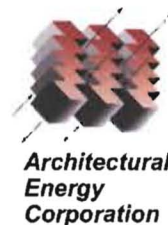
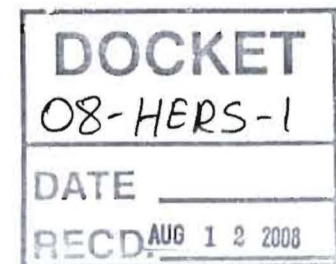


# Agenda

## California Home Energy Rating System Program Phase II Regulations Development

*Efficiency Committee  
Workshop  
August 14, 2008*

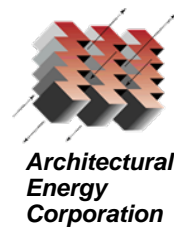
- Scope and Application
- HERS Reports
- Entities Recognized
- Energy Modeling
- Utility Bill Analysis
- Rating Recommendations
- What's Next



# Scope and Application

California Home  
Energy Rating  
System Program  
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Development

*Efficiency Committee  
Workshop  
August 14, 2008*



# HERS Regulations, Section 1672(a)



**“A California Whole-House Home Energy Rating or a California Home Energy Audit shall be completed for a home only if it is completed as specified by these regulations and the HERS Technical Manual.”**

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# Approach



- **Rate the home not the occupants**
- **But, consider utility bills and life-style patterns when developing recommendations and estimating savings**

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# California HERS Program Objectives



## ● Complete implementation of the HERS Program pursuant to Public Resources Code Section 25942

### ➤ Phase I:

- Adopted in 1999
- Established general framework
- Field verification and diagnostic testing

### ➤ Phase II:

- Expands program scope
- Includes the audit or rating of new and existing homes

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## ● Phase II fulfills the goals of Public Resources Code 25942 by:

- Guiding the production of consistent, accurate, and uniform ratings based on a single statewide rating scale
- Ensuring that any audit or rating include reasonable estimates of potential utility bill savings and reliable recommendations on cost-effective measures to improve energy efficiency
- Establishing labeling procedures that will meet the needs of home buyers, homeowners, renters, the real estate industry, and mortgage lenders with an interest in home energy ratings
- Proposing a technique for determining energy efficiency measure cost-effectiveness
- Proposing a technique to develop recommendations for energy efficiency improvements, including cross checking against utility bills

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- The CEC report “Options for Energy Efficiency in Existing Buildings” developed pursuant to AB 549
- The Phase I regulations for HERS
- Title 24 Standards, Residential Alternative Calculation Method (ACM) Manual, and Commission-adopted field verification and diagnostic testing procedures
- RESNET’s “2006 Mortgage Industry National Home Energy Rating Systems Standards”
- “HERS Topic Report,” May 2008, AEC
- CEC’s “California Statewide Residential Appliance Saturation Study,” June 2004
- NREL’s “Building America Research Benchmark Definition,” January 2008

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# Existing Home Opportunities in California



- **Over 13 million residential dwelling units**
- **Many were built before 1978 with limited energy efficiency measures**
- **Homes built after 1978 continue to have significant opportunities for energy efficiency improvements**
- **Highly cost-effective energy efficiency measures**
- **Consumer education**

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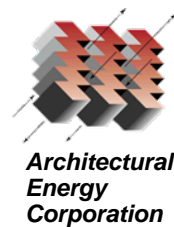




# HERS Reports

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# Rating Report Elements



- **The Rating Certificate**
- **A statement of recommended improvements**
- **An analysis of projected and historic energy consumption**
- **A detailed listing of the features of the home that were used in the analysis**

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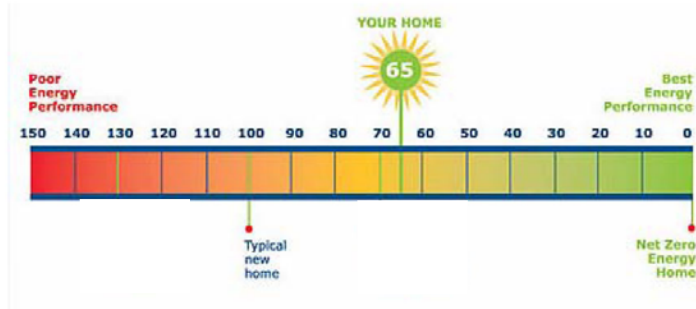
Efficiency  
Committee  
Workshop  
August 14, 2008



# Sample Rating Certificate



## California Home Energy Rating Certificate



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area 2,200 ft<sup>2</sup>  
Conditioned Volume 16,000 ft<sup>3</sup>  
Bedrooms 4  
House Type Single Family  
Foundation Type Slab-on-Grade

### Energy Efficiency Features

#### Insulation

Ceiling R-38  
Wall R-19  
Floor over crawlspace R-19  
Slab Edge R-7

#### Windows

Frame Alum. Clad Wood  
Glazing Double low-e

#### Heating System

Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

#### Cooling System

None

#### Ventilation System

None

#### Water Heating System

Gas storage type, 0.62 EF  
ICS solar system

Rater Signature

Date: \_\_\_\_\_

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### Energy Impact

#### Greenhouse Gas Emissions

Carbon Dioxide xxx  
tons/year

#### Energy Consumption

Electricity (kWh/year) —  
Cooling —  
Lights —  
Appliances —  
Total —

#### Natural Gas (therms/year)

Space Heating —  
Water Heating —  
Total —

#### Operating Cost (\$/year)

Electricity —  
Gas —  
Total —

#### Renewable Energy Production

None

Information  
goes here on  
compliance  
with other  
programs

Qualifying  
Information  
Goes Here

HERS Provider  
and/or Sponsor  
Co-Branding  
Logos Go Here

#### HERS Provider

Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

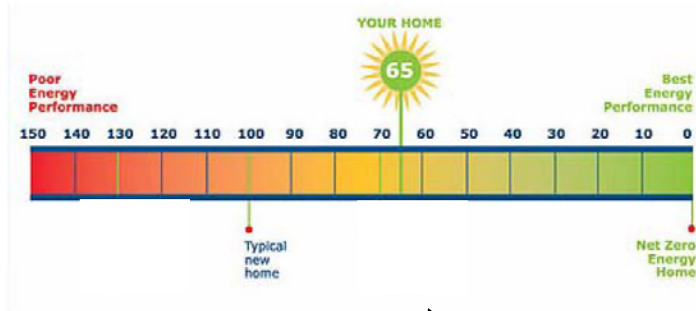
#### Rating Information

Rating Number xxxx-yyyy  
Certified Rater EEH, Inc.  
Stockton, CA  
Rating Date January dd, yyyy

# California HERS Index



## California Home Energy Rating Certificate



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area 2,200 ft<sup>2</sup>  
Conditioned Volume 16,000 ft<sup>3</sup>  
Bedrooms 4  
House Type Single Family  
Foundation Type Slab-on-Grade

### Energy Efficiency Features

#### Insulation

Attic R-19  
Floor over crawlspace R-19  
Foundation R-10  
Frame Glazing Alum. Clad Wood  
Double low-e  
Heating System Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

Cooling System  
None  
Water Heating System  
Storage type, 0.62 EF  
ICS solar system

- HERS Index is ratio of the TDV energy of the rated house to the TDV energy of a reference house
- Zero represents a zero energy home
- 100 represents the reference home (minimum compliance with the 2008 California energy efficiency standards)
- Most older homes will have an index greater than 100

Information  
goes here on  
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programs

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### Energy Impact

Greenhouse Gas Emissions  
Carbon Dioxide xxx  
tons/year

#### Energy Consumption

Electricity (kWh/year) —  
Cooling —  
Lights —  
Appliances —  
Total —

#### Natural Gas (therms/year)

Space Heating —  
Water Heating —  
Total —

#### Operating Cost (\$/year)

Electricity —  
Gas —  
Total —

#### Renewable Energy Production

None

# What's Included in the Rating



## ● What's Included

- Traditional uses of heating, cooling, and water heating are already produced by compliance software
- Lighting and appliances energy as determined through the recommended model
- Exterior lighting attached to the building

## ● What's not included

- Pools
- Spas
- Lighted sports courts
- Well pumps
- Grinder pumps

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# On-site Renewable Generation



- **Two ratings are required: one with the building's energy efficiency features and one with those features plus on-site renewable generation (e.g., photovoltaics)**
- **The California Energy Commission in its 2007 Integrated Energy Policy Report recommends a goal of achieving zero-energy newly constructed homes by 2020**
- **It is critically important to invest first in energy efficiency**
- **On-site renewable generation should be included in the modeling of projected utility bills**

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# Site Information



## California Home Energy Rating Certificate

**Site Information**

Address of the home

General Information

YOUR HOME

Best Energy Performance

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

Net Zero Energy Home

new home



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area 2,200 ft<sup>2</sup>  
Conditioned Volume 16,000 ft<sup>3</sup>  
Bedrooms 4  
House Type Single Family  
Foundation Type Slab-on-Grade

### Energy Efficiency Features

#### Insulation

Ceiling R-38  
Wall R-19  
Floor over crawlspace R-19  
Slab Edge R-7

#### Windows

Frame Alum. Clad Wood  
Glazing Double low-e

#### Heating System

Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

#### Cooling System

None

#### Ventilation System

None

#### Water Heating System

Gas storage type, 0.62 EF  
ICS solar system

Rater Signature \_\_\_\_\_ Date: \_\_\_\_\_

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### Energy Impact

**Greenhouse Gas Emissions**  
Carbon Dioxide xxx  
tons/year

#### Energy Consumption

Electricity (kWh/year) —  
Cooling —  
Lights —  
Appliances —  
Total —

Natural Gas (therms/year)

