Upon the operative date of this chapter, permit applicants must submit documentation to achieve LEED® “Certified” certification.

Effective January 1, 2010, applicants must submit documentation to achieve a LEED® “Silver” certification. Alternatively, GreenPoint Rated 50 points minimum may be achieved to meet this requirement upon the operative date of this ordinance, and GreenPoint Rated 75 points minimum effective January 1, 2010, providing all LEED®-NC Prerequisites are also met.

1304C.1.3.2. Water efficient landscaping. Upon the operative date of this chapter, permit applicants must submit documentation verifying that a minimum 50 percent reduction in use of potable water for landscaping was achieved. (LEED® WE1.1)

1304C.1.3.3. Water use reduction. Upon the operative date of this chapter, permit applicants must submit documentation demonstrating achievement of a minimum 20 percent reduction in the use of potable water. (LEED® WE3. 2) Effective January 1, 2011, the required reduction in use of water is 30 percent. (LEED® WE3.2)

1304C.1.3.4. Construction debris management. Effective January 1, 2009, permit applicants must submit documentation to verify that diversion of at least 75 percent of the project's construction debris was achieved. (LEED® MR2.2)

1304C.2. Requirements for New Group B and M Occupancy Buildings.

1304C.2.1. Mid-Size Commercial Buildings.

1304C.2.1.1. Rating requirement. Upon the operative date of this chapter, permit applicants must complete and submit a LEED® Checklist but no points are required to be achieved.

1304C.2.1.2. Fundamental commissioning of the building energy systems. Effective January 1, 2009, permit applicants must submit documentation prepared by a Commissioning Agent demonstrating compliance with LEED® EA Prereq 1.

1304C.2.1.3. Water efficient landscaping. Effective January 1, 2009, permit applicants must submit documentation verifying that a minimum 50 percent reduction in use of potable water for landscaping was achieved. (LEED® WE1.1)

1304C.2.1.4. Water use reduction. Effective January 1, 2009, and effective through 2010, permit applicants must submit documentation demonstrating achievement of a minimum 20 percent reduction in the use of potable water. (LEED® WE3.1) Effective January 1 2011, the required reduction in use of water is 30 percent. (LEED® WE3.2)

1304C.2.1.5. Construction debris management. Effective January 1, 2009, permit applicants must submit documentation to verify that diversion of at least 75 percent of the project's construction debris was achieved. (LEED® MR2.2)

1304C.2.1.6. Enhanced commissioning. Effective January 1, 2011, a new building must achieve enhanced commissioning. (LEED® EA3.0)

1304C.2.1.7. Energy. Effective January 1, 2012, permit applicants must submit documentation to verify renewable on-site energy or purchase green energy credits in accord with LEED® EA2 or EA6.

#### 1304C.2.2. New Large Commercial Buildings.

1304C.2.2.1. Rating requirement. Upon the operative date of this chapter, permit applicants must submit documentation to achieve LEED® "Certified" Certification. Effective January 1, 2009, permit applicants must submit documentation to achieve a LEED® Silver rating. Effective January 1, 2012, permit applicants must submit documentation to achieve a LEED® Gold rating.

1304C.2.2.2. Water efficient landscaping. Upon the operative date of this chapter, permit applicants must submit documentation verifying that a minimum 50 percent reduction in use of potable water for landscaping was achieved. (LEED® WE1.1)

1304C.2.2.3. Water use reduction. Upon the operative date of this chapter, permit applicants must submit documentation demonstrating achievement of a minimum 20 percent reduction in the use of potable water. (LEED® WE3.2) Effective January 1, 2011, the required reduction in use of potable water is 30 percent. (LEED® WE3.1)

1304C.2.2.4. Construction debris management. Upon the operative date of this chapter, permit applicants must submit documentation to verify that diversion of at least 75 percent of the project's construction debris was achieved. (LEED® MR2.2)

1304C.2.2.5. Enhanced commissioning. Effective January 1, 2010, a new building must achieve enhanced commissioning. (LEED® EA3.0)

1304C.2.2.6. Energy. Effective January 1, 2012, permit applicants must submit documentation to verify achievement of renewable on-site energy or purchase of green energy credits in accord with LEED® EA2 or EA6.

1304C.3. New Large Commercial Interiors and Major Alterations to Existing Buildings.

1304C.3.2.1. Rating requirement. Upon the operative date of this chapter, permit applicants for such construction, must submit documentation to achieve LEED® “Certified” Certification. Effective January 1, 2009, applicants must submit documentation to achieve a LEED® Silver rating. Effective January 1, 2012, applicants must submit documentation to achieve a LEED® Gold rating.

