Application for:

Revised Locally Adopted Energy Standards by the County of Marin Community Development Agency

for Houses Larger than 3,500 Square Feet In Accordance With Section 10-106 of the California Code of Regulations, Title 24, Part 1

July 26, 2005

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Executive Summary

The County of Marin Community Development Agency developed a *Single Family Dwelling Energy Efficiency Ordinance* (the "Ordinance") to reduce the annual energy consumption and peak electricity and natural gas loads of large homes. In the proposed Ordinance, any single family residential building larger than 3,500 square feet cannot exceed the Title 24 energy use of the equivalent 3,500 square foot home. The Board of Supervisors approved the development of the Ordinance on October 16, 2001, and the California Energy Commission approved the implementation plan of the ordinance in June, 2002. The County ordinance took effect in January, 2003.

The County retained Gabel Associates, LLC as Contractor to revise the existing ordinance to ensure consistency with the state's 2005 energy standards which take effect on October 1st, 2005. The implementation has been designed with several criteria in mind. These include:

- Consistency with the structure, format and calculation 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 homes larger than 3,500 sf use no more total TDV energy than the equivalent 3,500 sf house;

- Simplicity and clarity for building department enforcement for both energy plan review and field inspection; and,

- The provision of maximum flexibility for building permit applicants in meeting the Ordinance by one or more design approaches: (a) energy conservation measures; (b) glazing area and glazing orientation; (c) installation of a solar photovoltaic (PV) system or other alternative energy systems; and/or (d) reduction of total conditioned floor area.

This Application to the California Energy Commission follows 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 takes effect 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 residential buildings are designed to consume no more TDV energy than permitted by Title 24, Part 6. Under the proposed ordinance*, residential single-family buildings over 3,500 square feet of total conditioned area will consume less energy than the 2005 Building Energy Efficiency Standards require.*

For any detailed questions concerning the development methodology or the descriptions outlined in this application, please contact Michael Gabel at Gabel Associates, LLC.

Development of the New Ordinance

Prototype House. For the purpose of this study, a prototype house was developed with a total conditioned floor area of 3,500 sf. The Prototype House establishes the geometry of a typical large custom house design, without specifying the energy conservation measures or levels of energy components such as fenestration, insulation or HVAC and domestic hot water system efficiencies.

The Prototype House is a 2-story structure, with a raised floor over a crawl space, and 9' ceilings w/ attic space. Exactly 60% of the total area is on the 1st floor, and 40% is on the 2nd floor. The aspect ratio (length to width) is 2:1 on 1st floor, and 3:2 on 2nd floor. There is 22.0% glazing as vertical sliding windows (7.7% on front & rear elevations, 3.3% on left & right elevations); and 0.5% as horizontal skylight for a grand total of 22.5% glazing. Space heating is provided by two forced air furnaces, one serving the upstairs and one the downstairs; and no air conditioning is installed. Ducts are in the crawl space for the 1st floor, and in the attic for the 2nd floor. A large (60 gal or 75 gal) storage tank water heater serves the whole house. The prototype house description is based on 20 years experience by Gabel Associates in assisting architects, homeowners and builders meet the energy code for large custom homes within Marin County.

The same prototype house, with the same relative 1st and 2nd floor areas and aspect ratios has also been developed for 4,000 sf; 5,000 sf; 6,000 sf; 7,000 sf; 8,000 sf; 9,000 sf; and 10,000 sf homes. Each of the prototype houses has been analyzed with the state-certified version of EnergyPro v4.0 to establish what the energy budget is for each of these size homes under the 2005 Building Energy Efficiency Standards in Climate Zones 1, 2 and 3. Climate Zone 2 represents most locations in Marin County. The results are listed in Table 1.

Table 1. Energy Budgets for the Prototype House under the 2005 Energy Standards.

