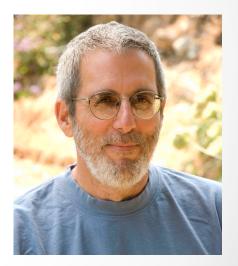
Whole House HERS Ratings (and Raters)

Steve Mann, Home Energy Services

Res CEA, Non-Res CEPE, HERS Rater CalCERTS QA Rater/Certified Instructor, LEED AP+ Homes Certified Passive House Consultant and Builder





Whole House HERS Ratings

- Overview and Background
- Whole House Audit/Rating Details
- Program-specific Applications
 - Energy Upgrade California (EUC)
 - Energy Efficient Mortgages (EEM)
- Title 24 Performance Modeling
 - 2013 Existing + Addition + Alterations (E+A+A)
- Scope: Low-rise Residential



Whole House Ratings & Audits

- Whole House Home Energy Rating
 - Calibrated comparison of different real estate properties
 - Official rating report CA HERS Index (based on TDV)
- Whole House Home Energy Audit
 - Analysis/recommendations/efficiency improvements
- CEC-defined process not tied to Title 24, Part 6 code cycle
- Requires specially-trained HERS rater: Whole House Rater



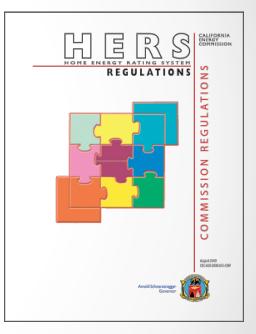
Purposes

- "Consistent, accurate, and uniform ratings"
- "Reasonable estimates of potential utility bill savings"
- "Reliable recommendations on cost-effective measures to improve energy efficiency"



Legislative Sources

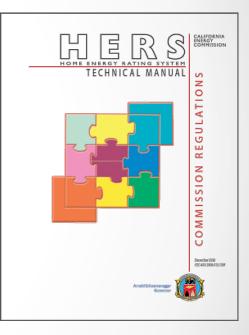
- Home Energy Rating System Regulations
- CEC-400-2008-011.CMF
- Part of Title 20, Part 4
- Administrative code: definitions, provider requirements, training content, rater conduct, conflict of interest, registry policies, records retention, QA, software approval process





Legislative Sources

- Home Energy Rating System Technical Manual
- CEC-400-2008-012.CMF
- Report formats, algorithms, modeling rules and assumptions, data inputs
- Software/registry requirements
- Calculations are different than Title 24 Part 6





Why Should You Care?

- Energy Upgrade California Calculations (EUC Rater)
- Energy Efficient Mortgage (EEM) documentation
- Voluntary Home Energy Audits/Home Energy Ratings
- Whole House Raters are required to do the visual verifications for 2013 Energy Code E+A+A compliance credit/permitting



The Participants

- Homeowners
- Whole House Energy Raters
- Program managers/IOUs (EUC)
- Financial institutions (EEMs)
- Energy consultants/building departments (E+A+A)
- CalCERTS: training/certification, registry, HERS Index reporting
- Building Performance Contractors (BPCs)



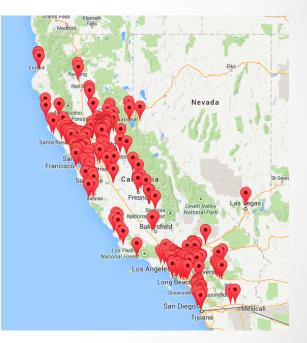
Whole House Rater Training

- HERS Basics (1 day)
- Hands-on Lab (2 days)
- Alterations to Existing Homes (Title 24-specific, 1 day)
- EPA 608 Refrigeration Technician (Type II) certification
- Newly Constructed Homes (Title 24-specific, 2 days)
- Compliance Rater Field House Exam (2 hours)
- Whole House Home Energy Rater (4 days)
- Whole House Rater Field House Exam (2 hours)



Where Are They?