Space Heating —  
Water Heating —  
Total —

#### Operating Cost (\$/year)

Electricity —  
Gas —  
Total —

#### Renewable Energy Production

None

Information  
goes here on  
compliance  
with other  
programs

Qualifying  
Information  
Goes Here

HERS Provider  
and/or Sponsor  
Co-Branding  
Logos Go Here

#### HERS Provider

Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

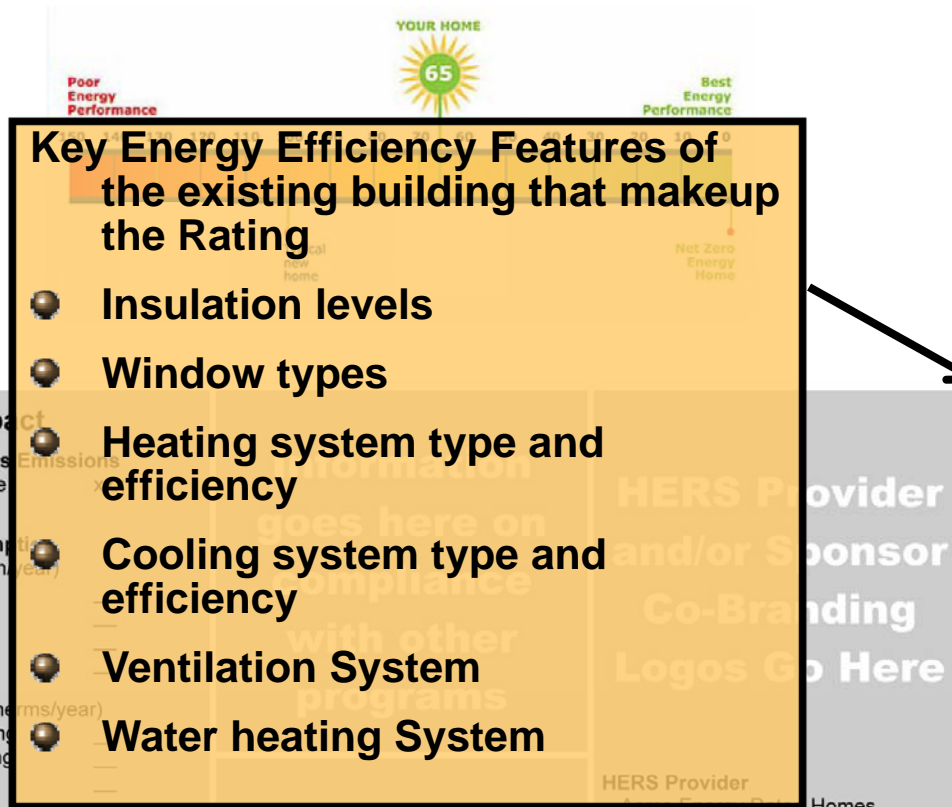
#### Rating Information

Rating Number xxxx-yyyy  
Certified Rater EEH, Inc.  
Stockton, CA  
Rating Date January dd, yyyy

# Energy Efficiency Features



## California Home Energy Rating Certificate



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

**Address**  
123 Jones Street  
Anywhere, California 9410x

**General Information**  
Conditioned Floor Area 2,200 ft<sup>2</sup>  
Conditioned Volume 16,000 ft<sup>3</sup>  
Bedrooms 4  
House Type Single Family  
Foundation Type Slab-on-Grade

### Energy Efficiency Features

**Insulation**  
Ceiling R-38  
Wall R-19  
Floor over crawlspace R-19  
Slab Edge R-7

**Windows**  
Frame Alum. Clad Wood  
Glazing Double low-e

**Heating System**  
Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

**Cooling System**  
None

**Ventilation System**  
None

**Water Heating System**  
Gas storage type, 0.62 EF  
ICS solar system

Rater Signature \_\_\_\_\_ Date: \_\_\_\_\_

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### Energy Impact

Greenhouse Gas Emissions  
Carbon Dioxide  
tons/year

### Energy Consumption

Electricity (kWh/year)  
Cooling  
Lights  
Appliances  
Total

### Natural Gas (therms/year)

Space Heating  
Water Heating  
Total

### Operating Cost (\$/year)

Electricity  
Gas  
Total

### Renewable Energy Production

None

Qualifying  
Information  
Goes Here

HERS Provider  
Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

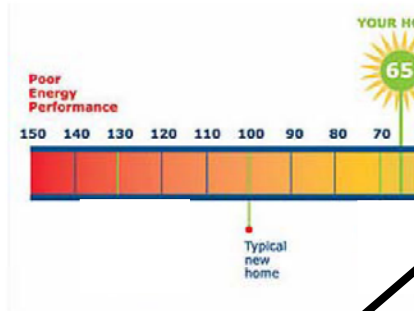
**Rating Information**  
Rating Number xxxx-yyyy  
Certified Rater EEH, Inc.  
Stockton, CA  
Rating Date January dd, yyyy



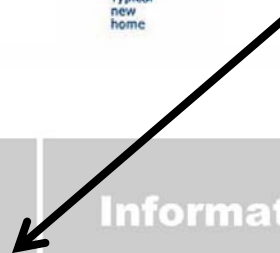
# Estimated Energy Impact of the Home



## California Home Energy Rating Certificate



- Greenhouse gas emissions
- Electricity consumption (broken down by end uses)
- Gas consumption (broken down by end uses)
- Operating costs
- Renewable energy production



<b>Energy Impact</b> <b>Greenhouse Gas Emissions</b> Carbon Dioxide xxx tons/year <b>Energy Consumption</b> Electricity (kWh/year) Cooling — Lights — Appliances — Total — Natural Gas (therms/year) Space Heating — Water Heating — Total — <b>Operating Cost (\$/year)</b> Electricity — Gas — Total — <b>Renewable Energy Production</b> None	<b>Information goes here on compliance with other programs</b>	<b>HERS Provider and/or Sponsor</b>	<b>Co-Branding Logos Go Here</b>	<b>HERS Provider</b> Acme Energy Rated Homes 934 Energy Efficient Way Power Junction, California www.AcmeEnergyRatedHomes.com <b>Rating Information</b> Rating Number xxxx-yyyy Certified Rater EEH, Inc. Stockton, CA Rating Date January dd, yyyy	<b>Official Home Energy Rating in conformance with the requirements of the California Energy Commission</b> www.energy.ca.gov <b>Site Information</b> Address 123 Jones Street Anytown, California 9410x <b>General Information</b> Conditioned Floor Area 1,200 ft² Conditioned Volume 6,000 ft³ Bedrooms House Type Single Family Foundation Type Slab-on-Grade <b>Energy Efficiency Features</b> <b>Insulation</b> Ceiling R-38 Wall R-19 Floor over crawlspace R-19 Slab Edge R-7 <b>Windows</b> Frame Alum. Clad Wood Glazing Double low-e <b>Heating System</b> Condensing gas furnace, 0.92 AFUE Sealed air distribution ducts <b>Cooling System</b> None <b>Ventilation System</b> None <b>Water Heating System</b> Gas storage type, 0.62 EF ICS solar system
<b>Rater Signature</b> _____ <b>Date:</b> _____					

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# Energy Impact Summary



- The Rating Certificate *energy impact summary* is based on the modeled energy use of the home, using the same inputs as are used for the rating
- The *summary* does not consider the historical energy use of the home
- The *summary* is not adjusted for the particular energy usage patterns of the home's current occupants
- The rating software should produce the same energy impacts and overall rating regardless of the rater that does the rating

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# HERS Provider and Rater Information



## California Home Energy Rating Certificate

Logo and identification of the HERS provider

Logo of possible co-sponsor of the rating program

Rating Information

YOUR HOME



Poor Energy

Best Energy Performance

Net Zero Energy Home

**HERS Provider and/or Sponsor Co-Branding Logos Go Here**

**HERS Provider**  
Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

**Rating Information**  
Rating Number xxxx-yyyy  
Certified Rater EEH, Inc.  
Stockton, CA  
Rating Date January dd, yyyy

**Qualifying Information Goes Here**



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area	2,200 ft <sup>2</sup>
Conditioned Volume	16,000 ft <sup>3</sup>
Bedrooms	4
House Type	Single Family
Foundation Type	Slab-on-Grade

### Energy Efficiency Features

#### Insulation

Ceiling	R-38
Wall	R-19
Floor over crawlspace	R-19
Slab Edge	R-7

#### Windows

Frame	Alum. Clad Wood
Glazing	Double low-e

#### Heating System

Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

#### Cooling System

None

#### Ventilation System

None

#### Water Heating System

Gas storage type, 0.62 EF  
ICS solar system

Rater Signature

Date: \_\_\_\_\_

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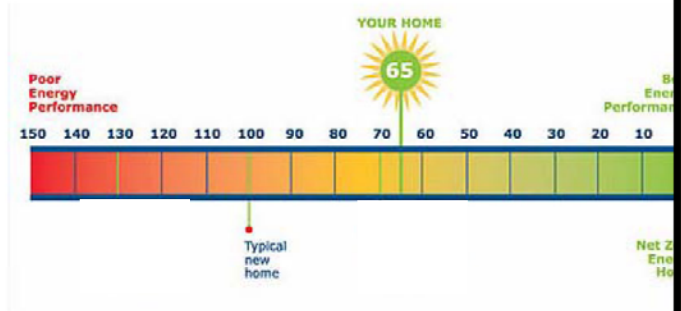
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# Compliance with other Programs



## California Home Energy Rating Certificate



The house might also participate in one of the rapidly growing green building programs

- Build-It-Green
- LEED for Homes
- California Green Builder

The Commission should coordinate with green building programs to incorporate the California HERS program into those programs once adopted by the Commission.