House Size (Square Feet)	Climate Zone 1 Title 24 Budget (TDV KBtu/sf-yr)	Climate Zone 2 Title 24 Budget (TDV KBtu/sf-yr)	Climate Zone 3 Title 24 Budget (TDV KBtu/sf-yr)
3,500	24.61	41.67	24.68
4,000	23.23	39.70	23.23
5,000	20.46	35.30	20.33
6,000	19.86	34.71	19.68
7,000	18.82	33.11	18.60
8,000	18.03	31.86	17.78
9,000	17.38	30.88	17.12
10,000	16.86	30.00	16.57
11,000	16.41	29.32	16.11
12,000	16.04	28.74	15.72

Energy Budgets Under the New Ordinance. Applying the requirements of the proposed Ordinance, a house over 3,500 sf shall use no more energy than the equivalent house with 3,500 sf of conditioned space. Table 2 summarizes the theoretical energy budgets for the prototype house (which is the middle value of each category or range of House Size listed under Marin County's proposed Ordinance).

Table 2. Energy Budgets for the Prototype House under the 2005 Marin Ordinance

House Size (Square Feet)	Climate Zone 1 Title 24 Budget (TDV KBtu/sf-yr)	Climate Zone 2 Title 24 Budget (TDV KBtu/sf-yr)	Climate Zone 3 Title 24 Budget (TDV KBtu/sf-yr)
3,500	24.61	41.67	24.68
4,000	21.53	36.46	21.60
5,000	17.23	29.17	17.28
6,000	14.36	24.31	14.40
7,000	12.31	20.84	12.34
8,000	10.77	18.23	10.80
9,000	9.57	16.21	9.60
10,000	8.61	14.58	8.64
11,000	7.83	13.26	7.85
12,000	7.18	12.15	7.20

For the purposes of implementation, houses are grouped according to total conditioned floor area. Houses with between 3,501 sf and 4,499 sf exceed the energy performance of Title 24 based on a 4,000 sf house; houses with between 4,500 sf and 5,499 sf are based on the requirements for a 5,000 sf house; and so on (as illustrated in Tables 3a & 3b). A house size of 12,000 sf represents all houses greater than 11,500 sf.

Table 3a uses the implementation tiers or categories of the Ordinance to establish what the revised energy budget for the prototype house would be in Climate Zone 1, and the percentage (%) by which the house submitted for permit in that climate zone must exceed the Title 24 budget listed in Table 1.

Table 3b uses the implementation tiers or categories of the Ordinance to establish what the revised energy budget for the prototype house would be in Climate Zone 2, and the percentage (%) by which the house submitted for permit in that climate zone must exceed the Title 24 budget listed in Table 1.

Table 3c uses the implementation tiers or categories of the Ordinance to establish what the revised energy budget for the prototype house would be in Climate Zone 3, and the percentage (%) by which the house submitted for permit in that climate zone must exceed the Title 24 budget listed in Table 1.

Table 3a. Climate Zone 1 Energy Budgets under the Proposed Ordinance for Various House Sizes and the Relationship to the 2005 Title 24 Energy Budgets

House Size (Square Feet)	Proposed Ordinance Energy Budget (TDV KBtu/sf-yr)	Must Exceed Title 24 Budget By (%)
3,500 – 4,499	21.53	7.3%
4,500 – 5,499	17.23	15.8%
5,500 – 6,499	14.36	27.7%
6,500 – 7,499	12.31	34.6%
7,500 – 8,499	10.77	40.3%
8,500 – 9,499	9.57	44.9%
9,500 – 10,499	8.61	48.9%
10,500 – 11,499	7.83	52.3%
11,500+	7.18	55.2%

Table 3b. Climate Zone 2 Energy Budgets under the Proposed Ordinance for Various House Sizes and the Relationship to the 2005 Title 24 Energy Budgets

House Size (Square Feet)	Proposed Ordinance Energy Budget (TDV KBtu/sf-yr)	Must Exceed Title 24 Budget By (%)
3,500 – 4,499	36.46	8.2%
4,500 – 5,499	29.17	17.4%
5,500 – 6,499	24.31	30.0%
6,500 – 7,499	20.84	37.1%
7,500 – 8,499	18.23	42.8%
8,500 – 9,499	16.21	47.5%
9,500 – 10,499	14.58	51.4%
10,500 – 11,499	13.26	54.8%
11,500+	12.15	57.7%

Table 3c. Climate Zone 3 Energy Budgets under the Proposed Ordinance for Various House Sizes and the Relationship to the 2005 Title 24 Energy Budget