- There are currently about 275 Whole House Raters in California
- Look them up by type of rater, city, county, or zip code at www.calcerts.com





Whole House Rater Rules (Title 20)

- Conflict of interest requirements
 - Independent from providers, contractors
 - Relaxed for BPCs they can make recommended changes
- Rules of conduct
 - Provide true, accurate, complete information
- Quality assurance process
 - 1% of the addresses per year
- Complaint response system/decertification



Whole House Rating





Whole House Rating

- Focus comparing properties using a universal metric, HERS Index
- Collect utility bills 12 months (optional but useful)
- Site visit is <u>required</u> to verify existing conditions
- Modeling using approved compliance software
 - EnergyPro 5.x + Res CalCerts module
- Create XML file for upload to project in CalCerts registry
- Create official HERS reports from registry
- Can only be done by Whole House Rater



Whole House Rating Site Visit

- Floor plan sketch w/dimensions
- Fenestration types, sizes, use Title 24 default values
- Building assemblies types, square footages, insulation values
- Appliances types, model #s, age (default efficiencies)
- Lighting types, location, controls
- Heating, cooling types, model #s, efficiencies, capacities
- Water heating type, efficiencies
- Blower door, duct test (optional)



Whole House Rating Modeling

- Reference house 2008 Energy Code Standard Design
- Includes more than just heating/cooling/DHW
- Calculations based on TDV kBTU/SF/yr
- Static evaluation of a building
- Index of 100 == 2008 code built house, lower is more efficient

Res CalCERTS														
Calculation	Heating	Cooling	Int Light	Ext Light	Appliances	Misc	Renew	Fans	DHW Pump	DHW	Exterior	Total	HERS Index	Savings
Reference Home	22.46	22.86	7.68	0.55	28.92	0.00	0.00	7.00	0.00	24.70	0.00	114.17	100	\$0
Rated Home	39.28	56.14	6.14	0.61	20.08	0.00	0.00	18.03	0.45	28.05	0.00	168.76	148	\$0



Whole House Rating Reports

- Rating Certificate property info, EE features, utility consumption, HERS Index
- Data Summary similar to 2008 CF-1R
- Utility Consumption Analysis kWh, Therms, \$
- Key piece of information is the HERS Index energy efficiency analysis of home related to 2008 CA Energy Code
- CA HERS Index vs. HERS Index