### Energy Impact

**Greenhouse Gas Emissions**  
Carbon Dioxide xxx  
tons/year

### Energy Consumption

Electricity (kWh/year) —  
Cooling —  
Lights —  
Appliances —  
Total —

Natural Gas (therms/year)

Space Heating —  
Water Heating —  
Total —

### Operating Cost (\$/year)

Electricity —  
Gas —  
Total —

### Renewable Energy Production

None

Information  
goes here on  
compliance  
with other  
programs

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Information  
Goes Here

HERS Provider  
and/or Sponsor  
Co-Branding  
Logos Go Here

### HERS Provider

Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
www.AcmeEnergyRatedHomes.com

### Rating Information

Rating Number xxxx-yyyy  
Certified Rater EEH, Inc.  
Stockton, CA  
Rating Date January dd, yyyy

### Windows

Frame Alum. Clad Wood  
Glazing Double low-e

### Heating System

Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

### Cooling System

None

### Ventilation System

None

### Water Heating System

Gas storage type, 0.62 EF  
ICS solar system

Rater Signature

Date: \_\_\_\_\_

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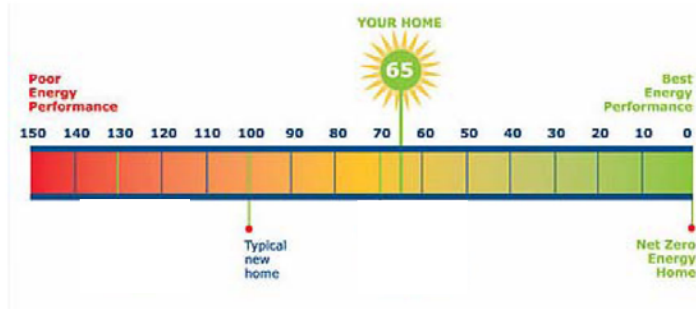




# Caveats and Qualifying Information



## California Home Energy Rating Certificate



Official Home Energy Rating  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area	2,200 ft <sup>2</sup>
Conditioned Volume	16,000 ft <sup>3</sup>
Bedrooms	4
House Type	Single Family
Foundation Type	Slab-on-Grade

### Energy Efficiency Features

Energy impact and rating are based  
on typical home occupancy patterns  
(your mileage will vary)

Ceiling	R-38
Floor over Crawl Space	R-9
Windows	Frame Alum. Clad Wood
Glazing	Double low-e
Heating System	Condensing gas furnace, 0.92 AFUE
	Sealed air distribution ducts

Cooling System  
None

Ventilation System  
None

Water Heating System  
Gas storage type, 0.62 EF  
ICS solar system

Rater Signature

Date: \_\_\_\_\_

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### Energy Impact

Greenhouse Gas Emissions  
Carbon Dioxide xxx  
tons/year

#### Energy Consumption

Electricity (kWh/year)	—
Cooling	—
Lights	—
Appliances	—
Total	—

Natural Gas (therms/year)

Space Heating	—
Water Heating	—
Total	—

#### Operating Cost (\$/year)

Electricity	—
Gas	—
Total	—

#### Renewable Energy Production

None

Information  
goes here on  
compliance  
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programs

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Information  
Goes Here

HERS Provider  
and/or Sponsor  
Co-Branding  
Logos Go Here

#### HERS Provider

Acme Energy Rated Homes  
934 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

#### Rating Information

Rating Number	xxxx-yyyy
Certified Rater	EEH, Inc. Stockton, CA
Rating Date	January dd, yyyy



- **The second component of the overall rating report will be a graphical representation of energy consumption in the home. It will be comprised of three graphs:**
  - **One representing the monthly cost of energy use in the home**
  - **One representing the kWh of electricity used monthly in the home**
  - **One representing the Btu's of gas used monthly in the home**
- **All three reports will compare, where possible:**
  - **Simulated energy use for the home**
  - **Actual “raw” energy use for the home over the last 12 months of normal occupancy**
  - **Actual energy use for the home normalized to the same weather profile as was used to determine the simulated energy use**

Scope and Application

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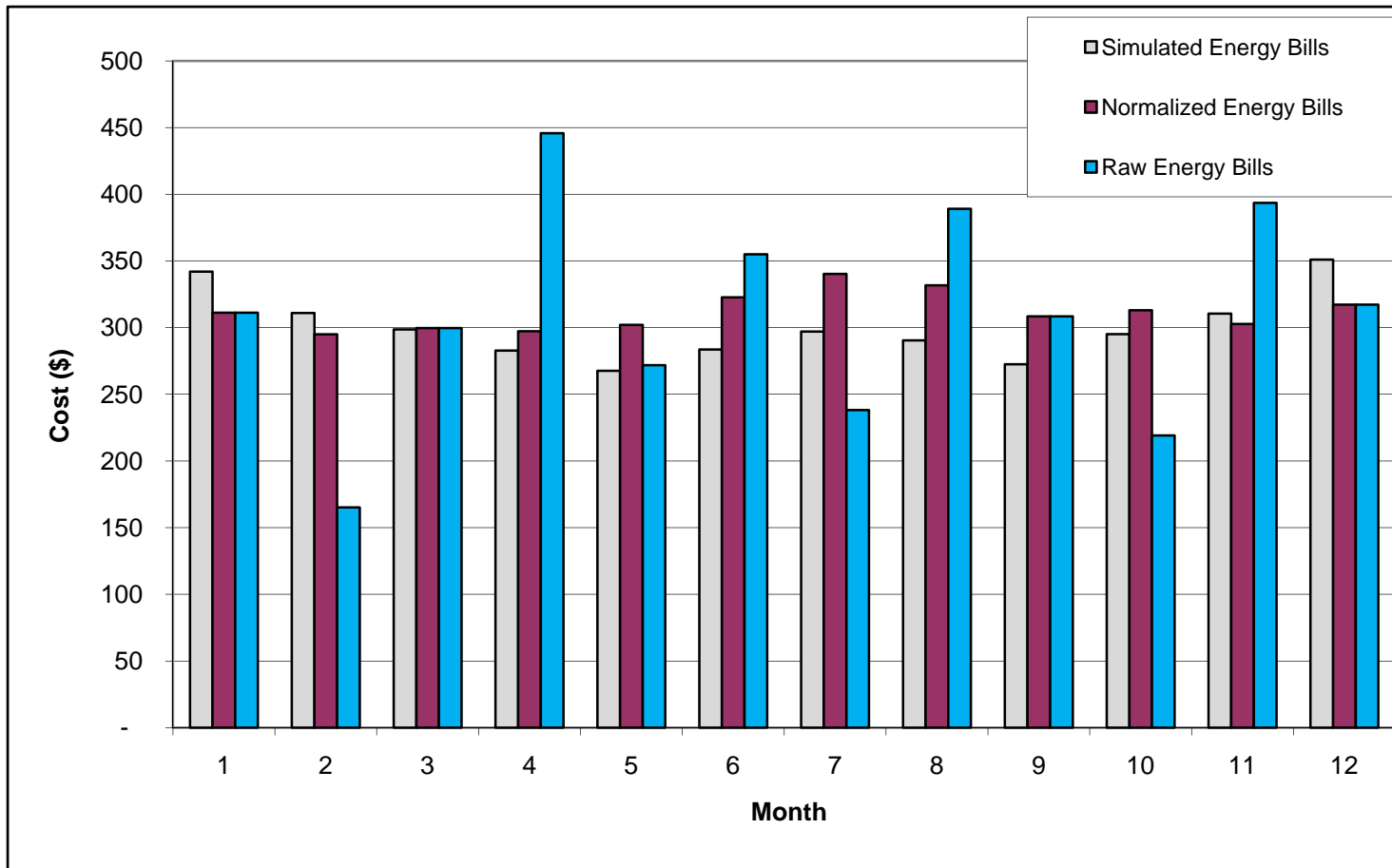
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# Example Energy Costs



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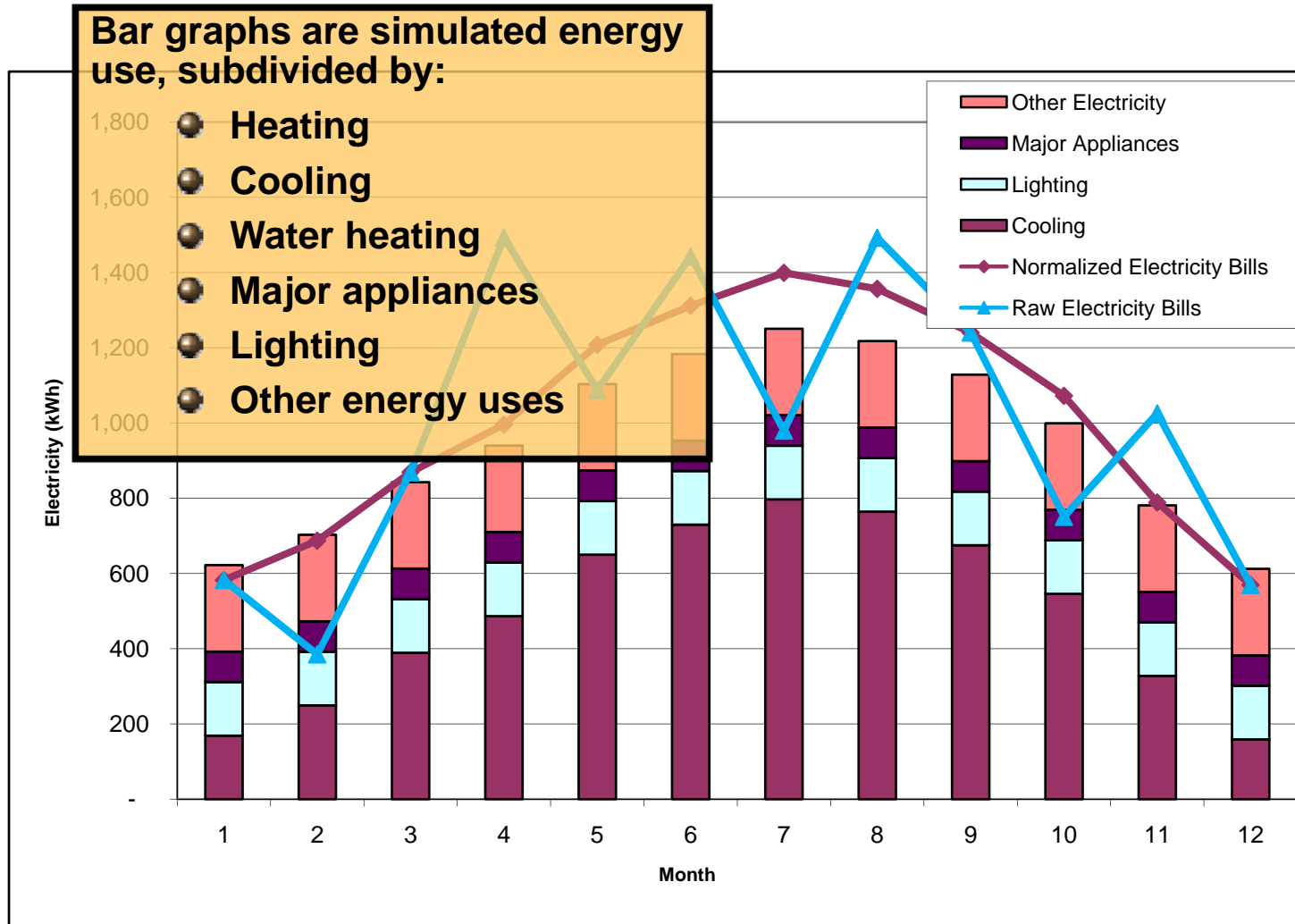
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# Example Electricity Usage