1304C.3.2.2. Use of low-emitting materials. Upon the operative date of this chapter, permit applicants for alterations subject to this subsection-must submit documentation to verify the use of low-emitting materials under LEED® EQ4.1, 4.2, and 4.3.

1305C - Implementation. Rules and regulations regarding the implementation of this chapter shall be detailed in an Administrative Bulletin to be prepared and issued by the Department of Building Inspection.

1306C - Hardship or Infeasibility Exemption

1306C.1. Exemption. If a permit applicant for a project believes that circumstances exist that make it a hardship or infeasible to meet fully the requirements of this chapter, the applicant may apply to the Director for an exemption as set forth below.

In applying for an exemption, the burden is on the permit applicant to demonstrate hardship or infeasibility.

1306C.2. Application. A permit applicant seeking an exemption shall submit the following information in support of the application:

1. the maximum number of credits or other compliance that the permit applicant believes is practical or feasible
2. the circumstances that the permit applicant believes make it a hardship or infeasible to comply fully with this chapter. Such circumstances may include, but are not limited to, availability of markets for materials to be recycled, availability of green building materials and technologies, and compatibility of green building requirements with other regulations.

1306C.3. Granting an Exemption. If the Director determines that it is a hardship or infeasible for the applicant to meet fully the requirements of this chapter based on the information submitted with the application for an exemption, the Director shall determine the maximum feasible number of credits or other compliance reasonably achievable for the project and shall indicate this on the documentation submitted by the permit applicant. If an exemption is granted, the permit applicant must achieve the number of credits or compliance the Director determines to be achievable and shall comply with this chapter in all other respects.

1306C.4. Exemption for Historic Structure. The Director shall grant an exemption for an historic structure if the Director determines that compliance with certain requirements would impair the structure's historic integrity. The historic structure shall comply with this chapter in all other respects.

1306C.5. Denial of Exemption. If the Director determines that it is possible for the application to meet fully the requirements of this chapter, the Director shall notify the permit applicant in writing. The permit applicant must then submit all documentation required by Section 1304C. If the applicant does not submit the documentation within the

time period required by Section 106A.3.7, or the documentation does not comply with the requirements of Section 1304C, the Director shall disapprove the building permit.

1307C - Appeal. Determinations of the Director related to this chapter are appealable to the Building Inspection Commission pursuant to the procedure set forth in Chapter 77 of the San Francisco Administrative Code. Denial of a building permit is appealable to the Board of Appeals pursuant to the procedure set forth in Section 8 et seq. of the San Francisco Business and Tax Regulations Code.

1308C. Enforcement. The applicant's failure to build a project in accordance with approved construction documents and plans shall be subject to the procedures governing abatement of unsafe structures set forth in Section 102A of this Code. In addition, the Director may require other reasonable green building measures to mitigate the failure to comply fully with this chapter.

1309C. Conflict With Other Provisions of This or Other Codes. In the event that the requirements of this chapter conflict with other provisions of this Code or the other codes enforced by the Department of Building Inspection, the requirements of this chapter shall apply and the more restrictive building design standards of this or the other codes shall prevail.

1310C. Operative Date. This ordinance shall become operative 90 days after it is adopted by the Board of Supervisors and signed by the Mayor. If, however, the California Energy Commission has not approved the legislation by that time, this ordinance shall not become operative until the Energy Commission has approved it.

Section 3. The Clerk of the Board of Supervisors is hereby directed to forward this ordinance to the California Building Standards Commission upon final passage.

APPROVED AS TO FORM:  
DENNIS J. HERRERA, City Attorney

By:

JUDITH A. BOYAJIAN  
Deputy City Attorney

**Appendix A:**

**Examples of San Francisco Compliance Forms/Spreadsheets**

*(Electronic spreadsheets and printed forms to be provided by the City)*

Project Name/Address: <b>Sample House</b>	
Date of Title 24 Report: <b>1/30/09</b>	Conditioned Floor Area (SF): <b>2,577</b>

**1. Calculate San Francisco Ordinance Standard Design:**

<b>Standard Design</b> <b>Total TDV KBtu/sf-yr</b> <b>27.01</b> <i>[from Part 1, CF-1R; see Note 1 below]</i>	<b>Revised</b> <b>Standard Design</b> <b>Total TDV KBtu/sf-yr</b> <b>21.61</b> <i>[used in Step #4]</i>
<b>Proposed Design</b> <b>Total TDV KBtu/sf-yr</b> <b>22.58</b> <i>[from Part 1, CF-1R; see Note 1 below]</i>	<b>Maximum Allowed</b> <b>Proposed Design</b> <b>(TDV Kbtu/sf-yr)</b> <b>22.96</b>