House Size (Square Feet)	Proposed Ordinance Energy Budget (TDV KBtu/sf-yr)	Must Exceed Title 24 Budget By (%)
3,500 – 4,499	21.60	7.0%
4,500 – 5,499	17.28	15.0%
5,500 – 6,499	14.40	26.8%
6,500 – 7,499	12.34	33.7%
7,500 – 8,499	10.80	39.3%
8,500 – 9,499	9.60	43.9%
9,500 – 10,499	8.64	47.9%
10,500 – 11,499	7.85	51.3%
11,500+	7.20	54.2%

Excellent Performance House

To determine how real-world house designs fare within the framework of the proposed Ordinance, an "Excellent Performance House" was evaluated. The house is assumed to have no air conditioning, so several energy measures specific to cooling efficiency (e.g., high EER, TXV, adequate air flow, maximum cooling efficiency) could not be used. All other energy efficiency measures are considered to be practical and cost-effective in a large single family home with heating only. The measures and associated modeling assumptions include the following:

- R-21 insulation in all exterior walls; R-30 in raised floors over crawl space; R-38 insulation in roof/ceilings and an attic radiant barrier in Zone 2.
- Wood Low-E^2 windows (U-Factor = 0.39, SHGC = 0.30) and Velux skylights (U-Factor = 0.41, SHGC = 0.30).
- House wrap
- Tankless gas water heaters with an Energy Factor = 0.808 and pipe insulation.
- Condensing forced air furnaces with an AFUE = 92.7%, R-8 duct insulation and HERS-verified Duct Sealing

Not included as energy credits in the Excellent Performance House are the following measures, some of which are frequently used in large new custom homes:

- Overhangs and sidefins associated with vertical glazing.

- Thermal mass credit for exposed concrete or masonry greater than 1" in thickness -- common with radiant floor hydronic heating.

- Zonal controls which provide different thermostatic controls between Living and Sleeping areas – common with radiant floor hydronic heating.

- High efficiency air conditioners (EER > 10) and/or credit for evaporative cooling;

- Other HERS measures such as TXV, adequate air flow, maximum cooling efficiency, quality insulation, buried ducts and high-efficiency fans

- Solar thermal collectors for domestic hot water.

The Excellent Performance House represents a reasonably good energy design*, but it is by no means the limit to residential building energy efficiency*. The Excellent Performance House energy measures are sufficient to meet the 2005 Marin County energy ordinance up to a house size of around 7,000 square feet. This is essentially the same scenario as under the previous version of the local ordinance. As house size increases above 7,000 square feet, gradually increasing photovoltaic systems are needed to make up the difference. In Zone 2, the 12,000 square foot prototype house requires a 7.0 KW PV system to meet the revised energy ordinance.

Credit for Solar Photovoltaic (PV) Systems In the Proposed Ordinance

To provide another avenue for the building permit applicant to demonstrate the requisite level of overall energy efficiency, the proposed Ordinance offers credit for solar photovoltaic (PV) electricity generation which is installed at the building site. The credit for PV systems is established by a conservative approximation of the likely electric output of a PV installation converted into Time Dependent Valuation [TDV] energy as KBtu/yr-sf.

Note: The ordinance and the Special Permit Form make it clear that the house must meet the 2005 Building Energy Efficiency Standards without PV credit. PV credit is applicable only when exceeding Title 24 to meet the requirements of the local energy ordinance.

The basis for the credit derives from the results of a CEC/RER Inc. study described at length in Home Energy Magazine's January/February 2003 issue (*Just How Big Is a 2kW Photovoltaic System?*). The annual monitoring of 19 PV installations in California shows that a each nominal KW of installed photovoltaic system produces an average of 1151 kWh/year. Including a 20% degradation factor for less-than-optimal installation and maintenance over the life of the system, this translates to annual site energy per nominal 1.0 kW of PV as follows:

1,151 kWh/yr x 0.80 x 3.413 Btu/watt = 3,142.7 kBtu/yr

The next step is to convert site energy into TDV energy. Assuming that PV systems will generate electricity from approximately an hour after sunrise to an hour before sunset, an average TDV value for electricity is calculated from the hourly TDV values incorporated into the residential and nonresidential ACMs, The daily hours included for each month (also incorporates Daylight Savings Time} are as follows:

Month	TDV Hours Included	Total Hours
January	10AM – 4PM	7
February	10AM – 5PM	8
March	9AM – 6PM	10
April	9AM – 7PM	11
May	8AM – 7PM	12
June	8AM – 8PM	13
July	8AM – 8PM	13
August	9AM – 8PM	12
September	10AM – 7PM	10
October	10AM – 6PM	9
November	10AM – 5PM	8
December	10AM – 4PM	7