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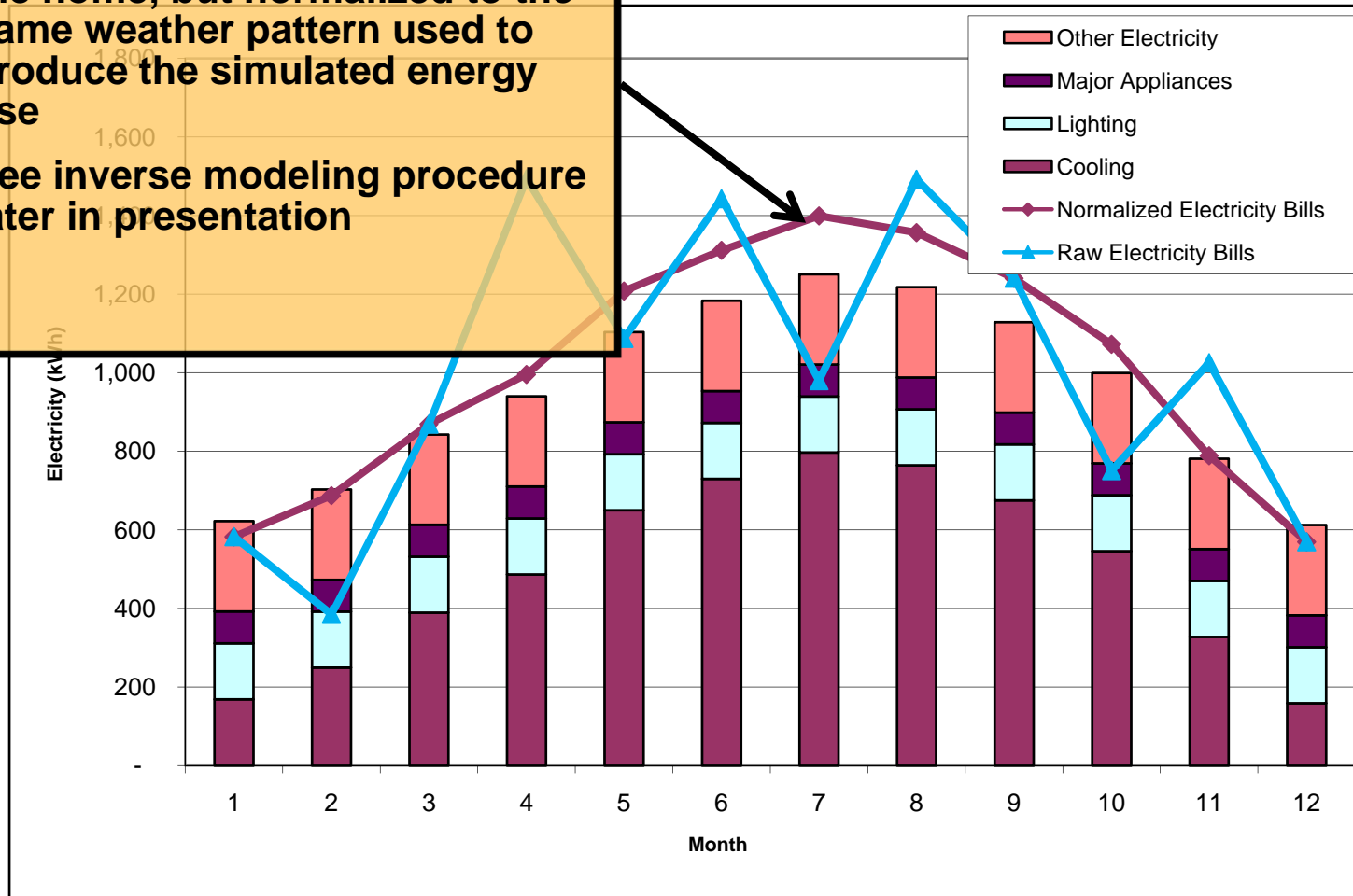


# Example Electricity Usage



The magenta line demonstrates the actual historic energy use of the home, but normalized to the same weather pattern used to produce the simulated energy use

See inverse modeling procedure later in presentation



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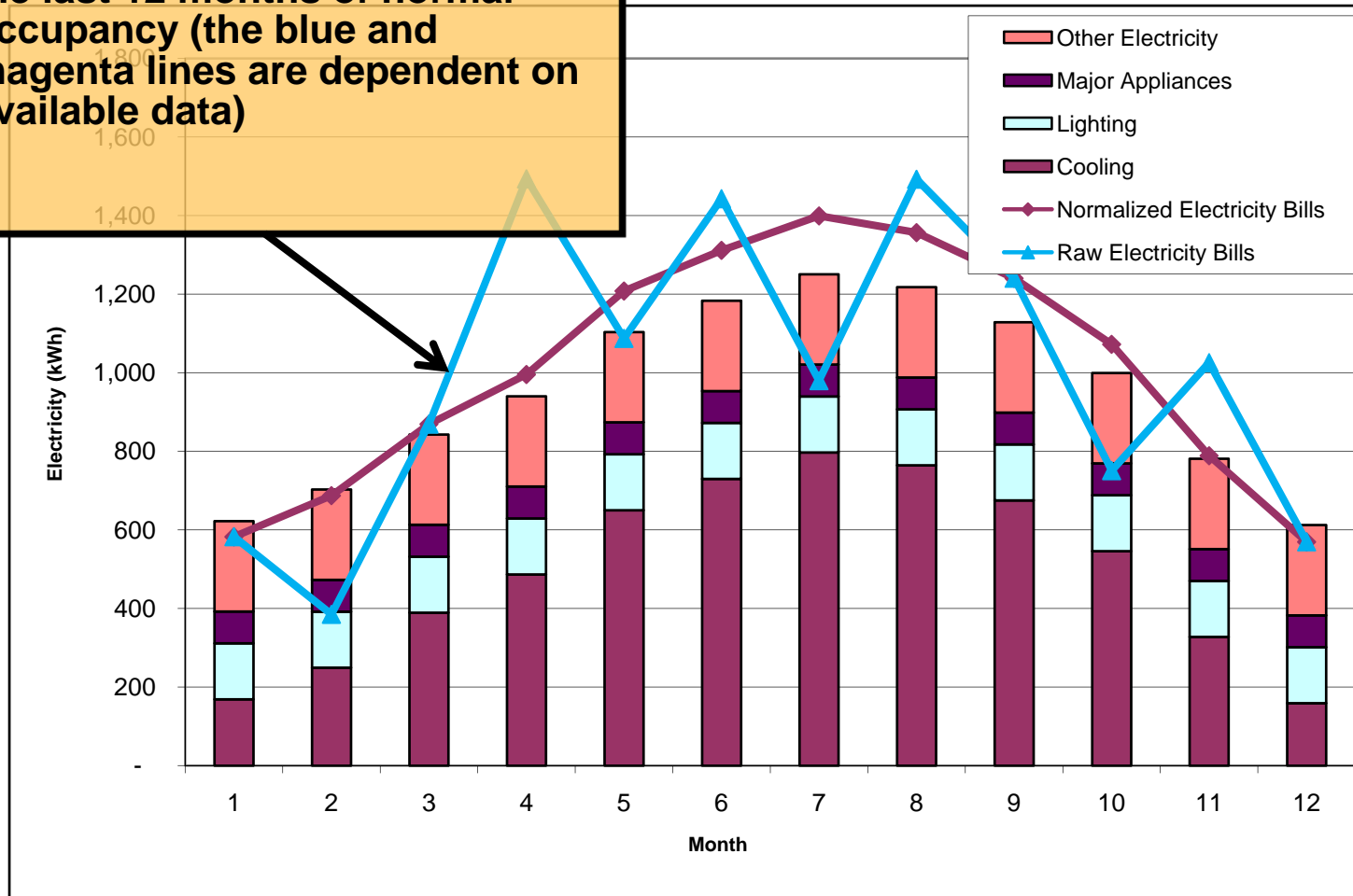
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# Example Electricity Usage



