

**Application for Locally Adopted Energy Standards
by the Town of San Anselmo in Accordance With
Section 10-106 of the California Code of Regulations,
Title 24, Part 1**

August 31, 2010

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1.0 Executive Summary for the Town of San Anselmo Green Building Ordinance

The Town of San Anselmo Council adopted their revised Green Building Ordinance on August 24, including review and approval of energy cost-effectiveness based on the *Marin County Green Building Ordinance Energy Cost-Effectiveness Study* (dated 12/10/09 and contained in the Appendix). The new ordinance is scheduled to take effect under the state's 2008 Building Energy Efficiency Standards on or around November 1, 2010. Gabel Associates has researched and reviewed the feasibility and energy cost-effectiveness of permit applicants exceeding the 2008 Standards in order to meet the minimum energy efficiency requirements of the proposed ordinance.

Overall Scope of the Town of San Anselmo Green Building Ordinance

New ordinance or revision to previous ordinance?	Revised Ordinance
Projected Effective Date:	November 1, 2010
Green building or stand-alone energy ordinance?	Green Building Ordinance
Do minimum energy requirements increase after initial effective date?	No
Occupancies covered?	Residential and Nonresidential Buildings
Energy requirements apply to new construction, additions, alterations?	New Construction, Additions and Alterations (Renovations)
Special or unusual energy requirements?	New Single Family Dwelling Units \geq 4,000 sq.ft.
Third party verification?	GreenPoint Rater for Residential Buildings; LEED AP for Nonresidential Buildings
Implementation details in the ordinance or in a separate document?	No

With one minor exception, the requirements of the San Anselmo Ordinance are identical to those contained in the Marin County Green Building Ordinance approved by the Energy Commission on May 5, 2010. The one exception is that additions and alterations which use the Existing + Addition + Alterations performance approach need not exceed Title 24 by 15% as they are required to do in the Marin County ordinance.

Key Features of the Town of San Anselmo Ordinance By Occupancy Type

Occupancy Type	General Requirements	Minimum Energy Requirement
Single Family and Two-Family Buildings:	2010 GreenPoint Rated	
500 - 2,499 sq. ft. (per unit)	75 points	15% Better-than-Title 24
2,500 - 3,999 sq. ft. (per unit)	100 points	15% Better-than-Title 24
4,000 - 5,499 sq. ft. (per unit)	125 points	20% Better-than-Title 24
5,500 - 6,999 sq. ft. (per unit)	150 points	30% Better-than-Title 24
7,000+ sq. ft. (per unit)	200 points	Net Zero Energy
Single Family and Two-Family Buildings:	2010 GreenPoint Rated for Existing Homes	
Additions or Alterations with a valuation ≤ \$300,000	(varies per Table A)	2008 Title 24 Standards
\$300,000+ valuation or 1,000+ sq. ft.	50 points	20% improvement in HERS II or BPI home performance audit; or a HERS II score of ≤ 100
Multi-Family Buildings:	2010 GreenPoint Rated	
< 1,000 sq. ft. / average unit	60 points	15% Better-than-Title 24
1,000+ sq. ft. / average unit	75 points	15% Better-than-Title 24
Nonresidential Buildings and Nonresidential Additions:	LEED Version 3.0	
2,000 - 4,999 sq. ft.	Checklist + Prerequisites	2008 Title 24 Standards
5,000 - 49,999 sq. ft.	LEED Silver	15% Better-than-Title 24
50,000+ sq. ft.	LEED Gold	15% Better-than-Title 24

2.0 Text of Town of San Anselmo Green Building Ordinance and Resolution

This section includes copies of the following documents:

- Town of San Anselmo Green Building Ordinance No. 1076
- Town of San Anselmo Green Building Resolution No. 3913

ORDINANCE NO. 1076

**AN ORDINANCE OF THE TOWN COUNCIL OF THE TOWN OF SAN ANSELMO
AMENDING THE MUNICIPAL CODE INCLUDING:**

- 1) CREATING CHAPTER 19 GREEN BUILDING REQUIREMENTS;**
- 2) AMENDMENTS TO CHAPTER 1 – CONSTRUCTION CODES OF TITLE 9 INCLUDING REQUIREMENTS FOR PRE-WIRING AND PRE-PLUMBING NEW RESIDENTIAL AND NON-RESIDENTIAL BUILDINGS FOR SOLAR PHOTOVOLTAIC OR SOLAR HOT WATER SYSTEMS;**
- 3) AMENDING CHAPTER 12.16 (CALIFORNIA PLUMBING CODE) TO INCLUDE A REQUIREMENT FOR INSULATING HOT WATER PIPES WHEN EXPOSED DURING REMODELING;**
- 4) AMENDING CHAPTER 12.12 (CALIFORNIA BUILDING CODE) TO INCLUDE A REQUIREMENT FOR INSTALLATION OF A RADIANT BARRIER DURING REROOFING;
AND**

WHEREAS, The San Anselmo General Plan 1989 promotes energy and resource efficiency in new construction and the 2007-2014 Preliminary Draft The Housing Element encourages the development of Green Building policies and programs for new residential development and existing residential units; and

WHEREAS, the San Anselmo 2005 Greenhouse Gas Emissions Analysis determined that of the four sectors studied (Residential, Commercial/Industrial, Transportation and Waste Generation) the residential sector produced the second highest quantity of emissions (34.2%) behind transportation (52.1%); and

WHEREAS, the California Global Warming Solutions Act of 2006, known as AB 32, established a statewide goal of reducing greenhouse gas emissions to 1990 levels by 2020 and to a level 80% below 1990 levels by 2050, and directs the California Air Resources Board to develop a strategy to achieve such reductions; and

WHEREAS, the California Air Resources Board adopted its Climate Change Scoping Plan on December 12, 2008, which identified the implementation of mandatory green building techniques as achieving 15% of the AB 32 greenhouse gas reduction goal for 2020; and

WHEREAS, the California Public Utilities Commission has adopted a goal of 40% improved energy efficiency in all buildings by 2020; and

WHEREAS, the San Francisco Bay Conservation and Development Commission has indicated that the level of San Francisco Bay has increased by 8 inches over the past century and projects that sea level will rise between 20 and 55 inches by 2100, which will inundate properties currently valued at over \$48 billion dollars cumulatively, will inundate over 700 miles of state and local roadways, and will require the installation of seawalls and levee increases costing over \$1 billion; and

WHEREAS, the United Nations Intergovernmental Panel on Climate Change has warned that failure to address the causes of global climate change within the next few years will result in significantly increasing sea levels and frequency of wildland fires and reduced freshwater resources, which will significantly increase the cost of providing local governmental services and protecting public infrastructure; and

WHEREAS, the United States Environmental Protection Agency (EPA) states that the construction and operation of buildings in the United States collectively account for 39% of total energy use, 68% of total electricity consumption, 12% of total freshwater consumption, 40% of all raw materials used, and 38% of total carbon dioxide emissions; and

WHEREAS, the total energy consumption by residential dwelling units in Marin County increased from 619 million kWh to 734 million kWh (a 19% increase) from 1995 to 2000; and

WHEREAS, the California Health and Safety Code Sections 18938 and 17958 provide that the California Building Standards Code establishes building codes and standards for all building throughout the State, and Section 17958.5 provides that a local government may establish more stringent building standards if they are reasonably necessary due to local climatic, geological or topographical conditions; and

WHEREAS, California Assembly Bill 210 states that a city is authorized to change or modify green building standards if the California Building Standards Commission determines such changes are reasonably necessary because of local climatic, geological or topographical conditions, and Section 18941.5(2)(b) of the California Health and Safety Code states that, “neither the State Building Standards Law contained in this part, nor the application of building standards contained in this section, shall limit the authority of a city or county to establish more restrictive building standards, including, but not limited to, green building standards, reasonably necessary because of local climatic, geological, or topographical conditions;” and

WHEREAS, the Public Resources Code Section 25402.1(h)(2) states that a local enforcement agency may adopt more restrictive energy standards when they are cost-effective and approved by the California Energy Commission; and

WHEREAS, green building is a practice of design, construction and maintenance techniques that have been demonstrated to have a significant positive effect on energy, water and resource conservation, waste management and pollution generation and on the health and productivity of building occupants over the life of the building; and

WHEREAS, green building benefits are spread throughout the systems and features of a building. Green buildings can include, among other things, the use of certified sustainable wood products, extensive use of high-recycled-content products; recycling of waste that occurs during deconstruction, demolition and construction; orientation and design of a building to reduce the demand on the heating, ventilating, and air conditioning systems; the use of heating, ventilating, and air conditioning systems that provide energy efficiency and improved air quality; enhancement of indoor air quality by selection and use of construction materials that do not emit chemicals that are toxic or irritating to building occupants; the use of water conserving methods and equipment; and installation of alternative energy methods for supplemental energy production; and

WHEREAS, in recent years, green building design, construction and operational techniques have become increasingly widespread. Many home owners, 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 and rating systems for green building practices. The U.S. Green Building Council, developer of the Leadership in Energy and Environmental Design (LEED®) Green Building Rating Systems, has become a leader in promoting and guiding green building, particularly for non-residential structures. Build It Green has developed the New Home, Existing Home and Multi-Family Green Building Guidelines and associated GreenPoints Calculators, which have been adopted for use in approximately 70 Bay Area jurisdictions; and

WHEREAS, it is estimated that construction of buildings in accordance with the GreenPoint Rated and LEED® rating systems results in average energy savings of approximately 20% compared with buildings constructed in accordance with current minimum standards of the state building code; and

WHEREAS, representatives of all municipalities within Marin County and of the county government participated in a collaborative effort known as the Marin Green BERST (Green Building, Energy Retrofit and Solar Transformation) Task Force, held meetings on June 11, July 13, September 29 and 30, and November 19, 2009 and endorsed a model green building ordinance recommended by a Technical Advisory Committee comprised of over 50 experts in the fields of architecture, building construction, green building, building energy systems, energy conservation, water conservation, building inspection, planning and real estate over the course of 11 meetings; and

WHEREAS, study sessions on the proposed model green building regulations were held by the San Anselmo Town Council on June 22, 2010 and by the San Anselmo Planning Commission on March 1, 2010, March 15, 2010, May 3, 2010 and a joint public workshop with the Council and the Commission was held on April 12, 2010; and

WHEREAS, on May 3, 2010 the San Anselmo Planning Commission conducted a public hearing and recommended adoption of the proposed Municipal Code amendments to the Town Council;

NOW, THEREFORE, THE TOWN COUNCIL OF THE TOWN OF SAN ANSELMO DOES ORDAIN AS FOLLOWS:

DIVISION 1: The Town Council finds as follows:

- A. The adoption of this ordinance is categorically exempt from the requirements of the California Environmental Quality Act (CEQA) pursuant to Section 15308 of the CEQA Guidelines (14 Cal. Code §15308) because it is an action taken by a regulatory agency for the protection of the environment ..
- B. The proposed amendments are consistent with the policies and programs of the San Anselmo General Plan 1989 in that the proposed green building requirements are designed to result in greater energy efficiency and water conservation and the use of recycled and sustainably produced building materials.

- C. The public health, safety and general welfare will not be adversely impacted by the proposed amendments which are designed to reduce impacts on respiratory health and chemical sensitivity of building occupants, reduce production of greenhouse gases, reduce impacts on wildlife and vegetative habitats and reduce the generation and disposal of waste products.
- D. In conformance with California Health and Safety Code Section 17958.5, local climatic conditions require the adoption of local building code amendments to implement green building techniques and increase building energy efficiency since total energy consumption from residential structures in Marin County increased 18.5% between 1995 and 2000 and the Greenhouse Gas Emissions Analysis determined that the of the four sectors studied (Residential, Commercial/Industrial, Transportation and Waste Generation) the residential sector produced the second highest quantity of emissions (34.2%) behind transportation (52.1%). The increased contribution to greenhouse gas production from local sources will contribute to overall climate change, potentially resulting in the increased height of San Francisco Bay, more wildland fires, reduced water supply and significantly increased Town costs for public services and infrastructure protection.
- E. In conformance with Public Resources Code Section 25402.1(h)(2) Gabel Associates, LLC has prepared a study which will be submitted as evidence to the California Energy Commission which demonstrates the feasibility and cost-effectiveness of the proposed municipal code amendments.

DIVISION 2: Chapter 19 (Green Building Regulations) is hereby added to read as follows:

Title 9, Chapter 19 Green Building Requirements.

Sections:

_9-19.010	Purpose
_9-19.020	Applicability
_9-19.030	Definitions
_9-19.040	Covered Projects Green Building Standards
_9-19.050	Incentives for Compliance
_9-19.060	Administrative Procedures
_9-19.070	Exemptions
_9-19.080	Appeal

9-19.010 Purpose.

The purpose of this Chapter is to enhance the long-term public health and welfare by contributing to the overall reduction of greenhouse gas production and emissions and improving the environmental and economic health of the Town through the efficient design, construction, operation, maintenance and deconstruction of buildings and site development by incorporating green building practices and materials. The green building provisions referenced in this Chapter are designed to achieve the following objectives:

- a. Increase energy efficiency in buildings;
- b. Encourage water and resource conservation;
- c. Reduce waste generated by construction projects;
- d. Reduce long-term building operating and maintenance costs; and

- e. Improve indoor air quality and occupant health; and
- f. Contribute to meeting the state and local commitments to reduce greenhouse gas production and emissions.

9-19.020 Applicability.

The provisions of this Chapter shall apply to all construction or development projects defined below as a “Covered Project.”

9-19.030 Definitions.

For the purposes of interpreting this Chapter and the associated Green Building Standards Tables A and B, the following terms are defined as follows. When the definitions below differ from those contained elsewhere in this Title, the provisions of this Chapter shall apply.