Whole House

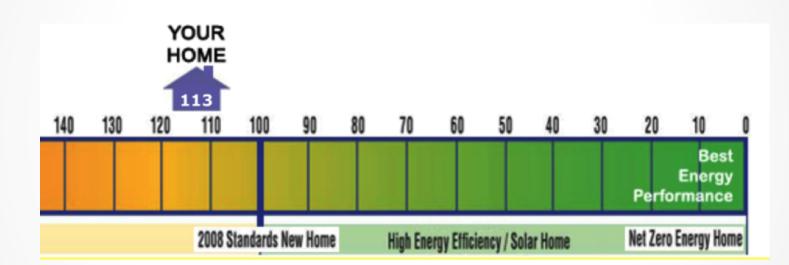
Rating

Certificate

			YOUR										
			1112										
250 240 230 220 210 200	190 180 170 160 150 140	13	0 120 110	100	90	80	70	60	50	40	30	20	10 0
Poor													Best
Energy													Energy
Performance												Perfo	rmance
Ra	nge for typical existing home 101 –250		2008 St	andards N	ew Home	ł	High Energ	gy Efficien	ncy / Sola	ar Home		Net Zero	Energy Home
Information on Compliance With	Energy Impact		Site Informat	ion			Offic	cial H	ome	Energ	y Rat	ting	
Other Programs:	Greenhouse Gas Emissions CO ₂ = 3.86 tons/year		Address 1301 Bidwell				in co Calif	nform	nance Energ	with t y Com		quirem	ents of th
	Energy Consumption		Folsom, CA 9					of CALIFORD	gy.ca.	.yov			
Over lifeting a Testamore Minan	Electricity (kWh/year)		General Infor	matio	n		Y	2.3	Y				
Qualifying Information: BPC NOT AUTHORIZED		503	Conditioned Floor Area		1,1	L84 ft ²		YA .	N.				
	Water Heating	0	Bedrooms			2	Chille and	T COMMITTE	B				
Software estimates are based on cypical occupancy patterns which		523	House Type		Single								
may be different from your house-	Appliances 2,9 Total 4,9	992	Foundation Ty	pe		ab on Grade							
hold use patterns. As a result, these	rotar 4,9		Energy Efficie	ncy F				latoma		uite 1	20		
software estimates may not match the household's energy actual	Natural Gas (therms/year)		Insulation					om, C					
consumption. Occupant's energy		155	Ceiling			R-30	916-			14			
use patterns may change after energy efficiency upgrades.	Cooling Water Heating 1	0 194	Wall			R-13	www	.calce	erts.co	m			
energy eniciency upgrades.	Lights	0	Floor Over C	rawlsp	ace		Rati	na In	form	ation			
		17	Slab Edge			lone, 0		ng Nu				79884	7021
	Total 3	366	Windows				Ener	gyPro			1.9.1		
			SHGC U-Factor		3, 0.67 6, 0.84			ified R	Rater:	Jo	hn Ra	ter	
	Operating Cost (\$/year) Electricity \$5	588	Heating Syst		0, 0.04	, 1.19					SR999		
		366	GasFurnace		0.95	5 AFUE						ter's H 95630	
		954	Ducted) HSPF	Patir		to			93030 6, 201	
	Renewable Energy Production		Electric Heat DuctlessFan		, ,	HSPF					GNED 1		.4
	Electricity Ancillary Energy Uses	0	Electric Heat			HSPF						-,	
	Electricity	0	DuctlessFan				at Ca	alCER	IS In	IC .			
	Gas	õ	Cooling Syst	em									
C IOFFIC			Split A/C Ducted		14.5	5 SEER	Rate	r Sign	ature			0	Date
Call Skinc			Split A/C			3 SEER							
			Ductless										
<u></u>			Split A/C		18	3 SEER							
			Ductless										
			Water Heati	na Sve	stem								









The Energy

Impact



Energy Impact		;
Greenhouse Gas Emissions CO ₂ = 3.86 tons/year Energy Consumption Electricity (kWh/year)		
Heating Cooling Water Heating	772 603 0	
Lights Appliances Total	623 2,992 4,990	ĺ
Natural Gas (therms/year) Heating Cooling Water Heating Lights Appliances Total	155 0 194 0 17 366	
Operating Cost (\$/year) Electricity Gas Total	\$588 \$366 \$954	
Renewable Energy Product Electricity Ancillary Energy Uses Electricity Gas	ion 0 0 0	

The Energy Consuming

Features



Energy Efficiency Fea	tures
Ceiling Wall	R-30
Floor Over Crawlspac Slab Edge Windows	R-13 ce None None, 0
SHGC 0.63, U-Factor 0.66,	0.67, 0.83 0.84, 1.19
Heating System GasFurnace Ducted	0.95 AFUE
Electric Heat Pump DuctlessFan	9 HSPF
Electric Heat Pump DuctlessFan	9 HSPF
Cooling System	
Split A/C Ducted	14.5 SEER
Split A/C Ductless	18 SEER
Split A/C Ductless	18 SEER
Water Heating Syste 1 - 50 Gal GasFire	

Whole House Audit



Official Home Energy Audit in conformance with the requirements of the California Energy Commission www.energy.ca.gov