In Climate Zone 2, which represents more than 90% of the construction in the County, the average TDV energy value for the above hours is 4.219. For Climate Zones 1 and 3, the TDV values are 4.195 and 4.237 respectively. In simplifying the calculation, 4.22 is selected as representative of the average condition to establish the annual TDV energy for each nominal 1.0 KW of photovoltaics as follows:

3,142.7 kBtu/yr x 4.22 = 13,262 TDV kBtu/yr

This value is then divided by the conditioned floor area of the house to calculate the TDV energy in kBtu/sf-yr, the metric used by the residential ACMs in demonstrating compliance with the Title 24 performance standards. For example, a 6,500 square foot house receives a PV credit for each nominal installed 1.0 KW as follows:

$$\frac{\text{13,262 TDV kBtu/yr}}{\text{6,500 sf}} = \textbf{2.04 kBtu/sf-yr}$$

PV credit in the same house for a 4.5 KW system = 4.5 (2.04) = **9.18 kBtu/sf-yr.**

The *Special Permit Form* completed for projects covered by the 2005 energy ordinance includes this credit as part of the overall compliance calculation.

Cost Effectiveness

The cost effectiveness of the Ordinance is based on the results of an analysis of the prototype home in Climate Zone 2 which represents more than 90% of the new construction in Marin County. The study considers energy measures that just meet the local energy code for different size homes and compares them to the equivalent Title 24 homes.

Using the Prototype House design in each instance, appropriate energy measures that just meet the current Title 24 Standards are assumed. Then the energy measures are incrementally increased to just meet the requirements of the Ordinance. The incremental total first cost of all the measures is divided by the incremental annual energy cost saving to establish a Simple Payback for the additional energy features. The study uses a price of $0.15/kWh for electricity and $0.75/therm for natural gas.

Because the Ordinance effectively increases the relative amount of building energy efficiency as house size increases, one would expect the payback period to gradually increase in the same fashion. This trend is reflected in the results.

Table 4: Summary of Simple Payback of Energy Measures that Meet the Requirements of the Ordinance in Climate Zone 2

House Size (Square Feet)	Incremental First Cost as Compared w/ Title 24 House ($)	Incremental Annual Energy Cost Saving ($)	Simple Payback (Years)
4,000	$200	$66	3.0
5,000	$2,450	$156	15.7
6,000	$6,600	$387	17.0
7,000	$10,842	$564	19.2
8,000	$17,585	$807	21.8
9,000	$23,425	$973	24.1
10,000	$31,212	$1,210	25.8
11,000	$35,985	$1,421	25.3
12,000	$40,772	$1,627	25.1

Implementation Plan

The implementation of the 2005 Marin County energy ordinance should be a simple and seamless modification of the previous local ordinance. The procedures for demonstrating compliance of homes larger than 3,500 square feet remain exactly the same as those that have been in place since January 1, 2003. The only changes are slight modifications to the Adjustment Factors on the Special Permit Form (see below), and the change in the TDV energy credit assigned for photovoltaic systems (as explained above). Permit applicants will be given the new form and new language of the revised ordinance for permits that come into the County after September 30, 2005.

Proposed Language of the 2005 Energy Ordinance

REVISIONS to ORDINANCE NO. 3356

ORDINANCE OF THE MARIN COUNTY BOARD OF SUPERVISORS ADOPTING ENERGY EFFICIENCY STANDARDS FOR SINGLE FAMILY DWELLINGS GREATER THAN 3,500 SQUARE FEET OF CONDITIONED FLOOR AREA

THE BOARD OF SUPERVISORS OF THE COUNTY OF MARIN HEREBY ORDAINS AS FOLLOWS:

SECTION I. Section 19.04.100 of the Marin County Code is hereby added to read as follows:

19.04.100 Energy Efficiency Standards For Single Family Dwellings Greater Than 3,500 Square Feet of Conditioned Floor Area.

a. Background. All single family dwellings 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. (The "Standards") This ordinance requires the application of the Standards, including but not limited to the definitions, procedures, forms, manuals and alternative calculation methods ("ACM's") associated with the Standards. In addition, this ordinance amends the Standards as described herein.

b. Buildings Covered. The provisions of this ordinance shall apply to all single family dwellings for which a building permit has not been applied for and accepted as complete by the Building Department prior to October 1, 2005 or received Design Review approval prior to October 1, 2005 that are:

1. New single family dwellings greater than 3,500 square feet of total conditioned floor area. In addition, a residential second unit of not greater than 750 square feet shall be exempt from the requirements of this ordinance.