- a. “Addition” means the addition of building square footage to an existing structure.
- b. “BIG” means Build It Green, a non-profit organization which established and maintains the Green Point Rated system for evaluating and certifying residential green buildings and green building professionals.
- c. “BPI” means the Building Performance Institute, a non-profit organization which provides training and certification of green building professionals.
- d. “Building envelope” means the ensemble of exterior and demising partitions of a building and roof structure that enclose conditioned space.
- e. “Compliance threshold” means the minimum number of points or rating level required to be achieved by a particular Covered Project as set forth by the Green Building Standards Tables A and B.
- f. “Conditioned space” means any area within a building or structure that is heated or cooled by any equipment.
- g. “Covered project” means a development project for new construction or renovations for which one or more building permits are required and which is also designated as a “Covered Project” by resolution of the Town Council in the Green Building Standards Tables A and B.
- h. “GBCI” means the Green Building Certification Institute, a non-profit organization which certifies green buildings and green building professionals under the LEED[®] rating system.
- i. “Green building” means a comprehensive process of design and construction that employs techniques to increase the efficiency of resource use, including energy, water and building materials, while minimizing adverse impacts on human health and the natural environment.
- j. “Green building checklist” means a checklist or rating sheet used for calculating a green building rating.
- k. “Green building rating system” means a standardized rating system providing specific criteria to determine the level of compliance of building projects as set forth by the Green Building Standards Tables A and B.
- l. “GreenPoint Rated” means a residential building certified as complying with the green building rating systems developed by the Build It Green organization.

- m. “GreenPoint Rater” means an individual certified by Build It Green as capable of evaluating and rating residential construction projects for compliance with the GreenPoint Rated green building rating systems.
- n. “HERS” means the Home Energy Rating System adopted by the California Energy Commission.
- o. “LEED®” means the “Leadership in Energy and Environmental Design” green building rating system developed by the U.S. Green Building Council.
- p. “LEED® AP” means an individual who has been certified a LEED® Accredited Professional by the U.S. Green Building Council or the Green Building Certification Institute as capable of evaluating and rating construction projects for compliance with the LEED® green building rating systems.
- q. “Net Zero Energy” means a building that has a net annual Time Dependent Valued (TDV) Energy Consumption, as defined by Title 24 of the California Code of Regulations, of zero, accounting for both energy consumption and the use of on-site renewable energy production.
- r. “New construction” means the construction of a new or replacement residential dwelling unit or a new or expanded non-residential building.
- s. “Qualified green building rater” means an individual who has been trained and certified as a LEED® AP, GreenPoint Rater or has similar qualifications and certifications if acceptable to the Chief Building Official.
- t. “Renovation” means any remodeling, modification or tenant improvement to an existing building that includes replacement or alteration of at least two of the following: heating/ventilating/air conditioning system, building envelope, hot water system or lighting system, but excluding improvements and project valuation related to seismic upgrades,, disabled access, or installation of renewable energy systems. Renovation shall include any addition of conditioned space to an existing dwelling unit.
- u. “USGBC” means the U.S. Green Building Council, a non-profit organization which established and maintains the LEED® rating systems for evaluating and certifying residential green buildings and green building professionals.

9-19.040 Covered Projects - Green Building Standards.

The Town Council shall adopt a resolution defining which projects shall be deemed to be “Covered Projects” within the meaning of this Chapter, and establishing “Green Building Standards” applicable to those Covered Projects, which standards shall include, but not be limited to, the green building rating system (s) applicable to various types and sizes of Covered Projects; minimum compliance thresholds for various types and sizes of Covered Projects; and methods for verification of compliance with the adopted standards. In applying Green Building Standards under this Chapter:

- a. Cumulative new construction or renovations over any one-year period shall be considered as a single Covered Project, and subject to the highest compliance threshold based on the cumulative project size or valuation.
- b. The Chief Building Official shall determine the appropriate project valuation based on the cost of similar improvements, and may request substantiating documentation from the applicant. Where Compliance Thresholds contain project size ranges expressed as both building square footage and project valuation, the intent is to base project requirements upon the project valuation range. However the Chief Building Official shall have the authority to determine whether the building square footage or valuation range most accurately reflects the scope of the proposed project for purposes of determining the required minimum Compliance Threshold.
- c. Mixed use (residential and non-residential) projects must comply either with the applicable Covered Project requirements for the respective residential and non-residential portions of the project, or may propose to utilize a mixed use rating system, subject to approval by the Chief Building Official.
- d. All buildings submitted for permit must meet all applicable requirements of the 2008 Building Energy Efficiency Standards, California Code of Regulations (“C.C.R.”), Title 24, Part 6.
- e. The applicable green building rating system shall be that which is most recently adopted by Build It Green or the U.S. Green Building Council. The green building rating system in effect at the time of building permit submittal shall be that which is applicable to the development project throughout the project construction.

9-19.050 Incentives for Compliance.

In addition to the required Green Building Standards, the Town Council may establish by resolution, financial or application processing incentives and/or award or recognition programs to encourage higher levels of green building compliance for a project.

9-19.060 Administrative Procedures.

The procedures for compliance with the provisions of this Chapter shall include, but not be limited to, the following:

- a. Project design. Applicants for a Covered Project are strongly encouraged to involve a qualified green building rater in the initial design phases of the project in advance of submittal of an application to determine applicable green building compliance thresholds and the most cost effective and appropriate means of achieving compliance.
- b. Planning applications. If a discretionary planning application is required for a Covered Project, applicants should be prepared to identify expected green building measures to be included in the project to achieve the compliance thresholds. Applicants should identify any anticipated

difficulties in achieving compliance and any exemptions from the requirements of this Chapter that may be requested.

- c. Building plan check review. Upon submittal of an application for a building permit, building plans for any Covered Project shall include a green building program description and completed checklist. The checklist shall be incorporated onto a separate full-sized plan sheet included with the building plans. A qualified green building rater, if required, shall provide evidence that the project, as indicated by the project plans and green building program description, will achieve the Green Building Standards Tables A and B prior to issuance of a building permit.
- d. Changes during construction. During the construction process, alternate green building measures may be substituted, provided that the qualified green building rater or applicable individual provides documentation of the proposed change and the project's continued ability to achieve the Green Building Standards to the Chief Building Official.
- e. Final building inspection. Prior to final building inspection and occupancy for any Covered Project, a qualified green building rater, if required, shall provide evidence that project construction has achieved the required compliance set forth in the Green Building Standards Tables A and B. The Chief Building Official shall review the documentation submitted by the applicant, and determine whether the project has achieved the compliance threshold as set forth in the Green Building Standards Tables A and B. Where subsequent certification of the building is required by the Green Building Standards, the Chief Building Official shall also determine whether the applicant has demonstrated that such certification is in process and will be achieved not later than one year after approval of final building inspection. If the Chief Building Official determines that the applicant has met these requirements, the final building inspection may proceed.
- f. Post final inspection requirement. Where certification through GreenPoint Rated or Leadership in Energy and Environmental Design (LEED) of the building is required by the Green Building Standards Tables A and B, and such certification is only available subsequent to occupancy of the completed building, the applicant shall provide documentation of such certification within one year of the date of the final building inspection for the project. Failure to provide evidence of this certification within this timeframe, or within an alternate timeframe as determined by the Chief Building Official, will result in a determination that the Covered Project is not in compliance with the requirements of this Chapter and Code Enforcement proceedings may be implemented by the Town.
- g. Conflict with other laws. The provisions of this Chapter are intended to be in addition to and not in conflict with other laws, regulations and ordinances relating to building construction and site development. If any provision of this Chapter conflicts with any duly adopted and valid statutes or regulations of the federal government or the State of California, the federal or state statutes or regulations shall take precedence.

9-19.070 Exemptions.

- a. The provisions of this Chapter shall not apply to the following exemptions; however, none of the exemptions listed shall provide the applicant with relief from the compliance requirements of the 2008 California Building Energy Efficiency Standards of the California Building Code (C.C.R. Title 24, Part 6):

1. Buildings which are temporary (such as construction trailers).
 2. Building area which is not or is not intended to be conditioned space.
 3. Any work required by this Chapter which would impair the historic integrity of any building listed on a local, state or federal register of historic structures, as determined by the Chief Building Official and as regulated by the California Historic Building Code (C.C.R. Title 24, Part 8). In making such a determination, the Chief Building Official may require the submittal of an evaluation by an architectural historian or similar expert.
- b. Hardship or Infeasibility Exemption. If an applicant for a Covered Project believes that circumstances exist that make it a hardship or infeasible to meet the requirements of this Chapter, the applicant may request an exemption as set forth below. In applying for an exemption, the burden shall be on the applicant to show hardship or infeasibility, and to demonstrate clearly the applicant's continued compliance with all requirements of the 2008 California Building Energy Efficiency Standards of the California Building Code (C.C.R. Title 24, Part 6).
1. Application. The applicant shall identify in writing the specific requirements of the Green Building Standards Tables A and B that the project is unable to achieve and the circumstances that make it a hardship or infeasible for the project to comply with this Chapter. Circumstances that constitute hardship or infeasibility shall include, but are not limited to, the following:
 - i. There is a conflict between the provisions of the applicable green building rating system and the California Building Standards Code, other State code provisions, other requirements of this Title or conditions imposed on the project through a previously approved planning application;
 - ii. There is a lack of commercially available green building materials and technologies to comply with the green building rating system;
 - iii. That the cost of achieving compliance is disproportionate to the overall cost of the project;
 - iv. That physical conditions of the project site make it impractical to incorporate necessary green building measures or achieve the requirements of Green Building Standards Tables A and B;
 - v. That compliance with certain requirements would impair the historic integrity of buildings listed on a local, state or federal list or register of historic structures;
 2. Granting of exemption. If the Chief Building Official determines that the granting of the exemption will not cause the building to violate the compliance requirements of the 2008 California Building Energy Efficiency Standards of the California Building Code (C.C.R. Title 24, Part 6) and that it is a hardship or infeasible for the applicant to fully meet the requirements of this Chapter, the Chief Building Official shall determine the maximum feasible threshold of compliance reasonably achievable for the project. In making this determination, the Chief Building Official shall consider whether alternate, practical means of achieving the objectives of this Chapter can be satisfied, such as reducing comparable energy use at an offsite location within the Town. If an exemption is granted, the applicant shall be required to comply with this chapter in all other respects and shall be required to achieve the threshold of compliance determined to be achievable by the Chief Building Official.

3. Denial of exemption. If the Chief Building Official determines that the denial of the exemption will not cause the building to violate the compliance requirements of the 2008 California Building Energy Efficiency Standards of the California Building Code (C.C.R. Title 24, Part 6) or that it is reasonably possible for the applicant to fully meet the requirements of this Chapter, the request shall be denied and the applicant shall be notified of the decision in writing. The project and compliance documentation shall be modified to comply with the Green Building Standards Tables A and B.

9-19.080 Appeal

Any aggrieved applicant or person may appeal a Chief Building Official's determination under this Chapter, including a determination regarding compliance with the provisions of this Chapter and a determination on the approval or denial of an exemption under Section 9-19.070, to the Planning Commission by filing a written appeal with the Town Clerk and paying the necessary filing fee within ten (10) days of the determination.

DIVISION 3: A new Section 9-1.209 (Solar water heater pre-plumbing requirements) is hereby added to the San Anselmo Municipal Code to read as follows:

9-1.209 Solar water heater pre-plumbing requirements

All new residential dwelling units shall include plumbing specifically designed to allow the later installation of a system which utilizes solar energy as a means of heating domestic potable water. Construction specifications to accomplish this requirement shall be adopted by the Chief Building Official. No building permit shall be issued unless the requirements of this section are incorporated into the approved building plans. The provisions of this section can be modified or waived when it can be satisfactorily demonstrated to the Chief Building Official that the requirements are impractical due to shading, building orientation, construction constraints or configuration of the parcel.

DIVISION 4: A new Section 9-1.210 (Photovoltaic pre-wiring requirements) is hereby added to the San Anselmo Municipal Code to read as follows:

9-1.210 Photovoltaic pre-wiring requirements

New non-residential buildings over 5,000 square feet in floor area and all new residential dwelling units shall include electrical conduit specifically designed to allow the later installation of a photovoltaic (PV) system which utilizes solar energy as a means to provide electricity. Construction specifications to accomplish this requirement shall be adopted by the Chief Building Official. No building permit shall be issued unless the requirements of this section are incorporated into the approved building plans. The provisions of this section can be modified or waived when it can be satisfactorily demonstrated to the Chief Building Official that the requirements are impractical due to shading, building orientation, construction constraints or configuration of the parcel.

DIVISION 5: Section 9-1.211 (Amendments made to the California Building Code) of the San Anselmo Municipal Code is hereby amended to add the following amendment:

Section 9-1.211 is amended by adding the following subsection:

9-1.211 Radiant Barriers. When reroofing causes more than 50% of the roof sheathing to be removed, a radiant barrier (reflective insulation) shall be installed in conjunction with the reroofing project.

DIVISION 6: Section 9-1.212 (Amendments to the California Plumbing Code) of the San Anselmo Municipal Code is hereby amended to add the following amendment:

Section 9-1.212 is amended by adding the following subsection:

9-1.212 Hot water piping insulation. When hot water pipes are exposed by removal of wall surfaces insulation shall be installed having a minimum thickness of 1 inch for pipe diameter of 2 inches or less, and having a minimum thickness of 1.5 inches for pipe diameter exceeding 2 inches.

DIVISION 7: This Ordinance shall not be applicable to any development project for which a planning application has been submitted or a complete building permit application has been filed prior to the effective date of the Ordinance.

DIVISION 8: If any section, subsection, sentence, clause or phrase of this Ordinance is for any reason held to be invalid, such decision shall not affect the validity of the remaining portions of this Ordinance. The Town Council hereby declares that it would have adopted the Ordinance and each section, subsection, sentence, clause or phrase thereof, irrespective of the fact that any one or more section, subsections, sentences, clauses or phrases be declared invalid.