Whole House Audit

- Focus evaluating energy efficiency recommendations
- Process similar to WHR but rater makes upgrade recommendations that are evaluated by the software
- Recommendations are rated according to cost effectiveness
- Loading order envelope, mechanicals, appliances, DHW
- Reports are very similar to the Whole House Rating
- Modeling using approved compliance software
 - EnergyPro 5.x + Res CalCerts module



Alternatives Analysis

- Whole House Rater suggests upgrades in specific categories
 - Insulation, windows, HVAC, HERS measures, appliances, lighting, hot water/distribution, renewables, pool pumps
- Software analyzes utility savings for each measure, individually, or combined
- Calculates energy efficiency improvement in percentages, HERS Index (if requested), and utility bill reductions
- Algorithms come from HERS Technical Manual
- Triggered by changes to "Existing" components via "Calculations" tab



Identifying Existing Components

Sγ	stem -	HVAC	
Ge	neral Dis	tribution Resid	ential HERS Credits MECH-2
	- System E)etails	
	Name:		HVAC
	System	Туре:	Existing
	Existing	System:	Goodman GMS80603AXBA / Bryant 📖 🗙
	Multiplie	r:	1.00
	🔽 Use	Supply Air Temp	erature specified in Central System for Load Calculations.
	🔲 Cons	stant Volume Re	quired for Process
	Exempte	ed Fan Power:	0 inches



Sample Trigger

Res CalCERTS	
Options Alternatives Calibration	
Type of Upgrade Cost Image: State Stat	Cost Data Cost Data is User Defined Select Cost Data from Cost Database Select
Image: Arge interaction \$0 Floor Insulation \$0 Windows \$0 HVAC System \$0 HVAC Distribution \$0 HVAC Duct Leakage \$0 HVAC Duct Insulation \$0 Refrigerant Charge Verification \$0 System Fan Wattage Verification \$0 System Fan Wattage Verification \$0 Building Leakage \$0 Indoor Lighting \$0 Outdoor Lighting \$0 Domestic Hot Water Heater \$0 Solar Domestic Hot Water \$0 Heating Boiler \$0 Pool Pumps \$0 All Improvements \$0	Measure Life (years): 25 Annual Insurance Cost Reductions: 0 Annual R&M Cost Reductions: 0 Measure Residual Value: 0 Narrative for Report Upgraded Roof Roof: R 49 X



Whole House Audit Modeling

- Baseline 2008 Energy Code Standard Design
- Calculations based on TDV kBTU/SF/yr, \$ savings
- Evaluation of building before and after improvements

Calculation	Heating	Cooling	Int Light	Ext Light	Appliances	Misc	Renew	Fans	DHW Pump	DHW	Exterior	Total	HERS Index	Savings
Reference Home	22.46	22.86	7.68	0.55	28.92	0.00	0.00	7.00	0.00	24.70	0.00	114.17	100	\$0
Rated Home	39.28	56.14	6.14	0.61	20.08	0.00	0.00	18.03	0.45	28.05	0.00	168.76	148	\$0
Roof Insulation	31.63	39.20	6.14	0.61	20.08	0.00	0.00	13.12	0.45	28.05	0.00	139.27	122	\$211
DHW Distribution	31.63	39.20	6.14	0.61	20.08	0.00	0.00	13.12	0.00	24.47	0.00	135.25	118	\$250
HVAC System	26.21	36.46	6.14	0.61	20.08	0.00	0.00	13.15	0.00	24.47	0.00	127.11	111	\$307
Domestic Hot Water Heater	26.21	36.46	6.14	0.61	20.08	0.00	0.00	13.15	0.00	21.58	0.00	124.22	109	\$335
Renewables	26.21	36.46	6.14	0.61	20.08	0.00	0.00	13.15	0.00	21.58	0.00	124.22	109	\$335