The blue line tracks the actual energy usage of the home over the last 12 months of normal occupancy (the blue and magenta lines are dependent on available data)



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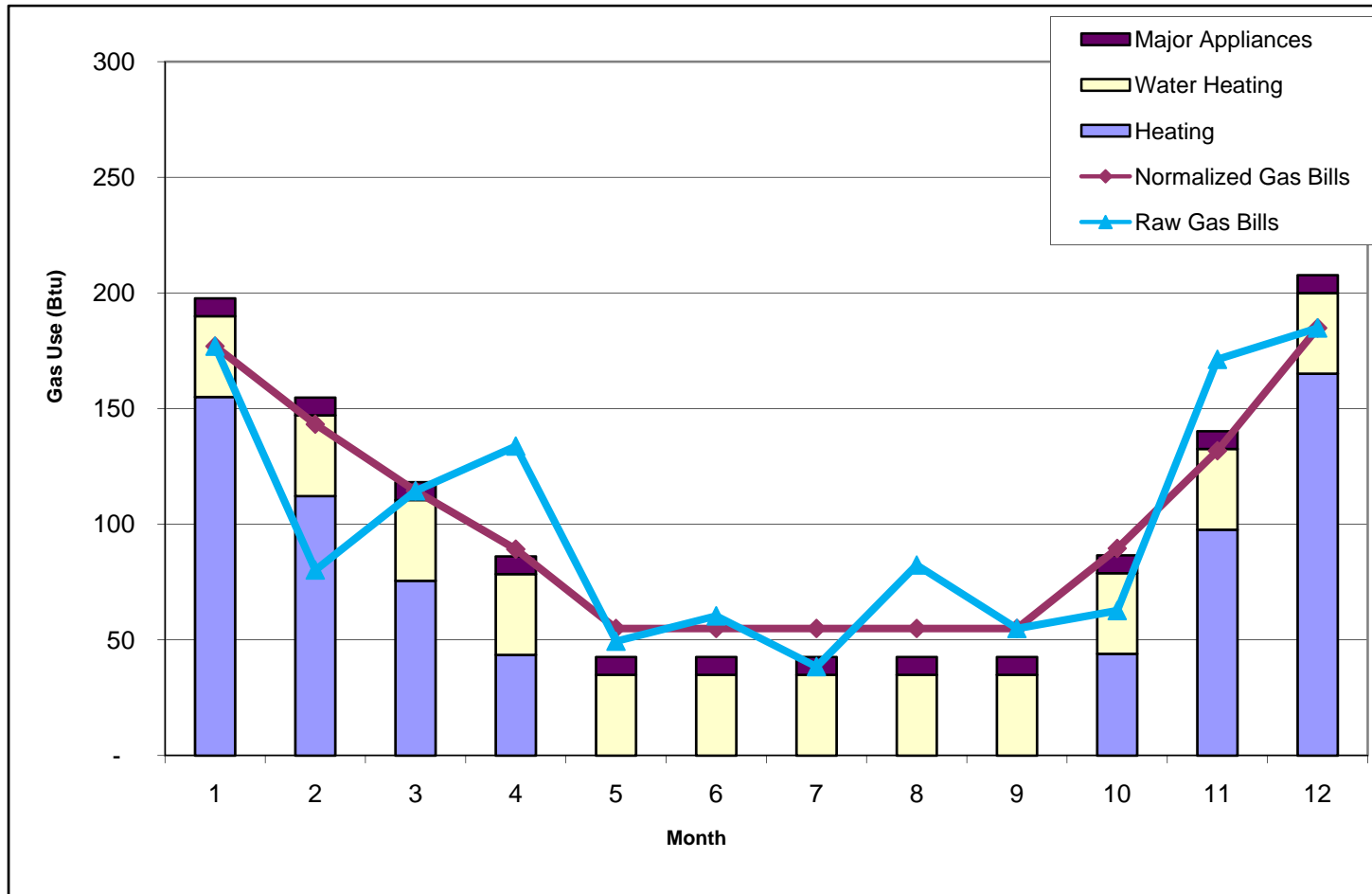
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# Example Gas Usage



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# The Standard and Custom Approaches



- The HERS system shall have the capability to generate recommendations using both a **Standard Approach** and a **Custom Approach**
- Approved HERS systems shall be able to accommodate both approaches. However, the Standard Approach is mandatory for every rating and the Custom Approach is optional
- The Standard Approach will result in the same set of recommendations, no matter who does the rating or which HERS system is used
- The Custom Approach allows for consideration of unique homeowner circumstances, such as operating practices and available financing

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# Recommendation Report Shall Include



- **A descriptive list of the cost-effective recommendations for energy efficiency improvements**
- **The cumulative projected annual energy bill savings of implementing each successive component of the recommended energy efficiency improvements**
- **For Rating reports, the expected California HERS Index reduction for each successive energy efficiency improvement**

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# Optional Custom Approach Recommendations



- **The rater may customize the inputs into the model to fit the particular behavioral patterns of homeowners**
- **The analysis can also be customized to use cost data for implementing measures more precisely tailored to the home**
- **The optional recommendations reports shall include details as needed to disclose the non-standard assumptions that are the basis of the recommendations**

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# Sample Home Energy Audit Certificate



## California Home Energy Audit Certificate

### Energy Impact

#### Greenhouse Gas Emissions

Carbon Dioxide      xxx  
tons/year

#### Energy Consumption

Electricity (kWh/year)  
Cooling                      —  
Lights                        —  
Appliances                —  
Total                          —

Natural Gas (therms/year)

Space Heating            —  
Water Heating            —  
Total                          —

#### Operating Cost (\$/year)

Electricity                —  
Gas                         —  
Total                        —

#### Renewable Energy Production

None



Official Home Energy Audit  
in conformance with the  
requirements of the  
California Energy Commission  
[www.energy.ca.gov](http://www.energy.ca.gov)

### Site Information

#### Address

123 Jones Street  
Anywhere, California 9410x

#### General Information

Conditioned Floor Area    2,200 ft<sup>2</sup>  
Conditioned Volume       16,000 ft<sup>3</sup>  
Bedrooms                    4  
House Type                  Single Family  
Foundation Type           Slab-on-Grade

### Energy Efficiency Features

#### Insulation

Ceiling                      R-38  
Wall                          R-19  
Floor over crawlspace    R-19  
Slab Edge                   R-7

#### Windows

Frame                        Alum. Clad Wood  
Glazing                      Double low-e

#### Heating System

Condensing gas furnace, 0.92 AFUE  
Sealed air distribution ducts

#### Cooling System

None

#### Ventilation System

None

#### Water Heating System

Gas storage type, 0.62 EF  
ICS solar system

Energy Auditor Signature

Date: \_\_\_\_\_

Information  
goes here on  
compliance  
with other  
programs

HERS Provider  
and/or Sponsor  
Co-Branding  
Logos Go Here

Qualifying  
Information  
Goes Here

#### HERS Provider

Acme Energy Rated Homes  
834 Energy Efficient Way  
Power Junction, California  
[www.AcmeEnergyRatedHomes.com](http://www.AcmeEnergyRatedHomes.com)

#### Rating Information

Rating Number      xxxx-yyyy  
Certified Rater      EEH, Inc.  
                             Stockton, CA  
Rating Date          January dd, yyyy

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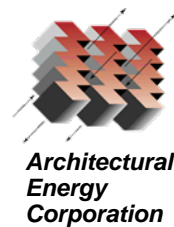
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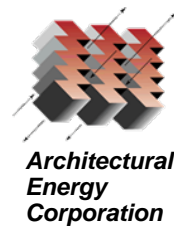




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- **Field Verification Ratings for Title 24 compliance**
- **Whole-House Home Energy Ratings produce a rating score (Home Energy Audits are a subset)**

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# The California Home Energy Rating Process



1. Inspection of the existing conditions of the home's energy-related features
2. Analysis of the energy impact of those features
3. Identification of potential energy efficiency improvements for that home
4. Evaluation of the cost effectiveness of each improvement
5. Recommendations to the homeowner of the cost effective improvements
6. Designation of a rating of the comparative energy efficiency of the home
7. Production of a label that communicates the rating

Energy Audit

Whole-House Home Energy Rating

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# The Oversight Role of HERS Providers



- **The CEC relies on HERS providers to train, test, and certify raters and to provide quality assurance**
- **HERS providers must maintain an arms-length relationship with the raters, auditors, and other entities that they certify and oversee to avoid conflicts of interest**
- **Each provider must assign a Quality Assurance Manager and Quality Assurance Reviewers to oversee the quality assurance processes**
- **There are presently three CEC certified providers in California: CHEERS, CalCERTS, and CBPCA**

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# Subordinate Roles Working Under a Whole-House Home Energy Rater



- **California Whole-House Home Energy Raters can complete the entire rating process by themselves**
- **Alternatively, they can use individuals serving two possible specialized roles to complete the process**
  - **Home Energy Inspectors collect data on the condition of a home and its energy related features**
  - **Home Energy Analysts model the energy usage of a home based on construction documentation or site verification by the Whole-House Home Energy Rater**
- **These specialists are required to be trained on the specifics of their duties and certified by a HERS Provider**

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# Primary Quality Assurance Tools



- **Raters must be “independent entities” – defined as having no “financial interest” – with the contractors who perform energy efficiency improvements on a home or the builder and contractors of a newly constructed home**
- **1% of all ratings received by a provider will be repeated by a provider’s Quality Assurance Reviewers to ensure that the original rating was performed properly**
- **In addition, each rater shall have the greater of one home or 1% of all of the rater’s ratings field checked each year by the provider’s quality assurance process**
- **For untested homes in field verification and diagnostic testing sample groups, a minimum of the larger of one home or 1% for each rater shall be field verified by the provider through a quality assurance check**