DIVISION 9: This Ordinance shall be published once in full before its final passage in a newspaper of general circulation, published and circulated in the Town of San Anselmo, and shall be in full force and effect thirty (30) days after its final passage, and until the Ordinance provisions are approved by both the California Energy Commission and the California Building Standards Commission, whichever comes later.

THE FOREGOING ORDINANCE was introduced at a regular meeting of the San Anselmo Town Council on the 22nd day of June, 2010 and was adopted at a regular meeting on the 24th day of August, 2010 by the following vote:

AYES: Councilmembers: Coleman, Greene, McNerney, Thornton

NOES: Councilmembers: Kroot

ABSENT: Councilmembers: None

Barbara Thornton, Mayor

ATTEST:

Barbara Chambers, Town Clerk

RESOLUTION NO. 3913

A RESOLUTION OF THE TOWN OF SAN ANSELMO TOWN COUNCIL ESTABLISHING GREEN BUILDING STANDARDS

WHEREAS, the San Anselmo Town Council approved an ordinance amending the municipal code including; creating Chapter 19 Green Building Requirements; Amendments to Chapter 1 – Construction Codes of Title 9; Amending Chapter 12.16 (California Plumbing Code) to include a requirement for insulating hot water pipes when exposed during remodeling; Amending Chapter 12.12 (California Building Code) to include a requirement for installation of a radiant barrier during reroofing; and

WHEREAS, the San Anselmo General Plan 1989 promotes energy and resource efficiency in new construction and the 2007-2014 Preliminary Draft The Housing Element encourages the development of Green Building policies and programs for new residential development and existing residential units; and

WHEREAS, the San Anselmo 2005 Greenhouse Gas Emissions Analysis determined that of the four sectors studied (Residential, Commercial/Industrial, Transportation and Waste Generation) the residential sector produced the second highest quantity of emissions (34.2%) behind transportation (52.1%); and

WHEREAS, the California Global Warming Solutions Act of 2006, known as AB 32, established a statewide goal of reducing greenhouse gas emissions to 1990 levels by 2020 and to a level 80% below 1990 levels by 2050, and directs the California Air Resources Board to develop a strategy to achieve such reductions; and

WHEREAS, the California Air Resources Board adopted its Climate Change Scoping Plan on December 12, 2008, which identified the implementation of mandatory green building techniques as achieving 15% of the AB 32 greenhouse gas reduction goal for 2020; and

WHEREAS, the California Public Utilities Commission has adopted a goal of 40% improved energy efficiency in all buildings by 2020; and

WHEREAS, the San Francisco Bay Conservation and Development Commission has indicated that the level of San Francisco Bay has increased by 8 inches over the past century and projects that sea level will rise between 20 and 55 inches by 2100, which will inundate properties currently valued at over \$48 billion dollars cumulatively, will inundate over 700 miles of state and local roadways, and will require the installation of seawalls and levee increases costing over \$1 billion; and

WHEREAS, the United Nations Intergovernmental Panel on Climate Change has warned that failure to address the causes of global climate change within the next few years will result in significantly increasing sea levels and frequency of wildland fires and reduced freshwater resources, which will significantly increase the cost of providing local governmental services and protecting public infrastructure; and

WHEREAS, the United States Environmental Protection Agency (EPA) states that the construction and operation of buildings in the United States collectively account for 39% of total

energy use, 68% of total electricity consumption, 12% of total freshwater consumption, 40% of all raw materials used, and 38% of total carbon dioxide emissions; and

WHEREAS, the total energy consumption by residential dwelling units in Marin County increased from 619 million kWh to 734 million kWh (a 19% increase) from 1995 to 2000; and

WHEREAS, the California Health and Safety Code Sections 18938 and 17958 provide that the California Building Standards Code establishes building codes and standards for all building throughout the State, and Section 17958.5 provides that a local government may establish more stringent building standards if they are reasonably necessary due to local climatic, geological or topographical conditions; and

WHEREAS, California Assembly Bill 210 states that a city is authorized to change or modify green building standards if the California Building Standards Commission determines such changes are reasonably necessary because of local climatic, geological or topographical conditions, and Section 18941.5(2)(b) of the California Health and Safety Code states that, “neither the State Building Standards Law contained in this part, nor the application of building standards contained in this section, shall limit the authority of a city or county to establish more restrictive building standards, including, but not limited to, green building standards, reasonably necessary because of local climatic, geological, or topographical conditions;” and

WHEREAS, the Public Resources Code Section 25402.1(h)(2) states that a local enforcement agency may adopt more restrictive energy standards when they are cost-effective and approved by the California Energy Commission; and

WHEREAS, green building is a practice of design, construction and maintenance techniques that have been demonstrated to have a significant positive effect on energy, water and resource conservation, waste management and pollution generation and on the health and productivity of building occupants over the life of the building; and

WHEREAS, green building benefits are spread throughout the systems and features of a building. Green buildings can include, among other things, the use of certified sustainable wood products, extensive use of high-recycled-content products; recycling of waste that occurs during deconstruction, demolition and construction; orientation and design of a building to reduce the demand on the heating, ventilating, and air conditioning systems; the use of heating, ventilating, and air conditioning systems that provide energy efficiency and improved air quality; enhancement of indoor air quality by selection and use of construction materials that do not emit chemicals that are toxic or irritating to building occupants; the use of water conserving methods and equipment; and installation of alternative energy methods for supplemental energy production; and

WHEREAS, 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 and rating systems for green building practices. The U.S. Green Building Council, developer of the Leadership in Energy and Environmental Design (LEED®) Green Building Rating Systems, has become a leader in promoting and guiding green building, particularly for non-residential structures. Build It Green® has developed the New Home, Existing Home and Multi-Family Green Building Guidelines and associated

GreenPoints Calculators, which have been adopted for use in approximately 70 Bay Area jurisdictions; and

WHEREAS, it is estimated that construction of buildings in accordance with the GreenPoint Rated and LEED® rating systems results in average energy savings of approximately 20% compared with buildings constructed in accordance with current minimum standards of the state building code; and

WHEREAS, representatives of all municipalities within Marin County and of the county government participated in a collaborative effort known as the Marin Green BERST (Green Building, Energy Retrofit and Solar Transformation) Task Force, held meetings on June 11, July 13, September 29 and 30, and November 19, 2009 and endorsed a model green building ordinance recommended by a Technical Advisory Committee comprised of over 50 experts in the fields of architecture, building construction, green building, building energy systems, energy conservation, water conservation, building inspection, planning and real estate over the course of 11 meetings; and

WHEREAS, study sessions on the proposed model green building regulations were held by the San Anselmo Town Council on June 22, 2010 and by the San Anselmo Planning Commission on March 1, 2010, March 15, 2010, May 3, 2010 and a joint public workshop with the Council and the Commission was held on April 12, 2010; and

WHEREAS, on May 3, 2010 the San Anselmo Planning Commission conducted a public hearing and recommended adoption of the proposed Municipal Code amendments to the Town Council;

NOW THEREFORE, BE IT RESOLVED that the Town Council of the Town of San Anselmo adopts the following Standards for Compliance and Incentives for administration of Green Building regulations contained in Chapter 19 of the San Anselmo Municipal Code:

Standards for Compliance

All covered projects shall be constructed using the green building standards listed on Table A for residential projects and on Table B for non-residential projects.

TABLE A
GREEN BUILDING STANDARDS FOR
RESIDENTIAL NEW CONSTRUCTION AND REMODELS

Project Type Residential New (RN) Residential Remodel (RR)	Covered Project	Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24	Verification
<u>Single-Family or Two-Family Residential: New Construction</u>					
RN1	500-2,499 sq. ft. (per unit)	GPR ³ New Home	75 points	15%	Requires Independent Third Party Green Point Rater and Approved Certification from Build It Green [®]
RN2	2,500-3,999 sq. ft. (per unit)	GPR ³ New Home	100 points	15%	Same as above (RN1)
RN3	4,000-5,499 sq. ft. (per unit)	GPR ³ New Home	125 points	20%	Same as above (RN1)
RN4	5,500-6,999 sq. ft. (per unit)	GPR ³ New Home	150 points	30%	Same as above (RN1)
RN5	7,000+ sq. ft. (per unit)	GPR ³ New Home	200 points	Net zero energy	Same as above (RN1)
<u>Multi-Family Residential: New Construction</u>					
RN6	Less than 1,000 sq. ft. average unit size	GPR ³ Multi-Family	60 points	15%	Same as above (RN1)
RN7	1,000+ sq. ft. average unit size	GPR ³ Multi-Family	75 points	15%	Same as above (RN1)

TABLE A
GREEN BUILDING STANDARDS FOR
RESIDENTIAL NEW CONSTRUCTION AND REMODELS (continued)

Project Type Residential New (RN) Residential Remodel (RR)	Covered Project	Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24	Verification
Single-Family or Two-Family Residential: Remodels (including additions to existing buildings)					
RR1	Less than \$50,000 valuation	n/a	<p>On plans submitted for building permit, indicate at least two (2) of the following measures, which shall be installed prior to final inspection:</p> <ul style="list-style-type: none"> a. Install insulation on exposed hot water pipes in unconditioned areas(G1) ²; b. Install radiant barrier when reroofing and removing/replacing more than 50% of the sheathing(J2); c. Install R-8 insulation wrap on heating and/or cooling ducts(H6); d. Install duct work under attic insulation(H6); e. Install R-36 or greater insulation in attic space of project area(J2); f. Install blow-in insulation in existing walls(J2); g. Install low-e or low-e² windows; h. Install one or more Energy Star ® appliances(M1-3); i. Install one or more low flow water fixtures(G3); j. Install one or more bathroom fans with a timer or humidistat(H9); k. Install a minimum of 20% recycled flyash and/or slag content cement in foundation work (B1); l. Install vapor barrier or foundation drainage system to control crawl space moisture (B3); m. Install engineered lumber(D2); n. Install FSC Certified Lumber(D3); 	NA	Town of San Anselmo Plan Check

			<ul style="list-style-type: none"> o. Install a high efficiency furnace(H3); p. Install at least one Carbon Monoxide Alarm(H12); q. Apply low (<50 g/L) or no (<5 g/L) VOC (Volatile Organic Compounds) in paints and stains for interior walls and ceilings(K2); r. Install environmentally preferable materials for interior finishes (i.e. cabinets, shelving, doors, etc.)(K6) 		
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**TABLE A
GREEN BUILDING STANDARDS FOR
RESIDENTIAL NEW CONSTRUCTION AND REMODELS (continued)**

Project Type Residential New (RN) Residential Remodel (RR)	Covered Project	Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24	Verification
Single-Family or Two-Family Residential: Remodels (including additions to existing buildings)					
RR2	\$50,000-\$99,999 valuation or less than 500 sq. ft. ¹	GPR ³ Existing Home	1. Submit a completed GreenPoint Rated Existing Home Checklist and; 2. Submit a completed HERSII or Building Performance Institute home performance audit and; 3. On plans submitted for building permit, indicate at least five (5) of the following measures, which shall be installed prior to final inspection: <ul style="list-style-type: none"> a. Install Insulation on exposed hot water pipes in unconditioned areas(G1) ²; b. Install radiant barrier when reroofing and removing/replacing more than 50% of the sheathing(J2); c. Install R-8 insulation wrap on heating and/or cooling ducts(H6); d. Install duct work under attic insulation(H6); e. Install R-36 or greater insulation in attic space of project area(J2); f. Install blow-in insulation in existing walls(J2); g. Install low-e or low-e² windows; h. Install one or more Energy Star ® appliances(M1-3); i. Install one or more low flow water fixtures(G3); j. Install one or more bathroom fans with a timer or humidistat(H9); k. Install a minimum of 20% recycled flyash and/or slag content cement in foundation work (B1); l. Install vapor barrier or foundation drainage system to control crawl space moisture (B3); m. Install engineered lumber(D2); n. Install FSC Certified Lumber(D3); 	NA	Town of San Anselmo Staff Plan Check

			<ul style="list-style-type: none"> o. Install a high efficiency furnace(H3); p. Install at least one Carbon Monoxide Alarm(H12); q. Apply low (<50 g/L) or no (<5 g/L) VOC (Volatile Organic Compounds) in paints and stains for interior walls and ceilings(K2); r. Install environmentally preferable materials for interior finishes (i.e. cabinets, shelving, doors, etc.)(K6) 		
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**TABLE A
GREEN BUILDING STANDARDS FOR
RESIDENTIAL NEW CONSTRUCTION AND REMODELS (continued)**

Project Type Residential New (RN) Residential Remodel (RR)	Covered Project	Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24	Verification
Single-Family or Two-Family Residential: Remodels (including additions to existing buildings)					
RR3	\$100,000-\$149,999 valuation or 500-749 sq. ft. ¹	GPR Existing Home – Elements	25 points	NA	Requires, at a minimum, a licensed contractor or licensed architect to verify the minimum number of compliance threshold points. Project does not require certification with Build It Green®.
RR4	\$150,000-\$299,999 valuation or 750-999 sq. ft. ¹	GPR Existing Home – Elements	35 points	NA	Same as above (RR3)
RR5	\$300,000+ valuation or 1,000+ sq. ft. ¹	GPR Existing Home – Whole House	50 points + 20% improvement in HERSII or Building Performance Institute home performance audit results or a minimum HERSII score of 100	NA	Requires Independent Third Party Green Point Rater and Approved Certification from Build It Green® Requires, at a minimum, a licensed contractor or licensed architect with a current GreenPoint Rater®. Certification to verify the minimum number of compliance threshold points. Project does not require certification with Build It Green®. Applicant may choose to use an independent third party GreenPoint Rater® and receive certification through Build It Green®.

¹ Project valuation will be the primary determinate in establishing the Minimum Compliance Threshold for the project; however, when the valuation is uncertain or in the opinion of the building official does not accurately reflect the project scope then the square footage range of the area being modified will be used to determine the Minimum Compliance Threshold for the project.

² The letter and number at the end of each measure (i.e. (G1)) refers to the section in the Build It Green® Existing Home Checklist.