Res CalCERTS



California Home Energy Audit Certificate **Energy Impact** Operating Cost (\$/year) Greenhouse Gas Emissions CO₂ = 3.86 tons/year Electricity \$588 \$366 Site Information Gas Energy Consumption Electricity (kWh/year) Total \$954 Address Heating 772 Renewable Energy Production 1301 Bidwell Coolind 603 Electricity Ancillary Energy Uses 0 Folsom, CA 95630 Water Heating 0 0 General Information 623 Lights Electricity Whole Appliances Total 2,992 Conditioned Floor Area Gas 0 4,990 Conditioned Volume Bedrooms Natural Gas (therms/year) House Type House Heating 155 Foundation Type Cooling 0 194 Water Heating **Energy Efficiency Features** 0 Lights 17 Appliances Insulation Total 366 Ceiling Wall Information on Compliance With Floor Over Crawlspace Other Programs: Slab Edge N/A Windows SHGC CalCERTSinc. **U-Factor** Heating System GasFurnace **Audit** Ducted Electric Heat Pump DuctlessFan Qualifying Information: BPC NOT AUTHORIZED Electric Heat Pump **HERS Provider:** CalCERTS, Inc 31 Natoma St Suite 120 DuctlessFan Folsom, CA 95630 **Cooling System** Software estimates are based on typical 916-985-3400 Split A/C Ducted occupancy patterns which may be different from your household use www.calcerts.com Split A/C patterns. As a result, these software Certificate **Rating Information** Ductless estimates may not match the household's energy actual consumption. Rating Number: CC11-1798847021 Split A/C Ductless Occupant's energy use patterns may change after energy efficiency upgrades. EnergyPro Version: 5.1.9.1 Certified Rater: John Rater Ventilation System USR999999 John Rater's HVAC Folsom, 95630 Water Heating System 1 - 50 Gal GasFired (0.6 EF) March 26, 2014 Rating Date: ELECTRONICALLY SIGNED by John Rater CalCERTS, Ind CalCERTS inc.

2014 CABEC Conference

Official Home Energy Audit

1,184 ft² 9,476 ft³

R-30 R-13

None

None, (

0.95 AFUE

9 HSPF

9 HSPF

14.5 SEER

18 SEER

18 SEER

None

Date:

erav Auditor Sic

0.63, 0.67, 0.83

SingleFamily

Slab on Grade

in conformance with the requirements of the California Energy ommission www.energy.ca.gov



Whole House Audit

Recommendations

Energy Upgrade R	ecomme	endations				
Project Name 1301 Bidwell Folsom, CA 95630				ation Author C	CalCERTS	
Recommended Improvements		Descri	ption		Annual Individual Savings	Annual Cumulative Savings
Roof Insulation	49.0				\$16	N/A**
Building Leakage	2.0 SLA / 1	1860 CFM			\$22	N/A**
Appliances	Indoor Ref.	: 450 kWh Dishw	asher: 0.67 E	F	\$32	N/A**
Domestic Hot Water Heater	Gas Fired /	/ 0.0 gal / 0.840 i	EF		\$68	N/A**
All Improvements				_	N/A**	\$136
** This Report utilized the CUST			-			
Annual Results		lectricity (kWh			Fossil Fuel (the	
End Use	Existing	Improved	Savings	Existing	Improved	Savings
Space Heating) 772	765	7	155	. 139	16
Space Cooling	603	509	95	0		0
Fans	535	484	51	0		111 0
Pumps	0			0		
Domestic Hot Water	0	Contraction of the local distance of the loc		194	- 132	
Indoor Lighting	577	577	0	0	Contraction of the local division of the loc	
Outdoor Lighting	46	46	0	0		
Appliances	2,457	2,095	362	17	17	0
Ancillary	0			0		
Renewables	0			0		
TOTAL	4,992	4,477	515	367	288	78
CO ₂ (lbs/year)	Existing	Improved	Savings	Climate Zone	e: I	12
Electricity	3,444	3,089	355	Floor Area:		1,184
Fossil Fuel	4,271	3,358	913	Туре:		SingleFamily
TOTAL	7,715	6,447	1,268	- 11 - 2		,
Average Demand (kW)	3	2.72	0.29			
	119.05	101.23	17.83	TDV % Savir		15%
TDV Energy (kBtu/ft ² -yr) Energy Cost	\$954	\$818	\$136	TOV % Savin	igs.	15%
The estimated operating costs shown are important. Equally important is th annual operating cost. The estimates rebate purposes, the site converted B	in this report ar e thermostat se provided in this	e dependent upon tting, How the ther report are based o	many factors. Ti mostat is used,	appliance use, and	d occupant interaction	on all influence the
Rating Num	per: CC11-179	98847021 Energ	yPro Version:	5.1.9.1 Rating	Date: 3/26/2014	