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# Building Performance Contractors



- **The Building Performance Contractor must be certified as a California Whole-House Home Energy Rater**
- **The Building Performance Contractor is permitted to both rate homes and perform contracting work on the home to improve its energy efficiency**
- **The Building Performance Contractor must comply with heightened disclosure and quality assurance procedures to protect consumers**

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# Heightened Quality Assurance Procedures for Building Performance Contractors



- **The Building Performance Contractor shall disclose to the consumer:**
  - **That the rater of the home has a financial interest in the work being performed**
  - **When measures are being recommended for reasons other than energy efficiency, such as safety or comfort**
  - **Why Standard Approach rating recommendations were not implemented**
- **Twelve months after implementation of improvements, complete a post-retrofit utility bill analysis that analyzes the actual energy savings realized in the home**
- **The provider shall conduct quality assurance checks on 5% of all homes rather than the standard 1% of quality assurance checks that apply to other ratings**

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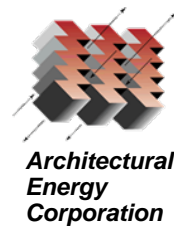




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# Recommended California HERS Index



$$\text{HERS Index} = \frac{\text{TDV}_{\text{Rated}} - \text{TDV}_{\text{PV}}}{\text{TDV}_{\text{Reference}}} \times 100$$

## ● What's included

- Traditional uses of heating, cooling, and water heating are already produced by compliance software
- Lighting and appliances energy as determined through the recommended model
- Exterior Lighting attached to the building
- PV system production – Allows for a HERS Index = 0

## ● What's not included (examples)

- Pools
- Spas
- Lighted sports courts
- Well pumps

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# Onsite Photovoltaic (PV) Production



- **The benefit of onsite renewable energy generation systems shall be accounted for in the rating**
- **Calculations of PV production shall be determined on an hourly basis using the CECPV calculator described in the 2008 Residential ACM Approval Manual, Appendix B**

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# Adjustments for House Size



- **If the conditioned floor area of the rated home is larger than 2,500 ft<sup>2</sup>, the TDV energy of the reference home shall be based on a 2,500 ft<sup>2</sup> home**
  - **Growing concern with the unnecessary energy consumption resulting from large homes**
  - **LEED for Homes recognizes home size in setting targets and penalizes homes larger than 2,600 ft<sup>2</sup> (four bedrooms)**
  - **2,500 square feet is one standard deviation (780 ft<sup>2</sup>) above the average size single family home in the state (1,780 ft<sup>2</sup>) according to the RASS dataset**
  - **Local ordinances for newly constructed homes have established caps for homes of 3,500 ft<sup>2</sup>**

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# Greenhouse Gas Emissions Associated with Energy Consumption



- **Emissions shall be calculated hourly based on estimates of electricity and gas consumption**
- **Emission rates shall be taken from the Time Dependent Valued (TDV) hourly files used for the Building Energy Efficiency Standards**

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# ACM Modeling Rules



**The modeling rules and assumptions specified in Chapter 3 of the 2008 Residential Alternative Calculation Method (ACM) Approval Manual shall be used to calculate the TDV Energy for the rated home and the reference home, except as otherwise stated in the HERS Technical Manual**

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# Reference Home Definition



- **The reference home is a building similar to the rated home, but one which is modified to just meet the requirements of the 2008 California Building Energy Efficiency Standards, and other specifications of the HERS Technical Manual**
- **The process of reference home generation shall not be accessible to program users for modification when the program is used for rating purposes or when HERS reports are generated**
- **The fixed and restricted modeling assumptions apply to both the reference home and to the rated home. The standard fixed and restricted modeling assumptions always apply to the reference home and are the default for the rated home**

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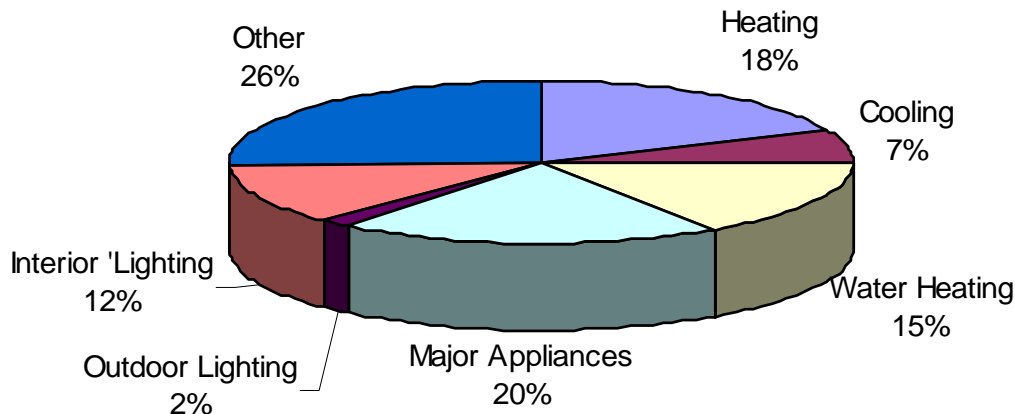




# Lighting and Appliance Energy



- **California Standards compliance calculations include only space heating, cooling and water heating energy**
- **Lighting and other appliance energy use is regulated through mandatory requirements, but not included in the performance standard.**
- **For HERS ratings, lighting and appliance energy shall be included**



## Average Single Family Source Energy Use

**Note: These data represent average source energy use for existing homes in California, many of which are near the coast with low cooling loads.**

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# Internal Load Schedules



- **Used HMG 1999 “Lighting Efficiency Technology Report” for lighting schedule**
- **Used constant schedule for refrigerator**
- **Used Building America miscellaneous schedule for remaining equipment load**
- **Adjusted occupant load schedule to account for activity level – less heat gain while sleeping and more while active**
- **Reference home and rated home use the same schedules**

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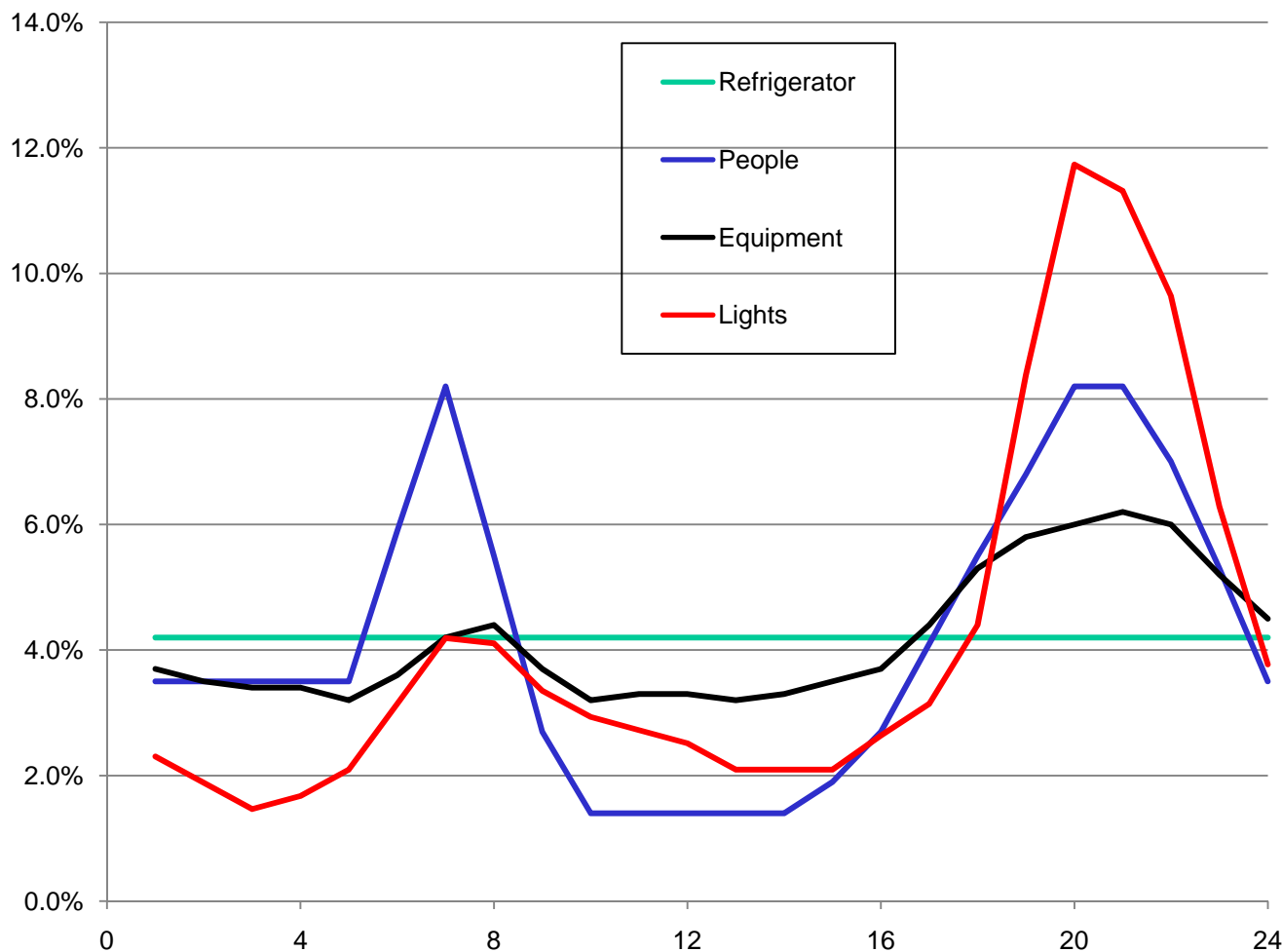
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# Schedules for Lights, Appliances, People, and Equipment