2. Additions to single family dwellings where the conditioned floor area of the existing building plus the addition is greater than 3,500 square feet and the addition is equal to or greater than 500 square feet, excluding up to a 750 square foot residential second unit.

c. Definitions

1. **PV CREDIT** is the energy credit applicable to the Proposed Design for a solar photovoltaic system that is capable of generating electricity from sunlight and supplying it directly to the building; and is connected, through a reversible meter, to the utility grid. The amount of PV credit under this Ordinance is defined as W_o multiplied by 13.262 KBtu/sf-yr TDV energy, where W_o is a unitless value calculated as 1000 multiplied by the nominal kilowatts of the proposed PV system and divided by the total conditioned floor area of the building.

2. **ALTERNATIVE PROPOSED DESIGN CREDIT** is an energy credit applicable to the Proposed Design including but not limited to any renewable energy system which is not a solar photovoltaic system and any energy-efficiency measures not included in the Title 24 performance analysis which significantly exceed current building practice or applicable minimum state or federal efficiency standards. The permit applicant must submit calculations to document, explain and justify the amount of the credit claimed subject to approval by the Chief Building Official and the Director of the Marin County Community Development Agency.

3. **REVISED STANDARD DESIGN TOTAL** is the performance energy budget, in KBtu/sf-yr, which this Ordinance establishes for all buildings to which it applies. It is defined as the Standard Design Total (TDV KBtu/sf-yr) obtained from any state-approved residential alternative calculation method (ACM) multiplied times the Standard Design Adjustment Factor (contained in Table A).

4. **STANDARD DESIGN ADJUSTMENT FACTOR** is the arithmetic factor listed below which when multiplied by the standard design energy budget (from a state-approved residential ACM) produces the Revised Standard Design Total.)

Table A: Standard Design Adjustment Factors

House Size (Total Conditioned Sq.Ft.)	Climate Zone 1 Adjustment Factor	Climate Zone 2 Adjustment Factor	Climate Zone 3 Adjustment Factor
3,501 – 4,499	*0.927*	*0.918*	*0.930*
4,500 – 5,499	*0.842*	*0.826*	*0.850*
5,500 – 6,499	*0.723*	*0.700*	*0.732*
6,500 – 7,499	*0.654*	*0.629*	*0.663*
7,500 – 8,499	*0.597*	*0.572*	*0.607*
8,500 – 9,499	*0.551*	*0.525*	*0.561*
9,500 – 10,499	*0.511*	*0.486*	*0.521*
10,500 – 11,499	*0.477*	*0.452*	*0.487*
11,500+	*0.448*	*0.423*	*0.458*

d. Performance Compliance Approach

1. **Basic Requirements**. New single family dwellings with a total conditioned floor area equal to or greater than 3,500 square feet shall meet both of the following:

   A. The Revised Standard Design Total energy budget, in source Kbtu/sf-yr, using the performance compliance approach.

   B. All other provisions applicable to low rise residential buildings contained in the California Building Energy Efficiency Standards.

e. Additions

1. Additions covered by this ordinance as defined in subsection (b)(2) shall meet the requirements of section and by one of the following:

A. The addition shall comply with subsection (d)

B. The energy efficiency of the existing building shall be improved so that the existing building plus the addition meet the energy budget in subsection (d)(1)(A) as applied to the Standard Design Total for the Existing-plus-Addition generated by a state approved Alternative Calculation Method (ACM).

f. Special Permit Form

1. In addition to the standard Title 24 report submitted to the building department, a special form will be required which shall be available at the building department.

SECTION II. Findings Pursuant to Public Resources Code section 25402.2 and Health and Safety Code sections 17958.5, 17958.7 and 18941.5.