Whole House Audit Recommendations

Energy Upgrade R	Recommendations									
Project Name 1301 Bidwell Folsom, CA 95630		Documentation Author CalCERTS								
Recommended Improvements	Descrip	tion	Annual Individual Savings	Annual Cumulative Savings						
Roof Insulation	49.0		\$16	N/A**						
Building Leakage	2.0 SLA / 1860 CFM		\$22	N/A**						
Appliances	Indoor Ref: 450 kWh Dishwas	sher: 0.67 EF	\$32	N/A**						
Domestic Hot Water Heater	Gas Fired / 0.0 gal / 0.840 El	-	\$68	N/A**						
All Improvements			N/A**	\$136						



Whole House Audit Savings

Annual Results	E	lectricity (kWh))	F	ossil Fuel (the	rms)
End Use	Existing	Improved	Savings	Existing	Improved	Savings
Space Heating	772	765	7	155	139	16
Space Cooling	603	509	95	0		
Fans	535	484	51	0		0000
Pumps	0			0		
Domestic Hot Water	0	100 m 10000 m		194	132	63
Indoor Lighting	577	577	0	0	"Noning and the	
Outdoor Lighting	46	46	0	0		
Appliances	2,457	2,095	362	17	17	0
Ancillary	0			0		
Renewables	0			0		
TOTAL	4,992	4,477	515	367	288	78
		•			•	
CO ₂ (lbs/year)	Existing	Improved	Savings	Climate Zone:		12
Electricity	3,444	3,089	355	Floor Area:		1,184
Fossil Fuel	4,271	3,358	913	Туре:		SingleFamily
TOTAL	7,715	6,447	1,268			
Average Demand (kW)	3	2.72	0.29			
TDV Energy (kBtu/ft ² -yr)	119.05	101.23	17.83	TDV % Saving	gs:	15%
Energy Cost	\$954	\$818	\$136			
The estimated operating costs shown				appliance use, and	occupant interactio	on all influence the
are important. Equally important is th annual operating cost. The estimates rebate purposes, the site converted B	provided in this	report are based or		ons; your actual usa	age will vary. For ir	nvestor owned utility



Energy Upgrade California





Energy Upgrade California

- Focus evaluating energy efficiency recommendations for public utility incentive programs
- Analysis similar to Whole House Audit + combustion testing
- Instead of Whole House Audit report, XML file (+ other stuff) is uploaded to Green Energy Compass (PG&E)
- Modeling must be done by enrolled contractors or EUC-certified raters (Whole House Raters with BPI certification)
- Modeling using approved compliance software
 - EnergyPro 5.x/6.x + Res Performance module



Energy Upgrade California

- Contractors/raters do test-in, modeling, & recommendations
- Contractors install the upgrades to qualify for the incentive
- Testing is required after the work is complete (test-out)
- Incentive is based on projected energy savings: more % = more \$
- Alternatives analysis identical to Whole House Audit
- Basic reports are EnergyPro reports, especially ECON-2
- Individual programs may tweak the EnergyPro results