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# Equipment Energy Use



- **Most plug in equipment moves with the occupants: TVs, home theater equipment, computers, stereos, water beds, clothes washers, and dryers**
- **HERS Equipment Energy use is estimated based on RASS survey of existing homes**
- **Reference home refrigerator, dishwasher, and range/oven based on current Appliance Standards**
- **Rated home refrigerator based on RASS if efficiency cannot be determined**
- **Location and type of equipment determines if energy use contributes to internal load for heating and cooling**

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# Changes to HERS Index for Equipment



## Lower Energy use and HERS Index:

- Energy efficient refrigerator in rated home
- Energy efficient dishwasher in rated home

## Higher Energy Use and HERS Index:

- Second refrigerator or standalone freezer
- Range/Oven with continuously burning pilot lights

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- **Most plug-in lamps move with the occupants**
- **Lighting energy use is based on RASS estimate**
- **Operating hours is a function of room type - Lights in kitchens are on more hours than bedrooms**
- **Reference home assumes compliance with 2008 Building Energy Efficiency Standards requirements for hardwired fixtures with high efficacy lighting for some rooms and incandescent with specific controls in other rooms**
- **Rated home accounts for number of high efficacy hardwired fixtures and controls**

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# Indoor Lighting Savings



- **Hardwired high efficacy fixture uses 33% of the energy use of a hardwired incandescent fixture**
- **A screw-in compact fluorescent lamp in a hardwired fixture uses 67% of the energy use of a hardwired incandescent fixture**
- **Hardwired incandescent fixture with a dimming control uses 90% of the normal incandescent energy use**
- **Hardwired incandescent fixture with an occupant sensor uses 80% of the normal incandescent energy use**

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# Ancillary Energy Uses



- **Ancillary energy use is for items such as swimming pools, spas, lighted tennis courts, shops in adjacent buildings, well water pumps, and well water treatment systems**
- **Ancillary energy uses are to be excluded from the California HERS Index**
- **However, they shall be included in the estimate of simulated energy use for energy bill and cost effectiveness analysis**

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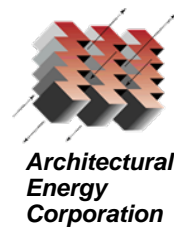
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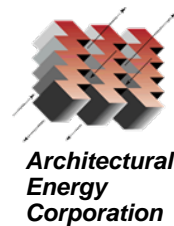
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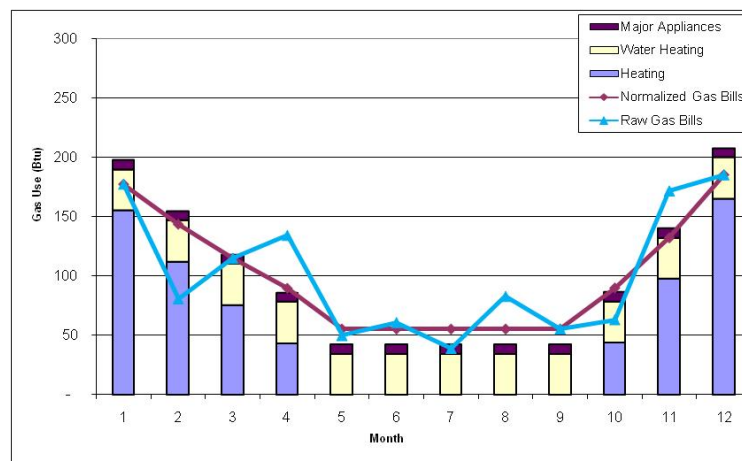
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# Cross Checking Energy Savings Against Utility Bills



- **Lifestyle and behavioral issues greatly affect energy consumption**
- **Energy consumption predicted by the energy models will often be greater or less than actual energy consumption, as indicated by the utility bills**
- **California HERS tools are required to have the capability of normalizing the utility bills to typical weather data represented by the CEC climate files so that utility data may be compared more reasonably to the models**
- **The overall rating report will include graphical representations of energy consumption in the home. There will be graphs of monthly energy costs, electricity use, and gas use**



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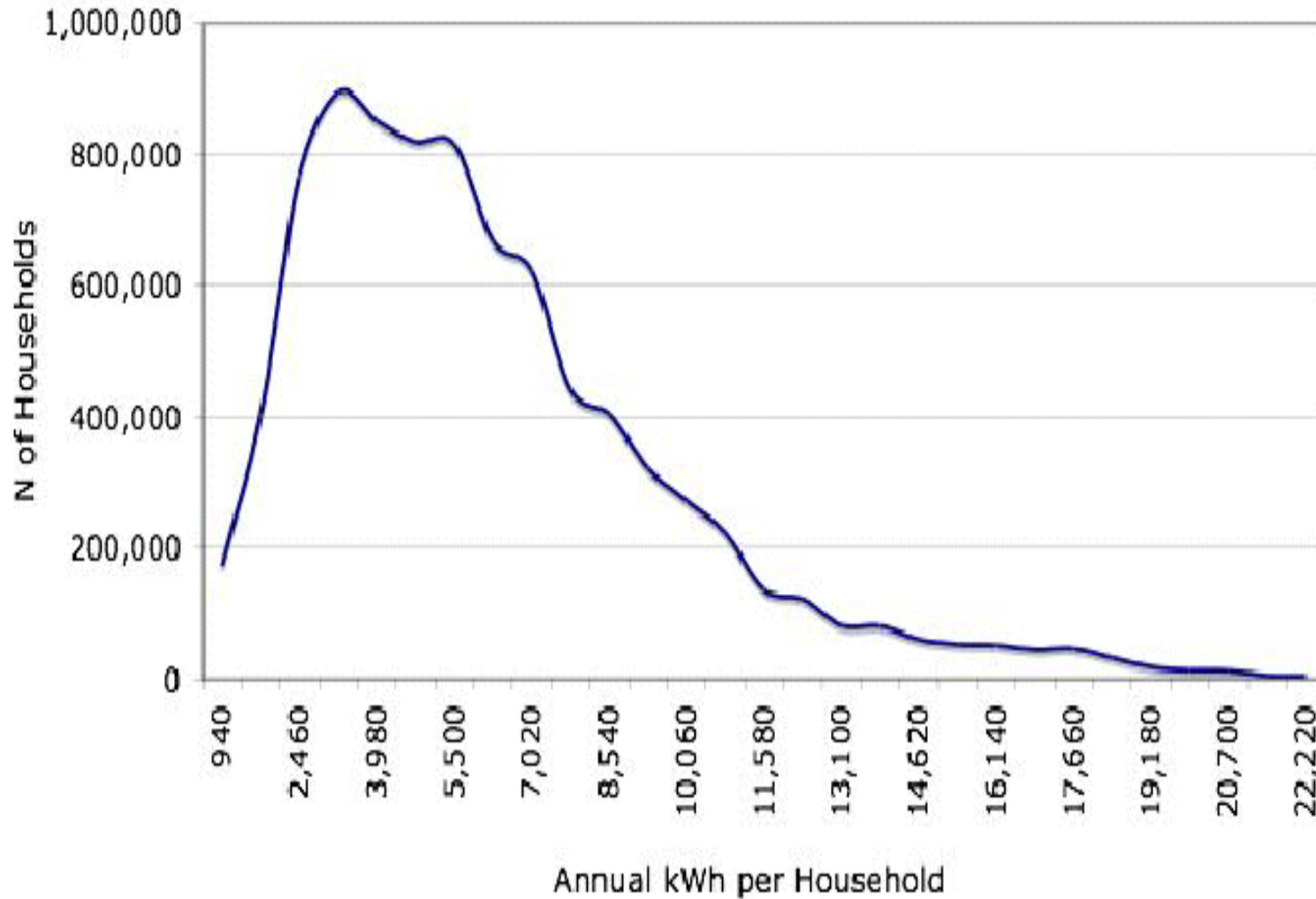
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# Distribution of California Residential Electricity Consumption