³ GPR - Build It Green GreenPoint Rated®

**TABLE B: GREEN BUILDING STANDARDS FOR
COMMERCIAL NEW CONSTRUCTION AND RENOVATIONS**

Project Type	Covered Project	Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24	Verification
Commercial New (CN) Commercial Renovation (CR)					
Commercial New Construction (including additions to existing buildings):					
CN1	2,000-4,999 sq. ft. of new floor area	LEED ^{®1} New Construction or Core & Shell	Checklist submittal + compliance with prerequisites		LEED [®] AP ² with GreenPoint Rater or BPIC ⁴
CN2	5,000-49,999 sq. ft. of new floor area	Same as Above (CN1)	LEED ^{®1} Silver	15%	LEED [®] AP ² with GreenPoint Rater or BPIC ⁴
CN3	50,000+ sq. ft. of new floor area	Same as Above (CN1)	LEED ^{®1} Gold	15%	United States Green Building Counsel Certified
Commercial Renovations:					
CR1	Less than \$250,000 valuation or 500-4,999 sq. ft. ³	LEED ^{®1} Commercial Interiors or Operations & Maintenance	Voluntary compliance with the following prerequisites: A) WE P1 (Water Efficiency–Baseline Requirements only) B) EA P3 (Fundamental Refrigerant Management) for renovations of ≥50% of the building interior area C) EA C1.3 (Optimize Energy Performance – HVAC) for renovations of ≥50% of the building interior area		None
CR2	\$250,000 to \$5 million valuation or 5,000-24,999sq.ft. ³	Same as Above (CR1)	Same as above, but mandatory instead of voluntary.		Town of San Anselmo Plan Check
CR3	More than \$5 million valuation or 25,000+ sq.ft. ³	Same as Above (CR1)	LEED ^{®1} Silver		LEED [®] AP ² with GreenPoint Rater or BPIC ⁴

¹ LEED - Leadership in Energy and Environmental Design

² LEED AP Leadership in Energy and Environmental Design Accredited Professional

³ Project valuations will be the primary determinate in establishing the Minimum Compliance Threshold for the project; however, when the valuation is uncertain or in the opinion of the building official does not accurately reflect the project scope then the square footage range of the area being modified will be used to determine the Minimum Compliance Threshold for the project.

⁴ BPIC – Building Performance Institute Certification

SOLAR ELECTRIC SYSTEMS

A solar photovoltaic (PV) energy system may be used to meet the Energy Budget Below CA Title 24 Part 6 requirements of this resolution which exceed 15%. To qualify for energy credits, the PV energy system must be capable of generating electricity from sunlight, supply the electricity directly to the building and the system is connected, through a reversible meter, to the utility grid. The installation of any qualifying PV energy system must meet all installation criteria contained in the California Energy Commission's Guidebook "Eligibility Criteria and Conditions for Incentives for Solar Energy Systems." The methodology used to calculate the energy equivalent to the PV credit shall be the CECPV Calculator, using the most recent version, provided by the California Energy Commission.

EXCEPTIONS

The following shall not be included as Covered Projects:

1. Buildings which are temporary.
2. Building area which is not or is not intended to be conditioned space.
3. Any requirement which would impair the historic integrity of any building listed on a local, state or federal register of historic structures.

The following shall not be included in project valuation:

1. Improvements primarily intended for seismic upgrades or required disabled access.
2. Installation of renewable energy systems.

The foregoing Resolution No. 3913 was approved at a Regular Meeting of the Town Council of the Town of San Anselmo, California, held on the 22nd day of June, 2010 and ordered passed to print by the following vote, to wit:

AYES: Councilmembers: Coleman, Greene, McInerney, Thornton

NOES: Councilmembers: Kroot

ABSENT: Councilmembers: None

Barbara Thornton, Mayor

ATTEST:

Debra Stutsman, Town Clerk

Appendix:

Marin County Energy Cost-Effectiveness Study

December 10, 2009

Codes and Standards Title 24 Energy-Efficient Local Ordinances

Title: Marin County Green Building Ordinance Energy Cost-Effectiveness Study

Prepared for:

Bob Brown
City of San Rafael
Community Development Director

Pat Eilert
Codes and Standards Program
Pacific Gas and Electric Company

Omar Pena
Marin County Community
Development Agency

Maril Pitcock
Government Partnership Program
Pacific Gas and Electric Company

Prepared by:
Michael Gabel
Gabel Associates, LLC

Last Modified: December 10, 2009



Marin County Green Building Ordinance
Energy Cost-Effectiveness Study

December 10, 2009

Report prepared for:

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San Rafael, CA 94901
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Report on behalf of:

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LEGAL NOTICE

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1.0 Executive Summary

This report presents the results of Gabel Associates' research and review of the feasibility and energy cost-effectiveness of building permit applicants exceeding the 2008 Building Energy Efficiency Standards to meet the minimum energy-efficiency requirements of the proposed Marin County Ordinance for local energy efficiency standards. The proposed ordinance states that residential new construction projects must meet the overall requirements summarized in the Resolution printed on the following pages.

The study contained in this report shall be included in Marin County's application to the California Energy Commission (CEC) which must meet the requirements specified in Section 10-106 of the California Code of Regulations, Title 24, Part 1, **LOCALLY ADOPTED ENERGY STANDARDS**. The proposed Ordinance shall be enforceable after the CEC has reviewed and approved the local energy standards as meeting all requirements of Section 10-106; and the Ordinance has been adopted by the County and filed with the Building Standards Commission.

The 2008 Building Energy Efficiency Standards, scheduled to take effect on January 1, 2010, are the baseline used to calculate the cost-effectiveness of the proposed Ordinance.

MARIN COUNTY MODEL GREEN BUILDING ORDINANCE (Draft)

TABLE A: GREEN BUILDING STANDARDS FOR COMPLIANCE FOR RESIDENTIAL CONSTRUCTION AND RENOVATION

Covered Project	Green Building Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24 Part 6	Verification
Single-Family or Two-Family Residential: New construction				
500-2,499 sq. ft.	GPR New Home	75 points	15%	Green Point Rated ¹
2,500-3,999 sq. ft.	GPR New Home	100 points	15%	Green Point Rated ¹
4,000-5,499 sq. ft.	GPR New Home	125 points	20%	Green Point Rated ¹
5,500-6,999 sq. ft.	GPR New Home	150 points	30%	Green Point Rated ¹
7,000+ sq. ft.	GPR New Home	200 points	Net zero energy	Green Point Rated ¹
Single-Family or Two-Family Residential: Renovations (including additions to existing buildings)				
Less than \$50,000 valuation	n/a	Insulate exposed hot water pipes; Install radiant barrier when reroofing and removing sheathing		City building inspector
Less than 500 sq. ft. or \$50,000-\$99,999 valuation ³	GPR Existing Home	Checklist submittal and completion of a HERSII or BPI home performance audit		City plan check
500-749 sq. ft. or \$100,000-\$149,999 valuation ³	GPR Existing Home – Elements	25 points		GreenPoint Rater ²
750-999 sq. ft. or \$150,000-\$299,999 valuation ³	GPR Existing Home – Elements	35 points		GreenPoint Rater ²
1,000+ sq. ft. or \$300,000+ valuation ³	GPR Existing Home – Whole House	50 points + 20% improvement in HERSII or BPI home performance audit results or a HERSII score 100 or better		GreenPoint Rated ²
Multi-Family Residential: New Construction				
Less than 1,000 sq. ft. average unit size	GPR Multi-Family	60 points	15%	GreenPoint Rated ¹
1,000+ sq. ft. average unit size	GPR Multi-Family	75 points	15%	GreenPoint Rated ¹

¹ Project verification by GreenPoint Rater and certification by Build It Green

² Project verification by GreenPoint Rater

³ Project valuation will be the primary determinate in establishing the Minimum Compliance Threshold for the project, with use of project size range when valuation is uncertain or in the opinion of the building official does not accurately reflect the project scope.

MARIN COUNTY MODEL GREEN BUILDING ORDINANCE (Draft)

TABLE B: GREEN BUILDING STANDARDS FOR COMPLIANCE FOR NONRESIDENTIAL CONSTRUCTION AND RENOVATION

Covered Project	Green Building Rating System	Minimum Compliance Threshold	Energy Budget Below CA Title 24 Part 6	Verification
New construction (including additions to existing buildings)				
2,000-4,999 sq. ft.	LEED® New Construction or Core & Shell	Checklist submittal + compliance with Prerequisites		LEED® AP with additional GreenPoint Rater or BPI Certification
5,000-49,999 sq. ft.	LEED® New Construction or Core & Shell	LEED® Silver	15%	LEED® AP with additional GreenPoint Rater or BPI Certification
50,000+ sq. ft.	LEED® New Construction or Core & Shell	LEED® Gold	15%	GBCI Certified
Renovations				
500-4,999 sq. ft. or less than \$500,000 valuation ³	LEED® Commercial Interiors or Operations & Maintenance	Voluntary compliance with the following Prerequisites: WE P1 (Water Efficiency – Baseline Requirements only) EA P3 (Fundamental Refrigerant Management) for renovations of ≥50% of the building interior area Voluntary compliance with the following Credits: EA C1.3 (Optimize Energy Performance – HVAC) for renovations of ≥50% of the building interior area		None
5,000-24,999 sq. ft. or \$500,000 - \$5 million valuation ³	LEED® Commercial Interiors or Operations & Maintenance	Same as above, but Required.		City building inspector
25,000+ sq. ft. or greater than \$5 million valuation ³	LEED® Commercial Interiors or Operations & Maintenance	LEED® Silver		LEED® AP with additional GreenPoint Rater or BPI Certification

³ Project valuation will be the primary determinate in establishing the Minimum Compliance Threshold for the project, with use of project size range when valuation is uncertain or in the opinion of the building official does not accurately reflect the project scope.

SOLAR ELECTRIC SYSTEMS

A solar photovoltaic (PV) energy system may be used to meet the Energy Budget Below CA Title 24 Part 6 requirements of this resolution which exceed 15%. To qualify for energy credits, the PV energy system must be capable of generating electricity from sunlight, supply the electricity directly to the building, and the system is connected, through a reversible meter, to the utility grid. The installation of any qualifying PV energy system must meet all installation criteria contained in the California Energy Commission's Guidebook "Eligibility Criteria and Conditions for Incentives for Solar Energy Systems." The methodology used to calculate the energy equivalent to the PV credit shall be the CECPV Calculator, using the most recent version, provided by the California Energy Commission.

INCENTIVES [optional]

A City Green Building emblem for construction signage shall be provided for all residential and non-residential projects that obtain a GreenPoint or LEED rating.

The following incentives shall be provided for residential projects that achieve at least 100 GreenPoints or non-residential projects that achieve at least a LEED® Gold rating:

1. Expedited building permit plan check (typically 2-week turnaround)
2. Reimbursement for the cost of the GreenPoint Rater services (residential projects only, up to a maximum of \$1,000)
3. Provision of a bronze plaque for building mounting, identifying the project as a green building

EXCEPTIONS [optional]

The following shall not be included as Covered Projects:

1. Second dwelling units,
2. Buildings which are temporary,
3. Building area which is not or is not intended to be conditioned space, and
4. Any requirement which would impair the historic integrity of any building listed on a local, state or federal register of historic structures.

The following shall not be included in project valuation:

1. Improvements primarily intended for seismic upgrades or required disabled access,
2. Building replacement due to catastrophic loss due to flood or earthquake damage, and
3. Installation of renewable energy systems.

2.0 Impacts of the New Ordinance

The energy performance impacts of the Ordinance have been evaluated using several prototypical designs which collectively reflect a broad range of building types, including:

- Single family house: 2-story 1,582 sf (CZ3)
- Single family house: 2-story 2,025 sf (CZ2, CZ3)
- Single family house: 2-story 2,682 sf (CZ2)
- Single family house: 2-story 5,000 sf (CZ2, CZ3): Exceeding Title 24 by 20%
- Single family house: 2-story 6,500 sf (CZ2, CZ3): Exceeding Title 24 by 30%
- Single family house: 2-story 7,500 sf (CZ2, CZ3): Net Energy Zero TDV
- Low-rise Multi-family building, 8 dwelling units: 2-story 8,442 sf (CZ2, CZ3)
- High-rise Multi-family building, 40 dwelling units: 4-story 36,800 sf (CZ2, CZ3)
- Nonresidential office building: 2-story, 21,160 sf (CZ2, CZ3)
- Nonresidential office building: 5-story, 52,900 sf (CZ2, CZ3)

The methodology used in the case studies is based on a design process for buildings that meet or exceed the energy standards, and includes the following:

- (a) Each prototype building design is tested for compliance with the 2008 Standards, and the mix of energy measures are adjusted using common construction options so the building first just meets the Standards. The set of energy measures chosen represent a reasonable combination which reflects how designers, builders and developers are likely to achieve a specified level of performance using a relatively low first incremental (additional) cost
- (b) Starting with that set of measures which is minimally compliant with the 2008 Standards, various energy measures are upgraded so that the building just meets the minimum energy performance required by the proposed Ordinance (e.g., 15% better than 2008 Title 24). The design choices by the consultant authoring this study are based on many years of experience with architects, builders, mechanical engineers; and general knowledge of the relative acceptance and preferences of many measures, as well as their incremental costs. This approach tends to reflect how building energy performance is typically evaluated for code compliance and how it's used to select design energy efficiency measures. Note that lowest simple payback with respect to building site energy is not always the primary focus of selecting measures; but rather the requisite reduction of Title 24 Time Dependent Valuation(TDV) energy at a reasonably low incremental cost consistent with other non-monetary but important design considerations.

- (c) A minimum and maximum range of incremental costs of added energy efficiency measures is established by a variety of research means. A construction cost estimator, Building Advisory LLC, was contracted to conduct research to obtain current measure cost information for many energy measures; and Gabel Associates performed its own additional research to establish first cost data. Site energy in kWh and therms, is calculated from the Title 24 simulation results to establish the annual energy savings, energy cost savings and CO2-equivalent reductions in greenhouse gases.