Energy Upgra	de Rec	ommen	dations						ECC	DN-2
Project Name BPCi Fie	eld Test Hous	e HERS II		Documenta	tion Author	Home Energy	Servic	es		
Project Address 1301 Bio Folsom,	dwell CA 95630			Author Add	ress	1609 8th Stre Berkeley, CA	8th Street eley, CA 94710			
Recommended Improvements			Descripti	0.0		Anr Savi		Est. Cost Install	to Sav	/ings TDV
Roof Insulation		9 Cavity Insulati sulation = 0.0 R-1	ion = 49.0 R-Value		on = 0.0 R-Valu	ie Sav	\$211	mətan	\$0 13.2 %	
DHW Distribution		bution Type = Al					\$250		\$0 17.3 %	5 19.9
Building Leakage	_	-	Leakage Rate at				\$232		\$0 15.5 %	5 18.4
Appliances	Indoor Refi	igerator = 500 kl	Wh Garage Refrige	erator = 0 kWh L	Dishwasher = 0	0.63 EF	\$179		\$0 14.2 %	5 14.6
HVAC System	Furnace E	fficiency = 0.97 A	14 CNP 38HD 2 T AFUE Cooling = Sp	olit Air Conditione	er SEER = 13.	00	\$238		\$0 20.2 %	5 19.5
Domestic Hot Water Heate		O Smith Water F fliciency = 0.640	roducts GPCR-40- EF	200 Type = Gas	Fired Volume	=	\$266		\$0 23.4 %	21.2
Annual Results		Energy Cost Electricity (kWh) Fossil Fuel					Fuel (therm	is)		
End Use	Existing	Improved	Savings	Existing	Improved		Ex			Saving
Space Heating	\$328	\$210	\$118	0	-	-		311	207	1
Space Cooling	\$283 \$131	\$177 \$96	\$106 \$36	2,342		848 279		0	0	
Fans	\$131 \$4	390 S0	\$30 \$4	1,086			-	0	0	
Pumps	\$240	\$184	\$65	50				237	182	

ECON-2

End Use	Existing	Improved	Savings	Existing	Improved	Savings		Existing	Improved	
Space Heating	\$328	\$210	\$118	0	0	0	1	311	207	104
Space Cooling	\$283	\$177	\$106	2,342	1,494	848	1	0	0	(
Fans	\$131	\$96	\$36	1,086	807	279	1	0	0	(
Pumps	\$4	\$0	\$4	36	0	36	1	0	0	(
Domestic Hot Water	\$249	\$184	\$65	0	0	0	1	237	182	55
Indoor Lighting	\$66	\$65	\$1	547	547	0	1	0	0	(
Outdoor Lighting	\$7	\$7	\$0	59	59	0	1	0	0	0
Appliances/Plug Loads	\$213	\$279	(\$65)	1,608	2,199	-592	1	18	18	6
Ancillary	\$0	\$0	\$0	0	0	0	1	0	0	6
Renewables	\$0	\$0	\$0	0	0	0	1	0	0	6
TOTAL	\$1,283	\$1,017	\$266	5,677	5,106	571	1	566	407	158
						•				
CO ₂ (lbs/year)	Existing	Improved	Savings	Climate Zo	ne:			12	Improveme	
Electricity	3,917	3,523	394	Electric Ra	te:			MUD RSG	above sho	
Fossil Fuel	6,588	4,742	1,846	Gas Rate:			P	PG&E G1 R	cumulative benefit for	
TOTAL	10,505	8,265	2,240	Floor Area				1,253	measures	compined
				Type:			Sir	ngle Family	measures	
Average Demand (kW)	5.66	4.43	1.23							
TDV Energy (kBtu/ft2-yr)	168.76	132.98	35.78							
The estimated operating cos Equally important is the then provided in this report are ba	mostat setting. H	low the thermosta	at is used, applia	nce use, and occup						
EnergyPro 5.1.9.2 by En	neravSoft	User Nur	nber: 7523	RunCode: 2	014-09-06T1	0:08:33	D: Te	st House #2	2 F	Page 1 of 1