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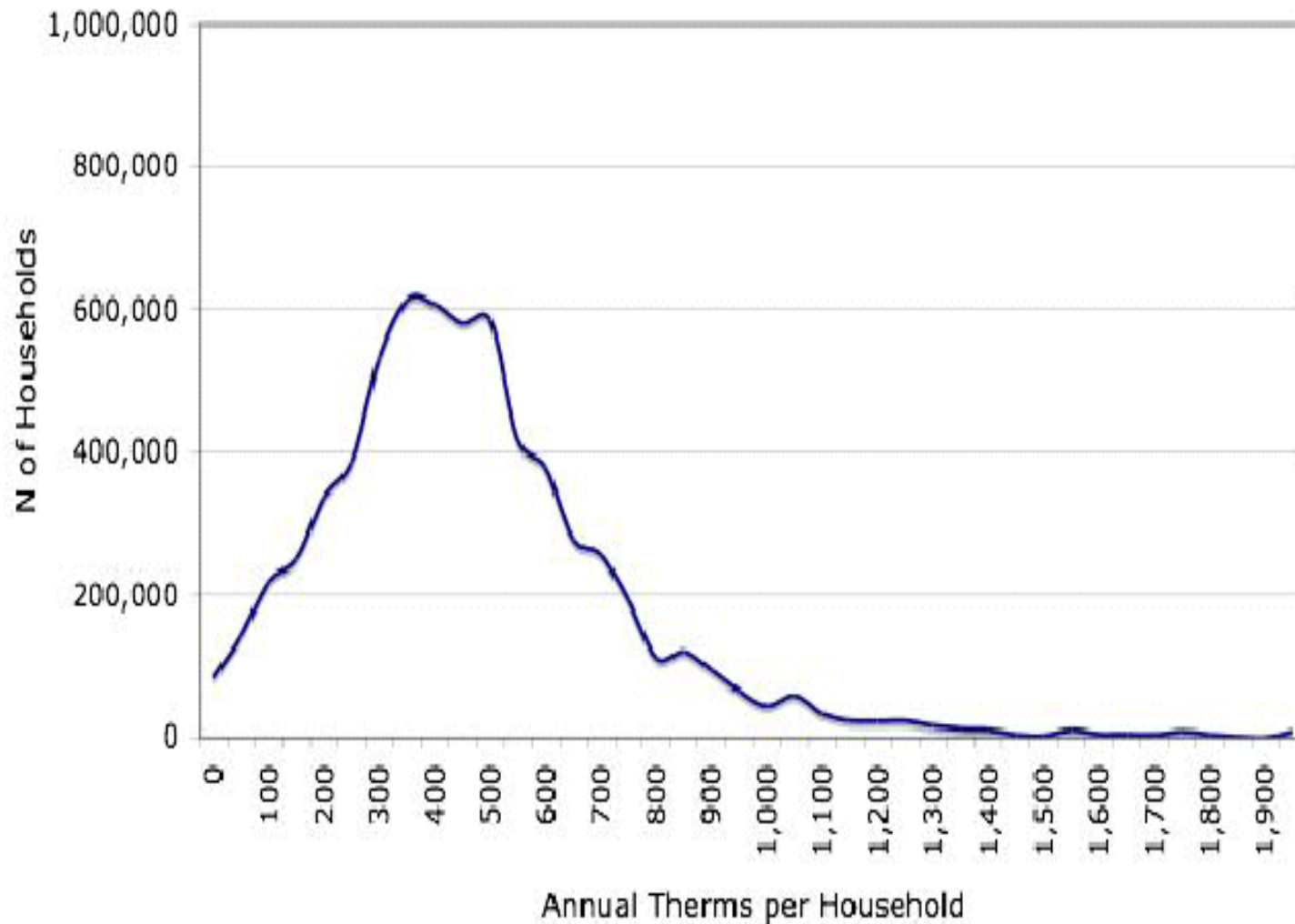
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# Distribution of California Residential Natural Gas Consumption



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# Inverse Modeling



- **Utility bills shall be analyzed to make it possible to compare them with energy simulations and to break out gas and electric uses as a function of outside temperature**
- **The utility bill analysis shall be based on ASHRAE Research Paper 1050, “Inverse Modeling Toolkit: Numerical Algorithms”**
- **The independent variable shall be outside temperature**

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# Utility Website Bill Disaggregation Alternative



- **Utilities often offer information about expected utility bills on their website using bill disaggregation methods**
- **HERS providers may use information from these utility programs when available instead of the inverse modeling procedures**

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# Post-Retrofit Utility Bill Analysis



- **The modeling software will permit providers and raters to analyze the energy consumption of the home following the implementation of efficiency improvements to assess whether actual energy savings have been realized**
- **This approach standardizes energy consumption patterns before and after the improvements to the same weather period so that a direct “apples to apples” comparison of energy usage can be made**
- **Such a report will not be produced as a part of a rating report for a home but can be provided as an optional service by the rater 12 months after a retrofit**
- **This process is required for programs using Building Performance Contractors 12 months after a retrofit**

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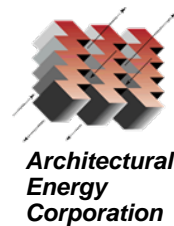
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# Rating Recommendations

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# Background on Rating Recommendations



**The Public Resources Code (§25942) specifies that statewide home energy rating programs shall include “reasonable estimates of potential utility bill savings and reliable recommendations on cost effective measures to improve energy efficiency”**

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# The Standard and Custom Approaches



- The HERS system shall have the capability to generate recommendations using both a **Standard Approach** and a **Custom Approach**
- Approved HERS systems shall be able to accommodate both approaches, however, the Standard Approach is mandatory for every rating and the Custom Approach is optional
- The Standard Approach will result in the same set of recommendations, no matter who does the rating or which HERS system is used

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# Rolling Basecase Method-Standard Approach



- **Start with the home in its present condition (the initial basecase)**
- **Evaluate all possible measures in all categories and rank measures in terms of benefit-to-cost ratio**
- **Add the top measure to the home and begin the process anew (this is the new basecase)**
- **Repeat the process until the next measure increases the life-cycle cost above the original basecase**

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## Standard Approach

**The list of recommendations shall include all measures that are cost effective, considering the interactions between the measures**

## Custom Approach

**The Custom Approach may use any of the following methods:**

- ***Fixed Budget.*** Achieve the greatest energy savings for a given cost
- ***Minimum Level of Performance.*** Bring the house up to some specified level of energy performance at the least cost
- ***Customer Identified Measures.*** Homeowners may propose one or more measures they prefer

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# Determining Cost Effectiveness of Energy Efficiency Measures



## Standard Approach

**Determine cost effectiveness of measures using the method used for the 2008 Building Energy Efficiency Standards**

## Custom Approach

**Consider cost-effectiveness from the perspective of the homeowner or investor, including: mortgages or other financing programs**

**Each homeowner's individual tax bracket and mortgage rate may be considered**

**Non-energy benefits (such as thermal comfort, indoor air quality, and acoustics) may also be considered in making recommendations**

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## Standard Approach

**CEC adopted forecasts of energy costs are incorporated in Title 24 method of determining cost- effectiveness**

## Custom Approach

**Use the utility rates in effect for each home that is rated or the most common rate for the area if the utility account is not active**

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## Standard Approach

**Use all modeling assumptions as specified in the HERS Technical Manual (same assumptions used to determine the California HERS Index)**

**Exception: Do not assume air conditioning for homes that do not have it**

## Custom Approach

**The rater may modify certain modeling assumptions to approximate the specific occupant patterns of the rated house, considering factors such as:**

- **Thermostat schedules**
- **Intermittent occupancy**
- **Presence of special energy using equipment**
- **Lifestyle patterns**

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# Measures and Costs that Affect the Rating Recommendations



## Standard Approach

**All HERS providers and raters shall use the same database of energy efficiency measures and costs**

## Custom Approach

**Raters may modify measure costs and add additional measures to address the field conditions of a particular home**

**Alternate costs and measures shall be reported to the provider. Such costs shall be considered when the standard database is periodically updated in collaboration with the Energy Commission**

**The HERS provider shall approve the use of alternate measures**

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# Categories of Measures to be Considered



## ● Building Envelope

- Attic insulation
- Wall insulation
- Window replacement
- Building envelope sealing
- Awnings, trellises, or other shading devices

## ● Lighting

- Energy efficient luminaires
- Screw in CFLs
- Automatic controls

## ● HVAC

- Equipment replacement
- Verification of charge, air flow and fan watt draw
- Duct sealing and insulation

## ● Water Heating

- Equipment replacement
- Controls
- Solar

## ● Appliances

- Refrigerator
- Dishwasher

## ● Photovoltaic Systems

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# Requirements for HERS Providers to Maintain Cost Database



- **The starting point for the database shall be the Database for Energy Efficient Resources (D.E.E.R.)**
- **HERS providers shall have primary responsibility for maintaining and updating the databases**
- **Data provided by HERS raters using the Custom Approach shall serve as the basis of updating the cost data**
- **Data would be periodically updated**
- **The providers shall collaborate with Commission staff to cross review costs for measures from different providers and reconcile differences for updating of the standard database**

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# Measures and Costs that Do Not Affect the California HERS Index



## Standard Approach

**Standard recommendations shall be provided based on the presence of energy using systems or equipment that are not considered in the California HERS Index, such as pools, spas, well pumps, lighted courts**

**These standard recommendations are based on good practice and/or low or no cost measures**

## Custom Approach

**The rater, using methods approved by the provider, may evaluate the cost-effectiveness of specific measures to improve the energy efficiency of swimming pools, spas, well pumps, and other energy uses not considered in the California HERS Index**

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# Comparison of Energy Bills to Building Simulation



## Standard Approach

**Rater is expected to collect utility bill data. If utility bill data is unavailable, then the rater should disclose why it is not available**

**When data is available, utility bills shall be analyzed using Inverse Modeling and normalized for the standard CEC weather data. The normalized results shall be compared with the simulated results and presented as one of the HERS reports**

**HERS providers may use information from utility web-based bill disaggregation programs instead of the inverse modeling procedures**

## Custom Approach

**Same requirements as the Standard Approach, except that results of the inverse modeling may be used to “calibrate” the model (see Modeling Assumptions above)**

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# Qualifying the Recommendations



**The recommendations in this report are based on the following assumptions:**

- **Cost-effectiveness method**
- **Determining cost-effectiveness of energy efficiency measures**
- **Utility rates**
- **Modeling assumptions**
- **Measures and costs that affect the California HERS Index**
- **Measures and costs that do not affect the California HERS Index**

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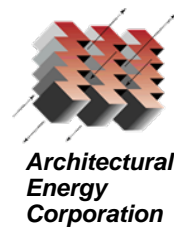
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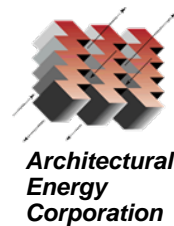
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# What's Next

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# Estimated Schedule for HERS Regulations



- **Committee Workshop Comments Due to CEC**
  - **August 25, 2008**
- **Release of Proposed Regulations**
  - **Early October 2008**
- **Committee Hearing on Proposed Regulations**
  - **Late October 2008**
- **Commission Adoption of Final Proposed Regulations**
  - **Mid-December 2008**
- **Anticipated Regulations Effective Date**
  - **July 1, 2009**

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