2.1 Single Family Homes

CLIMATE ZONE 2

The following energy design descriptions of single family building prototypes just meet the 2008 Title 24 Building Energy Efficiency Standards in **Climate Zone 2**:

CZ2: Single Family House 2,025 square feet, 2-story, 20.2% glazing/floor area ratio

Energy Efficiency Measures
R-38 Roof w/ Radiant Barrier
R-13 Walls
R-0 Slab on Grade
R-19 Raised Floor over Garage/Open at 2nd Floor
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
Furnace: 80% AFUE
Air Conditioner: 13 SEER
R-6 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
50 Gallon Gas Water Heater: EF=0.60

CZ2: Single Family House 2,682 square feet, 2-story, 21.1% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
Furnace: 80% AFUE
Air Conditioner: 13 SEER
R-6 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
50 Gallon Gas Water Heaters: EF=0.60

CZ2: Single Family House 5,000 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-38 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(2) Furnaces: 80% AFUE
(2) Air Conditioners: 13 SEER, 11 EER (HERS)
(2) Air Conditioners: Refrig. Charge (HERS)
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(2) 50 Gallon Gas Water Heaters: EF=0.60

CZ2: Single Family House 6,500 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Quality Insulation Installation (HERS)
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(3) Furnaces: 80% AFUE
(3) Air Conditioners: 13 SEER, 11 EER (HERS)
(3) Air Conditioners: Refrig. Charge (HERS)
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(3) 50 Gallon Gas Water Heaters: EF=0.60

CZ2: Single Family House 7,500 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Quality Insulation Installation (HERS)
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(3) Furnaces: 80% AFUE
(3) Air Conditioners: 13 SEER, 11 EER (HERS)
(3) Air Conditioners: Refrig. Charge (HERS)
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(3) 50 Gallon Gas Water Heaters: EF=0.60

Climate Zone 2 Energy Efficiency Measures Needed to Meet the Ordinance

The following tables list the energy features and/or equipment included in the Title 24 base design, the efficient measure options, and an estimate of the incremental cost for each measure included **to improve the building performance to use 15% less TDV energy than the corresponding Title 24 base case design** (except homes equal or greater than 4,000 square feet as indicated).

In any actual project, the designer, builder or owner selects which measures will be included to meet the proposed Ordinance requirements. There are a number of factors in choosing the final mix of energy measures including first cost, aesthetics, maintenance and replacement considerations. The analysis includes at least two different options to meet the proposed Ordinance requirements for each prototypical design.

Incremental Cost Estimate to Exceed Title 24 by 15%

Single Family Prototype: 2,025 SF, Option 1

2025 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-19 Walls (from R-13): 2,550 sf @ \$0.55 to \$0.85/sf	Upgrade	\$ 1,403	\$ 2,168	\$ 1,786
R-0 Slab on Grade	-	\$ -	\$ -	\$ -
R-19 Raised Floor over Garage/Open at 2nd Floor	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
Furnace: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioner: 13 SEER, 11 EER (HERS)	Upgrade	\$ 25	\$ 75	\$ 50
Air Conditioner: Refrig. Charge (HERS)	Upgrade	\$ 150	\$ 200	\$ 175
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
50 Gallon Gas Water Heater: EF=0.60	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,578	\$ 2,443	\$ 2,011
Total Incremental Cost per Square Foot:		\$ 0.78	\$ 1.21	\$ 0.99

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 2,025 SF, Option 2

2025 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,550 sf @ \$0.70 to \$0.95/sf	Upgrade	\$ 1,785	\$ 2,423	\$ 2,104
R-0 Slab on Grade	-	\$ -	\$ -	\$ -
R-19 Raised Floor over Garage/Open at 2nd Floor	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
Furnace: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioning: 13 SEER	-	\$ -	\$ -	\$ -
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
50 Gallon Gas Water Heater: EF=0.60	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,785	\$ 2,423	\$ 2,104
Total Incremental Cost per Square Foot:		\$ 0.88	\$ 1.20	\$ 1.04

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 2,682 SF, Option 1

2682 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-19 Walls (from R-13): 2,638 sf @ \$0.55 to \$0.85/sf	Upgrade	\$ 1,451	\$ 2,242	\$ 1,847
R-19 Floor	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
Furnace: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioner: 13 SEER, 11 EER (HERS)	Upgrade	\$ 25	\$ 75	\$ 50
Air Conditioner: Refrig. Charge (HERS)	Upgrade	\$ 150	\$ 200	\$ 175
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
50 Gallon Gas Water Heater: EF=0.60	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,626	\$ 2,517	\$ 2,072
Total Incremental Cost per Square Foot:		\$ 0.61	\$ 0.94	\$ 0.77

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 2,682 SF, Option 2

2682 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30): 1,402sf @ 0.40 to 0.60/sf	Upgrade	\$ 561	\$ 841	\$ 701
R-15 Walls (from R-13): 2,638 sf @ \$0.12 to \$0.20/sf	Upgrade	\$ 317	\$ 528	\$ 422
R-19 Floor	-	\$ -	\$ -	\$ -
Quality Insulation Installation (HERS)	Upgrade	\$ 450	\$ 600	\$ 525
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
Furnace: 90% AFUE (from 80% AFUE)	Upgrade	\$ 500	\$ 1,000	\$ 750
Air Conditioner: 13 SEER	-	\$ -	\$ -	\$ -
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
50 Gallon Gas Water Heater: EF=0.62 (from EF=0.60)	Upgrade	\$ 100	\$ 200	\$ 150
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,928	\$ 3,169	\$ 2,548
Total Incremental Cost per Square Foot:		\$ 0.72	\$ 1.18	\$ 0.95

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 2,682 SF, Option 3

2682 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,638 sf @ \$0.70 to \$0.95/sf	Upgrade	\$ 1,847	\$ 2,506	\$ 2,177
R-19 Floor	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
Furnace: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioner: 13 SEER	-	\$ -	\$ -	\$ -
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
50 Gallon Gas Water Heater: EF=0.62 (from EF=0.60)	Upgrade	\$ 100	\$ 200	\$ 150
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,947	\$ 2,706	\$ 2,327
Total Incremental Cost per Square Foot:		\$ 0.73	\$ 1.01	\$ 0.87

For homes $\geq 4,000$ square feet to 5,499 square feet, the following tables list the energy measures needed to improve a 5,000 square foot home so that it uses at least 20% less TDV energy than the corresponding Title 24 base case design.

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 5,000 SF, Option 1

5000 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,616 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,177	\$ 1,831	\$ 1,504
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,100 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 1,540	\$ 1,925	\$ 1,733
(2) Furnace: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,000	\$ 2,400	\$ 1,700
(2) Air Conditioners: 13 SEER, 11 EER (HERS)	-	\$ -	\$ -	\$ -
(2) Air Conditioner: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(2) 50 Gallon Gas Water Heaters: EF=0.62 (from EF=0.60)	Upgrade	\$ 200	\$ 400	\$ 300
Total Incremental Cost of Energy Efficiency Measures:		\$ 3,917	\$ 6,556	\$ 5,237
Total Incremental Cost per Square Foot:		\$ 0.78	\$ 1.31	\$ 1.05

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 5,000 SF, Option 2

5000 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,616 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,177	\$ 1,831	\$ 1,504
R-38 Raised Floor (from R-19): 3,000 sf @ \$0.30 to \$0.45	Upgrade	\$ 900	\$ 1,350	\$ 1,125
Quality Insulation Installation (HERS)	Upgrade	\$ 450	\$ 600	\$ 525
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,100 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 1,540	\$ 1,925	\$ 1,733
(2) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
(2) Air Conditioners: 13 SEER, 11 EER (HERS)	-	\$ -	\$ -	\$ -
(2) Air Conditioner: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-6 Attic Ducts (from R-8)	Downgrade	\$ (650)	\$ (450)	\$ (550)
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(2) 50 Gallon Gas Water Heaters: EF=0.62 (from EF=0.60)	Upgrade	\$ 200	\$ 400	\$ 300
Total Incremental Cost of Energy Efficiency Measures:		\$ 3,617	\$ 5,656	\$ 4,637
Total Incremental Cost per Square Foot:		\$ 0.72	\$ 1.13	\$ 0.93

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 5,000 SF, Option 3

5000 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,616 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,177	\$ 1,831	\$ 1,504
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,100 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 1,540	\$ 1,925	\$ 1,733
(2) Furnace: 80% AFUE	-	\$ -	\$ -	\$ -
(2) Air Conditioners: 13 SEER, 11 EER (HERS)	-	\$ -	\$ -	\$ -
(2) Air Conditioner: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-6 Attic Ducts (from R-8)	Downgrade	\$ (650)	\$ (450)	\$ (550)
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(2) Instantaneous Gas Water Heater: RE=0.80 (from (2) 50 Gal Gas: EF=0.62)	Upgrade	\$ 1,800	\$ 3,000	\$ 2,400
Total Incremental Cost of Energy Efficiency Measures:		\$ 3,867	\$ 6,306	\$ 5,087
Total Incremental Cost per Square Foot:		\$ 0.77	\$ 1.26	\$ 1.02

For homes \geq 5,500 square feet to 6,999 square feet, the following tables list the energy measures needed to improve a 6,500 square foot home so that it uses at least 30% less TDV energy than the corresponding Title 24 base case design.

Incremental Cost Estimate to Exceed Title 24 by 30%
Single Family Prototype: 6,500 SF, Option 1

6500 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 3,900 sf @ 0.15 to 0.20/sf	Upgrade	\$ 585	\$ 780	\$ 683
R-21 Walls (from R-13): 2,808 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,264	\$ 1,966	\$ 1,615
R-30 Raised Floor (from R-19): 3,900 sf @ \$0.25 to \$0.35	Upgrade	\$ 975	\$ 1,365	\$ 1,170
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,430 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 2,002	\$ 2,503	\$ 2,252
(3) Furnaces: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,500	\$ 3,600	\$ 2,550
(3) Air Conditioners: 13 SEER, 11 EER (HERS)	-	\$ -	\$ -	\$ -
(3) Air Conditioner: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-6 Attic Ducts (from R-8)	Downgrade	\$ (975)	\$ (675)	\$ (825)
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.80 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,000	\$ 5,100	\$ 4,050
Pipe Insulation	Upgrade	\$ 450	\$ 600	\$ 525
Total Incremental Cost of Energy Efficiency Measures:		\$ 8,801	\$ 15,238	\$ 12,019
Total Incremental Cost per Square Foot:		\$ 1.35	\$ 2.34	\$ 1.85

Incremental Cost Estimate to Exceed Title 24 by 30%
Single Family Prototype: 6,500 SF, Option 2

6500 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 3,900 sf @ 0.15 to 0.20/sf	Upgrade	\$ 585	\$ 780	\$ 683
R-19 Walls (from R-13): 2,808 sf @ \$0.31 to \$0.54/sf	Upgrade	\$ 870	\$ 1,516	\$ 1,193
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,430 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 2,002	\$ 2,503	\$ 2,252
(3) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
(3) Air Conditioners: 13 SEER, 11 EER (HERS)	-	\$ -	\$ -	\$ -
(3) Air Conditioner: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-6 Attic Ducts (from R-8)	Downgrade	\$ (975)	\$ (675)	\$ (825)
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) 50 Gallon Gas Water Heaters: EF=0.62 (from EF=0.60)	Upgrade	\$ 300	\$ 600	\$ 450
Solar Photovoltaic (PV) System: 1 KW	Upgrade	\$ 4,500	\$ 6,500	\$ 5,500
Total Incremental Cost of Energy Efficiency Measures:		\$ 7,282	\$ 11,224	\$ 9,253
Total Incremental Cost per Square Foot:		\$ 1.12	\$ 1.73	\$ 1.42

For homes $\geq 7,000$ square feet the following tables list the energy measures needed to improve a 7,500 square foot home so that its net Title 24 TDV energy use is zero (i.e. Net Zero TDV Energy) as compared with the corresponding Title 24 base case design. To achieve this level of performance, a solar PV system is added to the home sized to just meet the Net Zero Energy threshold by rounding up to the next largest whole KW of nominal solar PV capacity.