To the extent the requirements of this ordinance are deemed to constitute changes or modifications to the requirements of the California Building Standards Code and the other regulations adopted pursuant to Health and Safety Code section 17922, this Board of Supervisors expressly finds that the provisions of this ordinance are reasonably necessary because of local climatic, geological, or topographical conditions as follows. Marin County has three Title 24 climate zones and 24 microclimates. During periods when artic masses dominate the weather, nighttime lows drop into the high twenties with daytime highs in the thirties. In climate zone three, (Coastal and certain bay areas), fog is a consistent weather pattern that creates a demand for heating even during summer months. In addition, climatic conditions in Kentfield (Climate Zone 2), result in 2774 “heating degree days.”

The Average Maximum temperature is over 80°F for the months of June, July, August and September, and during the summer it is not uncommon for temperatures to reach 100°F in some parts of Marin. Climatic conditions in Kentfield, (Climate Zone 2) result in 441 “cooling degree days”.

The average house size in Marin is getting larger and using more energy. During the 1970s most home construction was approximately 1,500-2,500 square feet. In the years 1998 through 2001 average house size construction continued to rise to approximately 3,000 - 4,000 square feet. These large houses are using more energy and resources.

Due to local climatic conditions and increasing house size, total residential energy consumption increased from 619 million kWh to 734 million kWh from 1995 to 2000. This 18.5% increase in energy use raises the per capita contribution of costly uncertain energy supplies, pollution, and global warming. Due to local climatic conditions, it is reasonably necessary to enhance the State of California energy code requirements for homes over 3,500 square feet.

SECTION III. Effective Date. This ordinance shall be and is hereby declared to be in full force and effect as of October 1, 2005 or when the ordinance is approved by the California Energy Commission, whichever is later. This ordinance shall be published once before the expiration of fifteen (15) days after its passage, with the names of the supervisors voting for and against the same in the *Marin Independent Journal*, a newspaper of general circulation published in the County of Marin.

PASSED AND ADOPTED at a regular meeting of the Board of Supervisors of the County of Marin held on this _____ day of August, 2005 by the following vote:

AYES: SUPERVISORS John B. Kress, Harold C. Brown, Jr., Annette Rose, Cynthia L. Murray

NOES: NONE

ABSENT: SUPERVISOR Steve Kinsey

PRESIDENT, BOARD OF SUPERVISORS

ATTEST:

CLERK

Special Permit Form for the 2005 Marin County Energy Ordinance

Project Name / Address: _____
Date of Title 24 Report: _____

1. Calculation of Marin County Energy Ordinance Standard Design:

Standard Design Total (KBtu/sf-yr)		***Adjustment Factor***		***Revised Standard Design Total (KBtu/sf-yr)***
_____	***x***	_____	=	_____
[from Part 1, CF-1R]		*[from Table A]*		*[used in #3]*

2. Calculation of Credit for Solar Photovoltaic (PV) Systems in the Proposed Design:
(This calculation is used only if there is PV system receiving credit under the Ordinance.)

	Nominal KW of PV System			***Total Conditioned Floor Area (sq.ft.)***		***Proposed Design Credit (KBtu/sf-yr)***
(	_____	x 13,262)	/	_____	=	_____
	[from PV manufacturer]			*[from Part 1, CF-1R]*		*[used in #3]*

3. Verification of energy code compliance:

Proposed Design Total (KBtu/sf-yr)		***Proposed Design Credit (KBtu/sf-yr)***		***Revised Proposed Design Total (KBtu/sf-yr)***		***Revised Standard Design Total (KBtu/sf-yr)***
(_____	-	_____) =		_____	< or =	_____
[from Part 1, CF-1R]		*[from #2 or from an Alternative Proposed Design Credit per Section 2]*				*[from #1]*

Note: The Proposed Design (KBtu/sf-yr) must always be equal to or less than the Standard Design Total as shown on Part 1 of the CF-1R form in the Title 24 report.