**2. Calculate Solar Photovoltaic (PV) System Credit:**

*When a proposed solar PV system is to receive credit under the San Francisco Ordinance, Annual TDV Production is obtained using the CEC PV Calculator, Version 2.3 or higher at: [http://www.qosolarcalifornia.ca.gov/nshpcalculator/download\\_calculator.html](http://www.qosolarcalifornia.ca.gov/nshpcalculator/download_calculator.html)*

*Solar PV Credit may be used only if Proposed Design is = or < the Maximum Allowed Proposed Design.*

<b>Annual TDV</b> <b>Production</b> <b>(TDV KWh/yr)</b> <b>10,000</b>	<b>Solar PV Credit</b> <b>(TDV KBtu/sf-yr)</b> <b>13.24</b> <i>[used in Step #3]</i>
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**3. Calculate San Francisco Ordinance Proposed Design:**

<b>Proposed Design</b> <b>Total TDV KBtu/sf-yr</b> <b>22.58</b> <i>[from Part 1, CF-1R; see Note 1 below]</i>	<b>Solar PV Credit</b> <b>(TDV Kbtu/sf-yr)</b> <b>13.24</b>	<b>=</b>	<b>Revised</b> <b>Proposed Design</b> <b>Total TDV KBtu/sf-yr</b> <b>9.34</b> <i>[used in Step #4]</i>
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**4. Verify San Francisco Energy Compliance Requirement:**

<b>Revised</b> <b>Standard Design</b> <b>TDV KBtu/sf-yr</b> <b>21.61</b>	<b>must be = or &gt;</b>	<b>Revised</b> <b>Proposed Design</b> <b>TDV KBtu/sf-yr</b> <b>9.34</b>
<b>Revised Proposed Design is Better Than Title 24 by: 65.4%</b>		

*Revised 7/10/08*

**Nonresidential Form: San Francisco Green Building Ordinance** **PERF-1-SF**

*To be used for Nonresidential, Hotel/Motel and High-rise Residential Occupancies*

Project Name/Address:	<b>Sample Nonresidential Project</b>		
Date of T24 Report:	<b>1/30/09</b>	Conditioned Floor Area (SF):	<b>9,000</b>

**1. Input Data from Part 2 of 3, PERF-1 Form (from an approved Nonresidential ACM)**

Energy Component	Standard Design TDV KBtu/sf-yr	Proposed Design TDV KBtu/sf-yr	Instructions
Space Heating	0.27	0.22	Input Space Heating for every project.
Space Cooling	86.49	78.71	Input Space Cooling for every project.
Indoor Fans	54.35	54.13	Input Indoor Fans for every project.
Heat Rejection	0.00	0.00	Input Heat Rejection if including Mechanical compliance.
Pumps & Misc.	0.00	0.00	Input Pumps & Misc. if including Mechanical compliance.
DHW	0.00	0.00	Input DHW if service hot water is modeled for compliance.
Lighting	165.45	139.09	Input Lighting if including Lighting compliance.
<b>TOTALS:</b>	<b>306.56</b>	<b>272.15</b>	<b>x 0.90 =</b>

**Maximum Allowed Proposed Design (TDV Kbtu/sf-yr)**

**2. Calculate Solar Photovoltaic (PV) System Credit in the Proposed Design:**

*When a proposed solar PV system is to receive credit under the San Francisco Ordinance, Annual TDV Production is obtained using the CEC PV Calculator, Version 2.3 or higher at: [http://www.gosolarcalifornia.ca.gov/nshpcalculator/download\\_calculator.html](http://www.gosolarcalifornia.ca.gov/nshpcalculator/download_calculator.html)*

**Solar PV Credit may be used only if Proposed Design is = or < the Maximum Allowed Proposed Design.**

<b>Annual TDV Production (TDV KWh/yr)</b>	<b>Solar PV Credit (TDV KBtu/sf-yr)</b>
<b>100,000</b>	<b>37.92</b>
	<i>[used in Step #3]</i>

**3. Verify Compliance With San Francisco Ordinance:**

<b>Revised Standard Design TDV KBtu/sf-yr</b>	<b>must be = or &gt;</b>	<b>Revised Proposed Design TDV KBtu/sf-yr</b>
<b>275.90</b>		<b>234.23</b>

**Revised Proposed Design is Better Than Title 24 by: 23.6%**

*Revised 7/10/08*