Incremental Cost Estimate of Net Zero TDV Energy
Single Family Prototype: 7,500 SF, Option 1

7500 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 4,500 sf @ 0.15 to 0.20/sf	Upgrade	\$ 675	\$ 900	\$ 788
R-21 Walls (from R-13): 2,904 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,307	\$ 2,033	\$ 1,670
R-38 Raised Floor (from R-19): 4,500 sf @ \$0.30 to \$0.45	Upgrade	\$ 1,350	\$ 2,025	\$ 1,688
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,650 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 2,310	\$ 2,888	\$ 2,599
(3) Furnaces: 94% AFUE (from 80% AFUE)	Upgrade	\$ 2,700	\$ 5,400	\$ 4,050
(3) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	\$ 1,500	\$ 4,500	\$ 3,000
(3) Air Conditioners: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.82 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,600	\$ 6,000	\$ 4,800
Pipe Insulation	Upgrade	\$ 450	\$ 600	\$ 525
Solar Photovoltaic (PV) System: 4 KW	Upgrade	\$ 18,000	\$ 26,000	\$ 22,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 31,892	\$ 50,345	\$ 41,119
Total Incremental Cost per Square Foot:		\$ 4.25	\$ 6.71	\$ 5.48

**Incremental Cost Estimate of Net Zero TDV Energy
Single Family Prototype: 7,500 SF, Option 1**

7500 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 4,500 sf @ 0.15 to 0.20/sf	Upgrade	\$ 675	\$ 900	\$ 788
R-19 Walls (from R-13): 2,904 sf @ \$0.31 to \$0.54/sf	Upgrade	\$ 900	\$ 1,568	\$ 1,234
R-30 Raised Floor (from R-19): 4,500 sf @ \$0.25 to \$0.35	Upgrade	\$ 1,125	\$ 1,575	\$ 1,350
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Housewrap: 2,904 sf @ \$0.50 to \$0.75/sf	Upgrade	\$ 1,452	\$ 2,178	\$ 1,815
Super Low E Vinyl Windows, U=0.36, SHGC=0.23 (from Low E2, U=0.36, SHGC=0.23): 1,650 sf @ \$1.40 - \$1.75 / sf	Upgrade	\$ 2,310	\$ 2,888	\$ 2,599
(3) Furnaces: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,500	\$ 3,600	\$ 2,550
(3) Air Conditioners: 15 SEER, 12 EER (HERS) (from 13 SEER, 11 EER)	Upgrade	\$ 1,500	\$ 4,500	\$ 3,000
(3) Air Conditioners: Refrig. Charge (HERS)	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.82 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,600	\$ 6,000	\$ 4,800
Pipe Insulation	Upgrade	\$ 450	\$ 600	\$ 525
Solar Photovoltaic (PV) System: 4 KW	Upgrade	\$ 18,000	\$ 26,000	\$ 22,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 31,512	\$ 49,809	\$ 40,660
Total Incremental Cost per Square Foot:		\$ 4.20	\$ 6.64	\$ 5.42

CLIMATE ZONE 3

The following energy design descriptions of single family building prototypes just meet the 2008 Title 24 Building Energy Efficiency Standards in **Climate Zone 3**:

CZ3: Single Family House 1,582 square feet, 2-story, 14.3% glazing/floor area ratio

Energy Efficiency Measures to Meet Title 24
R-38 Roof w/ Radiant Barrier R-13 Walls R-19 Raised Floor Low E2 Vinyl Windows, U=0.36, SHGC=0.30; no overhangs Furnace: 80% AFUE; No Cooling R-6 Attic Ducts 50 gallon Gas DHW: EF=0.58; no extra pipe insulation

CZ3: Single Family House 2,025 square feet, 2-story, 20.2% glazing/floor area ratio

Energy Efficiency Measures to Meet Title 24
R-38 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Low E2 Vinyl Windows, U=0.40, SHGC=0.40; no overhangs
Furnace: 80% AFUE; No Cooling
R-6 Attic Ducts
50 gallon Gas DHW: EF=0.62; no extra pipe insulation

CZ3: Single Family House 5,000 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(2) Furnaces: 80% AFUE
Air Conditioners: None
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(2) 50 Gallon Gas Water Heaters: EF=0.60

CZ3: Single Family House 6,500 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Quality Insulation Installation (HERS)
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(3) Furnaces: 80% AFUE
Air Conditioners: None
R-8 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(3) 50 Gallon Gas Water Heaters: EF=0.60

CZ3: Single Family House 7,500 square feet, 2-story, 22.0% glazing/floor area ratio

Energy Efficiency Measures
R-30 Roof w/ Radiant Barrier
R-13 Walls
R-19 Raised Floor
Quality Insulation Installation (HERS)
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(3) Furnaces: 80% AFUE
Air Conditioners: None
R-6 Attic Ducts
Reduced Duct Leakage/Testing (HERS)
(3) 50 Gallon Gas Water Heaters: EF=0.60

Climate Zone 3 Energy Efficiency Measures Needed to Meet the Ordinance

The following tables list the energy features and/or equipment included in the Title 24 base design, the efficient measure options, and an estimate of the incremental cost for each measure included **to improve the building performance to use 15% less TDV energy than the corresponding Title 24 base case design** (except homes equal or greater than 4,000 square feet as indicated).

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 1,582 SF, Option 1

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
Furnace: 92% AFUE	Upgrade	\$ 500	\$ 1,200	\$ 850
Reduced Duct Leakage/Testing (HERS)	Upgrade	\$ 300	\$ 600	\$ 450
House wrap: 1,116 sf @ \$0.08 to \$0.12/sf	Upgrade	\$ 90	\$ 135	\$ 113
R-49 roof insulation: 1,582 sf \$0.19 to \$0.22/sf	Upgrade	\$ 300	\$ 350	\$ 325
50 gallon DHW: EF=0.62 (from EF=0.58)	Upgrade	\$ 100	\$ 200	\$ 150
R-15 Wall Insulation: 1,116 sf @ \$0.06 to \$0.08/sf	-	\$ -	\$ -	\$ -
All DHW Pipe Insulation	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,290	\$ 2,485	\$ 1,888
Total Incremental Cost per Square Foot:		\$ 0.82	\$ 1.57	\$ 1.19

Incremental Cost Estimate to Exceed Title 24 by 15%
Single Family Prototype: 2,025 SF, Option 1

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
Furnace: 92% AFUE	Upgrade	\$ 500	\$ 1,200	\$ 850
Reduced Duct Leakage/Testing (HERS)	Upgrade	\$ 300	\$ 600	\$ 450
House wrap: 1,116 sf @ \$0.08 to \$0.12/sf	Upgrade	\$ 205	\$ 305	\$ 255
R-49 roof insulation: 1,443 sf \$0.19 to \$0.22/sf	-	\$ -	\$ -	\$ -
50 gallon DHW: EF=0.62 (from EF=0.58)	-	\$ -	\$ -	\$ -
R-15 Wall Insulation: 2,550 sf @ \$0.06 to \$0.08/sf	-	\$ -	\$ -	\$ -
All DHW Pipe Insulation	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 1,005	\$ 2,105	\$ 1,555
Total Incremental Cost per Square Foot:		\$ 0.50	\$ 1.04	\$ 0.77

For homes \geq 4,000 square feet to 5,499 square feet, the following tables list the energy measures needed to improve a 5,000 square foot home so that it uses at least 20% less TDV energy than the corresponding Title 24 base case design.

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 5,000 SF, Option 1

5000 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-13): 2,616 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,177	\$ 1,831	\$ 1,504
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Quality Insulation Installation (HERS)	Upgrade	\$ 450	\$ 600	\$ 525
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(2) Furnaces: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,000	\$ 2,400	\$ 1,700
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(2) 50 Gallon Gas Water Heaters: EF=0.62 (from EF=0.60)	Upgrade	\$ 200	\$ 400	\$ 300
Total Incremental Cost of Energy Efficiency Measures:		\$ 2,827	\$ 5,231	\$ 4,029
Total Incremental Cost per Square Foot:		\$ 0.57	\$ 1.05	\$ 0.81

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 5,000 SF, Option 2

5000 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-19 Walls (from R-13): 2,616 sf @ \$0.31 to \$0.54/sf	Upgrade	\$ 811	\$ 1,413	\$ 1,112
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(2) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-6 Attic Ducts (from R-8)	Downgrade	\$ (650)	\$ (450)	\$ (550)
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(2) Instantaneous Gas Water Heater: RE=0.80 (from (2) 50 Gal Gas: EF=0.60)	Upgrade	\$ 2,000	\$ 3,400	\$ 2,700
Total Incremental Cost of Energy Efficiency Measures:		\$ 2,161	\$ 4,363	\$ 3,262
Total Incremental Cost per Square Foot:		\$ 0.43	\$ 0.87	\$ 0.65

For homes \geq 5,500 square feet to 6,999 square feet, the following tables list the energy measures needed to improve a 6,500 square foot home so that it uses at least 30% less TDV energy than the corresponding Title 24 base case design.

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 6,500 SF, Option 1

6500 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 3,900 sf @ 0.15 to 0.20/sf	Upgrade	\$ 585	\$ 780	\$ 683
R-21 Walls (from R-13): 2,808 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,264	\$ 1,966	\$ 1,615
R-30 Raised Floor (from R-19): 3,900 sf @ \$0.25 to \$0.35	Upgrade	\$ 975	\$ 1,365	\$ 1,170
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(3) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.80 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,000	\$ 5,100	\$ 4,050
Pipe Insulation	Upgrade	\$ 450	\$ 600	\$ 525
Total Incremental Cost of Energy Efficiency Measures:		\$ 6,274	\$ 9,811	\$ 8,042
Total Incremental Cost per Square Foot:		\$ 0.97	\$ 1.51	\$ 1.24

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 6,500 SF, Option 2

6500 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-19 Walls (from R-13): 2,808 sf @ \$0.31 to \$0.54/sf	Upgrade	\$ 870	\$ 1,516	\$ 1,193
R-19 Raised Floor	-	\$ -	\$ -	\$ -
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(3) Furnaces: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,500	\$ 3,600	\$ 2,550
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.80 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,000	\$ 5,100	\$ 4,050
Total Incremental Cost of Energy Efficiency Measures:		\$ 5,370	\$ 10,216	\$ 7,793
Total Incremental Cost per Square Foot:		\$ 0.83	\$ 1.57	\$ 1.20

For homes $\geq 7,000$ square feet the following tables list the energy measures needed to improve a 7,500 square foot home so that its net Title 24 TDV energy use is zero (i.e. Net Zero TDV Energy) as compared with the corresponding Title 24 base case design. To achieve this level of performance, a solar PV system is added to the home sized to just meet the Net Zero Energy threshold by rounding up to the next largest whole KW of nominal solar PV capacity.

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 7,500 SF, Option 1

7500 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 4,500 sf @ 0.15 to 0.20/sf	Upgrade	\$ 675	\$ 900	\$ 788
R-21 Walls (from R-13): 2,904 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,307	\$ 2,033	\$ 1,670
R-30 Raised Floor (from R-19): 4,500 sf @ \$0.25 to \$0.35	Upgrade	\$ 1,125	\$ 1,575	\$ 1,350
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Housewrap: 2,904 sf @ \$0.50 to \$0.75/sf	Upgrade	\$ 1,452	\$ 2,178	\$ 1,815
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(3) Furnaces: 92% AFUE (from 80% AFUE)	Upgrade	\$ 1,500	\$ 3,600	\$ 2,550
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-6 Attic Ducts	-	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.82 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 3,600	\$ 6,000	\$ 4,800
Solar Photovoltaic (PV) System: 2 KW	Upgrade	\$ 9,000	\$ 13,000	\$ 11,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 18,659	\$ 29,286	\$ 23,972
Total Incremental Cost per Square Foot:		\$ 2.49	\$ 3.90	\$ 3.20

Incremental Cost Estimate to Exceed Title 24 by 20%
Single Family Prototype: 7,500 SF, Option 2

7500 sf

Climate Zone 3

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier (from R-30 w/Radiant Barrier): 4,500 sf @ 0.15 to 0.20/sf	Upgrade	\$ 675	\$ 900	\$ 788
R-21 Walls (from R-13): 2,904 sf @ \$0.45 to \$0.70/sf	Upgrade	\$ 1,307	\$ 2,033	\$ 1,670
R-38 Raised Floor (from R-19): 4,500 sf @ \$0.30 to \$0.45	Upgrade	\$ 1,350	\$ 2,025	\$ 1,688
Quality Insulation Installation (HERS)	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(3) Furnaces: 94% AFUE (from 80% AFUE)	Upgrade	\$ 2,700	\$ 5,400	\$ 4,050
Air Conditioners: None	-	\$ -	\$ -	\$ -
R-8 Attic Ducts (from R-6)	Upgrade	\$ -	\$ -	\$ -
Reduced Duct Leakage/Testing (HERS)	-	\$ -	\$ -	\$ -
(3) Instantaneous Gas Water Heater: RE=0.84 (from (3) 50 Gal Gas: EF=0.60)	Upgrade	\$ 4,200	\$ 7,200	\$ 5,700
Pipe Insulation	Upgrade	\$ 450	\$ 600	\$ 525
Solar Photovoltaic (PV) System: 2 KW	Upgrade	\$ 9,000	\$ 13,000	\$ 11,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 19,682	\$ 31,158	\$ 25,420
Total Incremental Cost per Square Foot:		\$ 2.62	\$ 4.15	\$ 3.39

2.2 Low-rise Multi-family Residential Building

The following is the energy design description of the low-rise multifamily building prototype which just meets the 2008 Title 24 Building Energy Efficiency Standards:

CZ2: Low-rise Multi-family: 2-story 8,442 square feet, 8 units, 12.5% glazing

Energy Efficiency Measures
R-38 Roof w/ Radiant Barrier
R-15 Walls
R-0 Slab on Grade
Low E2 Vinyl Windows, U=0.36, SHGC=0.30
(8) Furnaces: 80% AFUE
(8) Air Conditioners: 13 SEER
R-8 Attic Ducts
(8) 40 Gallon Gas Water Heaters: EF=0.63

CZ3: Low-rise Multi-family: 2-story 8,442 square feet, 8 units, 12.5% glazing

Energy Efficiency Measures to Meet Title 24
R-38 Roof w/ Radiant Barrier
R-13 Walls
Slab-on-grade 1st floor
Low E2 Vinyl Windows, U=0.39, SHGC=0.33; no overhangs
Furnace: 80% AFUE; No Cooling
R-6 Attic Ducts
50 gallon Gas DHW: EF=0.575; no extra pipe insulation

Climate Zone 2 Energy Measures Needed to Meet the Ordinance

See Section 2.0 for the description of the approach used to establish which energy measures are used to meet the proposed Ordinance for this prototype building design.