Table A. Standard Design Adjustment Factors

House Size (Conditioned Sq.Ft.)	Climate Zone 1 Adjustment Factor	Climate Zone 2 Adjustment Factor	Climate Zone 3 Adjustment Factor
3,501 – 4,499	***0.927***	***0.918***	***0.930***
4,500 – 5,499	***0.842***	***0.826***	***0.850***
5,500 – 6,499	***0.723***	***0.700***	***0.732***
6,500 – 7,499	***0.654***	***0.629***	***0.663***
7,500 – 8,499	***0.597***	***0.572***	***0.607***
8,500 – 9,499	***0.551***	***0.525***	***0.561***
9,500 – 10,499	***0.511***	***0.486***	***0.521***
10,500 – 11,499	***0.477***	***0.452***	***0.487***
11,500+	***0.448***	***0.423***	***0.458***

Appendix A: Cost-Effectiveness Data

2005 Incremental Cost Summary for Houses in Zone 2

7/21/05

Insulation -- House Size (sf)	Roof Area (sf)	Net Wall Area (sf)	Floor Area (sf)	Incremental Roof Cost (/sf)	Incremental Wall Cost (/sf)	Incremental Floor Cost (/sf)	Total Incremental Insulation & Framing Cost ($)
4,000	2400	2462	2400	$0.00	$0.00	$0.00	$0
5,000	3000	2636	3000	$0.00	$0.00	$0.25	$750
6,000	3600	2772	3600	$0.25	$0.00	$0.25	$1,800
7,000	4200	2878	4200	$0.25	$0.15	$0.25	$2,532
8,000	4800	2966	4800	$0.25	$0.15	$0.25	$2,845
9,000	5400	3030	5400	$0.25	$0.15	$0.25	$3,155
10,000	6000	3082	6000	$0.25	$0.15	$0.25	$3,462
11,000	5400	3030	5400	$0.25	$0.15	$0.00	$1,805
12,000	6000	3082	6000	$0.25	$0.15	$0.00	$1,962

House Size (sf)	DHW	FAUs	Duct Sealing	House Wrap	Duct R-value	Pipe Insul.	($)
4,000	$0	$0	$0	$200	$0	$0	$200
5,000	$1,200	$0	$0	$250	$250	$0	$1,700
6,000	$2,400	$1,000	$800	$300	$300	$0	$4,800
7,000	$2,400	$1,500	$800	$350	$560	$2,700	$8,310
8,000	$2,400	$1,500	$800	$400	$640	$9,000	$14,740
9,000	$2,400	$1,500	$800	$450	$720	$14,400	$20,270
10,000	$2,400	$2,250	$1,100	$500	$800	$20,700	$27,750
11,000	$2,400	$2,250	$1,100	$550	$880	$27,000	$34,180
12,000	$2,400	$2,250	$1,100	$600	$960	$31,500	$38,810

House Size (sf)	Grand Total for All Measures ($)
4,000	$200
5,000	$2,450
6,000	$6,600
7,000	$10,842
8,000	$17,585
9,000	$23,425
10,000	$31,212
11,000	$35,985
12,000	$40,772

2005 Marin County Study: Zone 2 Annual Energy Savings

House (sf)	Title 24 Site (KWh/yr)	Title 24 Site (Therms)	Marin Site (KWh/yr)	Marin Site [1] (Therms)	Site Electricity Saving (KWh/yr)	Site Gas Saving (therms/yr)	Electricity Cost Saving ($)	Nat. Gas Cost Saving ($)	Total Annual Cost Saving ($)
4000	2499	983	2311	933	188	50	$28	$38	$66
5000	2654	1075	2568	884	86	191	$13	$143	$156
6000	3179	1248	2671	833	508	415	$76	$311	$387
7000	3592	1383	2389	871	1203	512	$180	$384	$564
8000	4002	1517	1433	955	2569	562	$385	$422	$807
9000	4374	1591	660	1037	3714	554	$557	$416	$973
10000	4776	1717	-302	1119	5078	598	$762	$449	$1,210
11000	5173	1840	-1158	1212	6331	628	$950	$471	$1,421
12000	5568	1964	-1860	1280	7428	684	$1,114	$513	$1,627

$/Therm = $0.750 $/kWh = $0.150

House (sf)	Incremental Installed Cost All Measures [2]	Simple Payback (Years)
4000	$200	3.0
5000	$2,450	15.7
6000	$6,600	17.0
7000	$10,842	19.2
8000	$17,585	21.8
9000	$23,425	24.1
10000	$31,212	25.8
11000	$35,985	25.3
12000	$40,772	25.1

NOTES:

(1) Site KWh is adjusted to include the annual electricity generated by the photovoltaic (PV) system.

(2) The Marin County house compared to the same house which just meets the 2005 Title 24 Standards.