Incremental Cost Estimate to Exceed Title 24 by 15%

Low-rise Multifamily Prototype: 8,442 SF, Option 1

8442 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-21 Walls (from R-15): 10,146 sf @ \$0.50 to \$0.75/sf	Upgrade	\$ 5,073	\$ 7,510	\$ 6,292
R-0 Slab on Grade	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(8) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
(8) Air Conditioner: 13 SEER, 11 EER (HERS)	Upgrade	\$ 200	\$ 600	\$ 400
(8) Air Conditioner: Refrig. Charge (HERS)	Upgrade	\$ 1,200	\$ 1,600	\$ 1,400
R-8 Attic Ducts	-	\$ -	\$ -	\$ -
(8) 40 Gallon Gas Water Heaters: EF=0.63	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 6,473	\$ 9,710	\$ 8,092
Total Incremental Cost per Square Foot:		\$ 0.77	\$ 1.15	\$ 0.96

Incremental Cost Estimate to Exceed Title 24 by 15%
Low-rise Multifamily Prototype: 8,442 SF, Option 2

8442 sf

Climate Zone 2

Energy Efficiency Measures	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Roof w/ Radiant Barrier	-	\$ -	\$ -	\$ -
R-19 Walls (from R-15): 10,146 sf @ \$0.45 to \$0.75/sf	Upgrade	\$ 4,566	\$ 7,610	\$ 6,088
R-0 Slab on Grade	-	\$ -	\$ -	\$ -
Low E2 Vinyl Windows, U=0.36, SHGC=0.30	-	\$ -	\$ -	\$ -
(8) Furnaces: 80% AFUE	-	\$ -	\$ -	\$ -
(8) Air Conditioners: 13 SEER	-	\$ -	\$ -	\$ -
R-4.2 Attic Ducts (from R-8)	Downgrade	\$ (3,000)	\$ (2,000)	\$ (2,500)
Reduced Duct Leakage/Testing (HERS)	Upgrade	\$ 2,000	\$ 4,000	\$ 3,000
(8) 40 Gallon Gas Water Heaters: EF=0.62 (from 0.63 EF)	Downgrade	\$ -	\$ (400)	\$ (200)
Total Incremental Cost of Energy Efficiency Measures:		\$ 3,566	\$ 9,210	\$ 6,388
Total Incremental Cost per Square Foot:		\$ 0.42	\$ 1.09	\$ 0.76

Climate Zone 3 Energy Measures Needed to Meet the Ordinance

Incremental Cost Estimate to Exceed Title 24 by 15%
Multifamily Prototype: 8,442 SF, Option 1

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
Furnace: (8) @ 92% AFUE	Upgrade	\$ 4,000	\$ 9,600	\$ 6,800
Reduced Duct Leakage/Testing (HERS)	Upgrade	\$ 2,000	\$ 4,000	\$ 3,000
House wrap: 9,266 sf @ \$0.08 to \$0.12/sf	Upgrade	\$ 745	\$ 1,115	\$ 930
R-49 roof insulation: 2,880 sf \$0.19 to \$0.22/sf	Upgrade	\$ 550	\$ 635	\$ 593
50 gallon DHW: EF=0.62 (from EF=0.58)	-	\$ -	\$ -	\$ -
R-15 Wall Insulation: 9,266 sf @ \$0.06 to \$0.08/sf	Upgrade	\$ 560	\$ 745	\$ 653
All DHW Pipe Insulation	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 7,855	\$ 16,095	\$ 11,975
Total Incremental Cost per Square Foot:		\$ 0.93	\$ 1.91	\$ 1.42

2.3 High-rise Multifamily Building

The following is the energy design description of the high-rise multifamily building prototype which just meets the 2008 Title 24 Building Energy Efficiency Standards:

CZ2: High-rise Residential: 4-story 36,800 sf, 40 units, Window Wall Ratio=35.2%

Energy Efficiency Measures to Meet Title 24
R-30 Attic; Cool Roof Reflectance=0.70, Emittance=0.75
R-19 in Metal Frame Walls
R-6 (2" K-13 spray-on) Raised Slab over parking garage
Vinyl Windows, NFRC U=0.36, SHGC=0.35
Split Heat Pumps: HSPF=7.2, EER=10.2
Central DHW boiler: 82.7% AFUE and recirculating system w/ timer-temperature controls & VSD hot water pump

CZ3: High-rise Residential: 4-story 36,800 sf, 40 units, Window Wall Ratio=35.2%

Energy Efficiency Measures to Meet Title 24
R-30 Attic w/ Cool Roof Reflectance=0.30, Emittance=0.75
R-19 in Metal Frame Walls
R-0 (un-insulated) raised slab over parking garage
Low E2 Vinyl Windows, U=0.33, SHGC=0.30 (see Note 1)
Split heat pumps: HSPF=7.2, EER=10.2
Central domestic DHW boiler: 82.7% AFUE and recirculating system w/ timer-temperature controls & VSD hot water pump

Note 1: Includes a small amount of fixed overhangs above first floor front tenestration

CZ 2: Energy Measures Needed to Meet the County's Ordinance

Incremental Cost Estimate to Exceed Title 24 by 15%

High-rise Residential Prototype: 36,800 SF, Option 1

Climate Zone 2

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Attic; Cool Roof Reflectance=0.70, Emittance=0.75	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-8 (2.5" K-13 spray-on) Raised Slab over parking garage	Upgrade	\$ 3,680	\$ 5,520	\$ 4,600
Vinyl Windows, NFRC U=0.33, SHGC=0.25; 6,240 sf @ \$1.40 to \$1.60/sf	Upgrade	\$ 8,736	\$ 9,984	\$ 9,360
(80) Room Heat Pumps: HSPF=7.84, eer=11.2 (No Ducts) @ \$150 to \$250/unit	Upgrade	\$ 12,000	\$ 20,000	\$ 16,000
Premium Efficiency DHW Hot Water Pump	Upgrade	\$ 150	\$ 250	\$ 200
Total Incremental Cost of Energy Efficiency Measures:		\$ 24,566	\$ 35,754	\$ 30,160
Total Incremental Cost per Square Foot:		\$ 0.67	\$ 0.97	\$ 0.82

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

Climate Zone 2

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Attic; Cool Roof Reflectance=0.70, Emittance=0.75	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls + R-5 exterior rigid insulation 11,472 sf @ \$5.00 to \$8.00/sf	Upgrade	\$ 57,360	\$ 91,776	\$ 74,568
R-6 (2" K-13 spray-on) Raised Slab over parking garage	-	\$ -	\$ -	\$ -
Vinyl Windows, NFRC U=0.33, SHGC=0.25; 6,240 sf @ \$1.40 to \$1.60/sf	Upgrade	\$ 8,736	\$ 9,984	\$ 9,360
Split Heat Pumps: HSPF=7.2, EER=10.2	-	\$ -	\$ -	\$ -
(2) 94% AFUE DHW boilers @ \$1500 to \$2500 each	Upgrade	\$ 3,000	\$ 5,000	\$ 4,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 69,096	\$106,760	\$ 87,928
Total Incremental Cost per Square Foot:		\$ 1.88	\$ 2.90	\$ 2.39

CZ 3: Energy Measures Needed to Meet the County's Ordinance

See Section 2.1 for the description of the approach used to establish which energy measures are used to meet the proposed Ordinance for this prototype building design.

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

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Attic; Cool Roof Reflectance=0.30, Emittance=0.75	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-3 (1" K-13 spray-on) Raised Slab over parking garage 9,200 sf @ \$1.20 to \$1.50 sf	Upgrade	\$ 11,040	\$ 13,800	\$ 12,420
Vinyl Windows, NFRC U=0.33, SHGC=0.23; 6,240 sf @ \$1.40 to \$1.60/sf	Upgrade	\$ 8,425	\$ 9,360	\$ 8,893
(80) Room Heat Pumps: HSPF=7.84, eer=11.2 (No Ducts) @ \$150 to \$250/unit	Upgrade	\$ 12,000	\$ 20,000	\$ 16,000
(2) 94% AFUE DHW boilers @ \$1500 to \$2500 each	Upgrade	\$ 3,000	\$ 5,000	\$ 4,000
Total Incremental Cost of Energy Efficiency Measures:		\$ 34,465	\$ 48,160	\$ 41,313
Total Incremental Cost per Square Foot:		\$ 0.94	\$ 1.31	\$ 1.12

2.4 Nonresidential Buildings

The following is the energy design description of the nonresidential building prototypes which just meet the 2008 Title 24 Building Energy Efficiency Standards:

CLIMATE ZONE 2

The following energy design descriptions of nonresidential building prototypes just meet the 2008 Title 24 Building Energy Efficiency Standards in **Climate Zone 2**:

CZ2: Nonresidential 2-story office building: 21,160 sf, Window Wall Ratio= 37.1%

Energy Efficiency Measures to Meet Title 24

R-38 Attic w/ No Cool Roof
R-19 in Metal Frame Walls
R-0 (un-insulated) slab-on-grade 1st floor
Windows NFRC U=0.50 and SHGCc=0.38, no exterior shading
(248) 2-lamp 4' T8 fixtures, 62w each; and (104) 26w CFLs
@ 26w each; no lighting controls (beyond mandatory)
(4) 10-ton Packaged DX units EER=11.0, 4,000 cfm; and
(4) 7.5-ton Packaged DX units EER=11.0, 3,000 cfm;
all standard efficiency fan motors
R-4.2 duct insulation w/ ducts in conditioned space
Standard 50 gallon gas water heater, EF=0.575

CZ2: Nonresidential 5-story office building: 52,900 sf, Window Wall Ratio= 29.1%

Energy Efficiency Measures to Meet Title 24

R-38 Attic w/ No Cool Roof
R-19 in Metal Frame Walls
R-0 (un-insulated) slab-on-grade 1st floor
Windows NFRC U=0.50 and SHGCc=0.31, 2' overhang 1st floor
front elevation only
(720) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts
& premium lamps, 50w; and (300) 18w CFLs @ 18w
each; no lighting controls (beyond mandatory)
(5) 30-ton Packaged VAV units EER=10.4, 10,000 cfm; 20% VAV
boxes w/ reheat; all standard efficiency fan motors
R-4.2 duct insulation w/ ducts in conditioned space
Standard hot water boiler, AFUE=80%

CZ2: Nonresidential 2-story office building: 21,160 sf, Window Wall Ratio= 37.1%

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 21,160 SF, Option 1

Climate Zone 2

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Attic w/ No Cool Roof	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-0 (un-insulated) slab-on-grade 1st floor				
Windows, NFRC U=0.50, SHGC=0.31; 5,160 sf @ \$2.00 to \$3.00/sf	Upgrade	\$ 10,320	\$ 15,480	\$ 12,900
(248) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w @ \$25.00 - \$30.00 each	Upgrade	\$ 6,000	\$ 7,200	\$ 6,600
(4) 10-ton Packaged DX units, EER= 13.4 @ \$2300 - \$2600 ea,	Upgrade	\$ 16,000	\$ 24,000	\$ 20,000
(4) 7.5-ton Packaged DX units, EER= 13.4 @ \$1950 - \$2450 ea,	Upgrade	\$ 12,000	\$ 18,800	\$ 15,400
(8) Premium Efficiency supply fans @ \$100 to \$200 each	Upgrade	\$ 800	\$ 1,600	\$ 1,200
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard 50 gallon gas water heater, EF=0.575	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 45,120	\$ 67,080	\$ 56,100
Total Incremental Cost per Square Foot:		\$ 2.13	\$ 3.17	\$ 2.65

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 21,160 SF, Option 2

Climate Zone 2

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Attic w/ No Cool Roof	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls + R-6.5 (1") rigid insulation 8,752 sf @ \$3.00 to \$4.00/sf	-	\$ 26,256	\$ 35,008	\$ 30,632
R-0 (un-insulated) slab-on-grade 1st floor				
Windows, NFRC U=0.50, SHGC=0.28; 5,160 sf @ \$3.50 to \$4.50/sf	Upgrade	\$ 18,060	\$ 23,220	\$ 20,640
(72) [30% of] 2-lamp 4' T8 fixtures on (36) multi-level occupant sensors in small offices @ \$65.00 to \$85.00 each	Upgrade	\$ 2,340	\$ 3,060	\$ 2,700
(248) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w @ \$25.00 - \$30.00 each	Upgrade	\$ 6,000	\$ 7,200	\$ 6,600
(4) 10-ton Packaged DX units EER=11.0, 4,000 cfm; and (4) 7.5-ton Packaged DX units EER=11.0, 3,000 cfm; all standard efficiency fan motors	-	\$ -	\$ -	\$ -
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard 50 gallon gas water heater, EF=0.575	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 52,656	\$ 68,488	\$ 60,572
Total Incremental Cost per Square Foot:		\$ 2.49	\$ 3.24	\$ 2.86

CZ2: Nonresidential 5-story office building: 52,900 sf, Window Wall Ratio= 29.1%

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Attic w/ Cool Roof Reflectance=0.70, Emittance=0.75 10,580 sf @ \$0.40 to \$0.60/sf	Upgrade	\$ 4,235	\$ 6,348	\$ 5,292
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-0 (un-insulated) slab-on-grade 1st floor				
Windows, NFRC U=0.50, SHGC=0.31; 5,160 sf @ \$2.00 to \$3.00/sf	-	\$ -	\$ -	\$ -
(180) [25% of] 2-lamp 4' T8 fixtures on (90) multi-level occupant sensors in small offices @ \$65.00 to \$85.00 each	Upgrade	\$ 5,850	\$ 7,650	\$ 6,750
(5) 10-ton Packaged DX units, EER= 11.0 w/ Premium fan motors @ \$10,800 to \$15,600 ea,	Upgrade	\$ 54,000	\$ 78,000	\$ 66,000
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard hot water boiler, AFUE=80%	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 59,850	\$ 85,650	\$ 72,750
Total Incremental Cost per Square Foot:		\$ 1.13	\$ 1.62	\$ 1.38

**Incremental Cost Estimate to Exceed Title 24 by 15%
Nonresidential Prototype: 52,900 SF, Option 2**

Climate Zone 2

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Attic w/ Cool Roof Reflectance=0.70, Emittance=0.75 10,580 sf @ \$0.40 to \$0.60/sf	Upgrade	\$ 4,235	\$ 6,348	\$ 5,292
R-19 in Metal Frame Walls + R-6.5 (1") rigid insulation 8,752 sf @ \$3.00 to \$4.00/sf	Upgrade	\$ 26,256	\$ 35,008	\$ 30,632
R-0 (un-insulated) slab-on-grade 1st floor				
Windows, NFRC U=0.50, SHGC=0.28; 8,500 sf @ \$2.00 to \$3.00/sf	Upgrade	\$ 17,000	\$ 25,500	\$ 21,250
(180) [25% of] 2-lamp 4' T8 fixtures on (90) multi-level occupant sensors in small offices @ \$65.00 to \$85.00 each	Upgrade	\$ 5,850	\$ 7,650	\$ 6,750
(248) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w @ \$25.00 - \$30.00 each	Upgrade	\$ 6,000	\$ 7,200	\$ 6,600
(5) 30-ton Packaged VAV units EER=10.4, 10,000 cfm; 20% VAV boxes w/ reheat; (10) Premium Efficiency fan motors	Upgrade	\$ 1,000	\$ 1,500	\$ 1,250
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard hot water boiler, AFUE=80%	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 56,106	\$ 76,858	\$ 66,482
Total Incremental Cost per Square Foot:		\$ 1.06	\$ 1.45	\$ 1.26

CLIMATE ZONE 3

The following energy design descriptions of nonresidential building prototypes just meet the 2008 Title 24 Building Energy Efficiency Standards in **Climate Zone 3**:

CZ3: Nonresidential 2-story office building: 21,160 sf, Window Wall Ratio= 37.1%

Energy Efficiency Measures to Meet Title 24
R-38 Attic w/ No Cool Roof R-19 in Metal Frame Walls R-0 (un-insulated) slab-on-grade 1st floor Windows NFRC U=0.50 and SHGCc=0.38, no exterior shading (248) 2-lamp 4' T8 fixtures, 62w each; and (104) 26w CFLs @ 26w each; no lighting controls (beyond mandatory) (4) 10-ton Packaged DX units EER=11.0, 4,000 cfm; and (4) 7.5-ton Packaged DX units EER=11.0, 3,000 cfm; all standard efficiency fan motors R-4.2 duct insulation w/ ducts in conditioned space Standard 50 gallon gas water heater, EF=0.575

CZ3: Nonresidential 5-story office building: 52,900 sf, Window Wall Ratio= 29.1%

Energy Efficiency Measures to Meet Title 24
R-30 Attic w/ No Cool Roof R-19 in Metal Frame Walls R-0 (un-insulated) slab-on-grade 1st floor Windows NFRC U=0.50 and SHGCc=0.38, no exterior shading (720) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w; and (260) 26w CFLs @ 26w each; no lighting controls (beyond mandatory) (5) 30-ton Packaged VAV units EER=10.4, 10,000 cfm; 20% VAV boxes w/ reheat; all standard efficiency fan motors R-4.2 duct insulation w/ ducts in conditioned space Standard hot water boiler, AFUE=80%

CZ3: Nonresidential 2-story office building: 21,160 sf, Window Wall Ratio= 37.1%

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 21,160 SF, Option 1

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-38 Attic + R-10 rigid insulation w/ Cool Roof Reflectance = 0.70, Emittance = 0.75; 10,580 sf @ \$1.75 to \$2.35/sf	Upgrade	\$ 18,515	\$ 24,865	\$ 21,690
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-0 (un-insulated) slab-on-grade 1st floor				
Windows, NFRC U=0.50, SHGC=0.31; 5,160 sf @ \$2.00 to \$3.00/sf	Upgrade	\$ 10,320	\$ 15,480	\$ 12,900
(248) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w @ \$25.00 - \$30.00 each	Upgrade	\$ 6,200	\$ 7,440	\$ 6,820
(64) [26% of] 2-lamp 4' T8 fixtures on (32) multi-level occupant sensors in small offices @ \$65.00 to \$85.00 each	Upgrade	\$ 2,080	\$ 2,720	\$ 2,400
(24) additional recessed CFL fixtures w/ all CFLs 18w lamps @ \$175 to \$250 each	Upgrade	\$ 4,200	\$ 6,000	\$ 5,100
(4) 10-ton Packaged DX units EER=11.0, 4,000 cfm; (4) 7.5-ton Packaged DX units EER=11.0, 3,000 cfm; and (8) Premium Efficiency fan motors @ \$100 to \$200 each	Upgrade	\$ 800	\$ 1,600	\$ 1,200
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard 50 gallon gas water heater, EF=0.575	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 42,115	\$ 58,105	\$ 50,110
Total Incremental Cost per Square Foot:		\$ 1.99	\$ 2.75	\$ 2.37

CZ3: Nonresidential 5-story office building: 52,900 sf, Window Wall Ratio= 29.1%

Incremental Cost Estimate to Exceed Title 24 by 15%

Nonresidential Prototype: 52,900 SF, Option 1

Climate Zone 3

Energy Efficiency Measures to Exceed Title 24 by 15%	Change Type	Incremental Cost Estimate		
		Min	Max	Avg
R-30 Attic w/ No Cool Roof	-	\$ -	\$ -	\$ -
R-19 in Metal Frame Walls	-	\$ -	\$ -	\$ -
R-0 (un-insulated) slab-on-grade 1st floor				
Windows NFRC U=0.50 and SHGCc=0.38, no exterior shading	-	\$ -	\$ -	\$ -
(720) 2-lamp 4' T8 fixtures w/ high efficiency instant start ballasts & premium lamps, 50w @ \$25.00 - \$30.00 each	Upgrade	\$ 18,000	\$ 21,600	\$ 19,800
(240) 33% of] 2-lamp 4' T8 fixtures on (120) multi-level occupant sensors in small offices @ \$65.00 to \$85.00 each	Upgrade	\$ 7,800	\$ 10,200	\$ 9,000
(40) additional recessed CFL fixtures w/ all CFLs 18w lamps @ \$175 to \$250 each	Upgrade	\$ 7,000	\$ 10,000	\$ 8,500
(5) 10-ton Packaged DX units, EER= 11.0 w/ Premium fan motors @ \$10,800 to \$15,600 ea,	Upgrade	\$ 54,000	\$ 78,000	\$ 66,000
R-4.2 duct insulation w/ ducts in conditioned space	-	\$ -	\$ -	\$ -
Standard hot water boiler, AFUE=80%	-	\$ -	\$ -	\$ -
Total Incremental Cost of Energy Efficiency Measures:		\$ 86,800	\$119,800	\$103,300
Total Incremental Cost per Square Foot:		\$ 1.64	\$ 2.26	\$ 1.95

3.0 Cost Effectiveness

The summary of results in this section are based upon the following assumptions:

- Annual site electricity (kWh) and natural gas (therms) saved are calculated using a beta version of the state-approved energy compliance software for the 2008 Building Energy Efficiency Standards, Micropas 8.
- Average utility rates of **\$0.173/kWh** for electricity and **\$1.15/therm** for natural gas in current constant dollars
- No change (i.e., no inflation or deflation) of utility rates in constant dollars
- No increase in summer temperatures from global climate change

The Simple Payback data includes a cost-effectiveness analysis of the Ordinance with respect to each case study building 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 (e.g, opportunity cost) invested in the incremental cost of energy efficiency measures is not included.

3.1 New Single Family Houses

Climate Zone 2: 15% Better Than Title 24

Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
2,025 sf (Option 1)	399	69	\$2,011	\$148	13.5
2,025 sf (Option 2)	348	81	\$2,104	\$153	13.7
Averages:	374	75	\$2,057	\$151	13.6

Annual Reduction in CO2-equivalent: 1,041 lb./building-year
0.51 lb./sq.ft.-year

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
2,682 sf (Option 1)	524	71	\$2,072	\$172	12.0
2,682 sf (Option 2)	338	111	\$2,549	\$186	13.7
2,682 sf (Option 3)	427	92	\$2,327	\$180	12.9
Averages:	430	91	\$2,316	\$179	12.9

Annual Reduction in CO2-equivalent: 1,256 lb./building-year
0.47 lb./sq.ft.-year

Climate Zone 3: 15% Better Than Title 24

Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
1,582 sf (Option 1)	63	67	\$1,888	\$88	21.5

Annual Reduction in CO2-equivalent: 808 lb./building-year
0.51 lb./sq.ft.-year

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
2,025 sf (Option 1)	81	88	\$1,555	\$115	13.5

Annual Reduction in CO2-equivalent: 1,061 lb./building-year
0.52 lb./sq.ft.-year

Climate Zone 2: 20% Better Than Title 24
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
5,000 sf (Option 1)	908	129	\$5,237	\$305	17.1
5,000 sf (Option 2)	1040	116	\$4,637	\$313	14.8
5,000 sf (Option 3)	850	148	\$5,087	\$317	16.0
Averages:	933	131	\$4,987	\$312	16.0

Annual Reduction in CO2-equivalent: 1,945 lb./building-year
0.39 lb./sq.ft.-year

Climate Zone 3: 20% Better Than Title 24
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
5,000 sf (Option 1)	171	146	\$4,029	\$197	20.4
5,000 sf (Option 2)	93	161	\$3,262	\$201	16.2
Averages:	132	154	\$3,646	\$199	18.3

Annual Reduction in CO2-equivalent: 1,846 lb./building-year
0.37 lb./sq.ft.-year

Climate Zone 2: 30% Better Than Title 24
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
6,500 sf (Option 1)	1130	321	\$12,020	\$565	21.3
6,500 sf (Option 2)	1029	26	\$9,253	\$398	23.2
Averages:	1080	174	\$10,636	\$481	22.3

Annual Reduction in CO2-equivalent: 2,753 lb./building-year
0.42 lb./sq.ft.-year

Climate Zone 3: 30% Better Than Title 24
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
6,500 sf (Option 1)	165	275	\$8,043	\$345	23.3
6,500 sf (Option 2)	95	281	\$7,793	\$340	22.9
Averages:	130	278	\$7,918	\$342	23.1

Annual Reduction in CO2-equivalent: 3,294 lb./building-year
0.51 lb./sq.ft.-year

Climate Zone 2: Net Zero TDV Energy
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
7,500 sf (Option 1)	1568	378	\$41,119	\$1,467	28.0
7,500 sf (Option 2)	1582	378	\$40,661	\$1,470	27.7
Averages:	1575	378	\$40,890	\$1,468	27.8

Annual Reduction in CO2-equivalent: 7,089 lb./building-year
0.95 lb./sq.ft.-year

Climate Zone 3: Net Zero TDV Energy
Large Single Family

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
7,500 sf (Option 1)	212	375	\$23,973	\$849	28.3
7,500 sf (Option 2)	205	375	\$25,420	\$847	30.0
Averages:	209	375	\$24,696	\$848	29.1

Annual Reduction in CO2-equivalent: 5,449 lb./building-year
0.73 lb./sq.ft.-year

3.2 Low-rise Multi-family Building

Climate Zone 2: 15% Better Than Title 24
Low-rise Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
8,442 sf (Option 1)	1575	261	\$8,089	\$573	14.1
8,442 sf (Option 2)	1468	284	\$6,388	\$581	11.0
Averages:	1522	273	\$7,238	\$577	12.6

Annual Reduction in CO2-equivalent: 3,857 lb./building-year
0.10 lb./sq.ft.-year

Climate Zone 3: 15% Better Than Title 24
Low-rise Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
8,442 sf (Option 1)	363	318	\$11,975	\$428	27.9

Annual Reduction in CO2-equivalent: 3,865 lb./building-year
0.46 lb./sq.ft.-year

3.3 High-rise Multi-family Building

Climate Zone 2: 15% Better Than Title 24

High-rise Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
36,800 sf (Option 1)	14292	0	\$30,160	\$2,473	12.2
36,800 sf (Option 2)	9590	268	\$87,428	\$1,967	44.4
Averages:	11941	134	\$58,794	\$2,220	28.3

*Annual Reduction in CO2-equivalent: 6,933 lb./building-year
0.19 lb./sq.ft.-year*

Climate Zone 3: 15% Better Than Title 24

High-rise Apartments

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
36,800 sf (Option 1)	10032	179	\$40,513	\$1,941	20.9

*Annual Reduction in CO2-equivalent: 6,598 lb./building-year
0.18 lb./sq.ft.-year*

3.4 Nonresidential Buildings

Climate Zone 2: 15% Better Than Title 24

2-Story Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
21,160 sf (Option 1)	19085	-95	\$56,100	\$3,192	17.6
21,160 sf (Option 2)	15862	90	\$60,572	\$2,848	21.3
Averages:	17474	-3	\$58,336	\$3,020	19.4

*Annual Reduction in CO2-equivalent: 7,834 lb./building-year
0.37 lb./sq.ft.-year*

Climate Zone 3: 15% Better Than Title 24

2-Story Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
21,160 sf (Option 1)	19294	-75	\$49,670	\$3,252	15.3

*Annual Reduction in CO2-equivalent: 7,809 lb./building-year
0.37 lb./sq.ft.-year*

Climate Zone 2: 15% Better Than Title 24
5-Story Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
52,900 sf (Option 1)	40514	-506	\$80,417	\$6,427	12.5
52,900 sf (Option 2)	35774	-653	\$39,917	\$5,438	7.3
Averages:	38144	-580	\$60,167	\$5,932	9.9

Annual Reduction in CO2-equivalent: 10,419 lb./building-year
0.20 lb./sq.ft.-year

Climate Zone 3: 15% Better Than Title 24
5-Story Office Building

Building Description	Total Annual KWh Saving	Total Annual Therms Saving	Incremental First Cost (\$)	Annual Energy Cost Savings (\$)	Simple Payback (Years)
52,900 sf (Option 1)	47039	1450	\$92,300	\$9,805	9.4

Annual Reduction in CO2-equivalent: 38,046 lb./building-year
0.72 lb./sq.ft.-year

Conclusions

Regardless of the building design, occupancy profile and number of stories, the incremental improvement in overall annual energy performance of buildings under the Marin Green Building Ordinance and the 2008 Title 24 Building Energy Efficiency Standards appears cost-effective. However, each building's overall design, occupancy type and specific design choices may allow for a large range of incremental first cost and payback. As with simply meeting the requirements of the Title 24 energy standards, a permit applicant complying with the energy requirements of the Marin Green Building Ordinance should carefully analyze building energy performance to reduce incremental first cost and the payback for the required additional energy efficiency measures.