ECON-2 Recommendations

Energy Upgrade Recommendations						
Project Name BPCi Field	Home Energy Se	ervices				
Project Address 1301 Bidwell Folsom, CA 95630		Author Address 1609 8th Street Berkeley, CA 94710				
Recommended			Annua	Est. Cost to	Savings	
Improvements	Description	1	Saving	s Install	Site	TDV
Roof Insulation	Type = R 49 Cavity Insulation = 49.0 R-Value Interior Insulation = 0.0 R-Value Exterior Insulation = 0.0 R-Value			\$11 \$0	13.2 %	17.5 %
DHW Distribution	DHW Distribution Type = All Pipes Ins			\$0 \$0	17.3 %	19.9 %
Building Leakage	Building Leakage = 3.0 SLA Leakage Rate at 50	\$2	\$0	15.5 %	18.4 %	
Appliances	Indoor Refrigerator = 500 kWh Garage Refrigerator = 0 kWh Dishwasher = 0.63 EF			79 \$0	14.2 %	14.6 %
HVAC System	Name = Carrier 58MVB40-14 CNP 38HD 2 T Type = Split DX Heating = Central Furnace Efficiency = 0.97 AFUE Cooling = Split Air Conditioner SEER = 13.00			\$0	20.2 %	19.5 %
Domestic Hot Water Heater	Name = A O Smith Water Products GPCR-40-20 40.0 gal Efficiency = 0.640 EF	= \$2	266 \$0	23.4 %	21.2 %	



ECON-2 Utility Analysis

Annual Results End Use	Energy Cost			Ele	Electricity (kWh)		Fossil Fuel (therms)		
	Existing	Improved	Savings	Existing	Improved	Savings	Existing	Improved	Savings
Space Heating	\$328	\$210	\$118	0	0	0	311	207	10
Space Cooling	\$283	\$177	\$106	2,342	1,494	848	0	0	
Fans	\$131	\$96	\$36	1,086	807	279	0	0	-
Pumps	\$4	\$0	\$4	36	0	36	0	0	
Domestic Hot Water	\$249	\$184	\$65	0	0	0	237	182	5
Indoor Lighting	\$66	\$65	\$1	547	547	0	0	0	
Outdoor Lighting	\$7	\$7	\$0	59	59	0	0	0	
Appliances/Plug Loads	\$213	\$279	(\$65)	1,608	2,199	-592	18	18	
Ancillary	\$0	\$0	\$0	0	0	0	0	0	
Renewables	\$0	\$0	\$0	0	0	0	0	0	-
TOTAL	\$1,283	\$1,017	\$266	5,677	5,106	571	566	407	15
CO ₂ (lbs/year)	Existing	Improved	Savings	Climate Zone: Electric Rate: Gas Rate:			12 Improvemen		ents
Electricity	3,917	3,523	394				above shown with		
Fossil Fuel	6,588	4,742	1,846			PG&E G1 R	cumulative savings		
TOTAL	10,505	8,265	2,240	Floor Area:			1,253	benefit for combined	
				Type:			measures		
Average Demand (kW)	5.66	4.43	1.23					1	
TDV Energy (kBtu/ft ² -yr)	168.76	132.98	35.78						
The estimated operating cost Equally important is the thern provided in this report are ba	nostat setting. H	ow the thermosta	at is used, applian	ce use, and occup					



Energy Efficient Mortgage

Property Rating					
Existing HERS Score:	289				
HERS Score With Improvements:	133				
Percent Improved:	54%				



Energy Efficiency Mortgage

- Focus evaluating the energy efficiency of a house to obtain financing to pay for home improvements
- Modeling/analysis same as Whole House Rating or Audit
- Reporting requirements depend on lender and program
- Typically CalCERTS rating reports + special lender forms
- Must be done by Whole House Rater (HUD)
- Modeling using approved compliance software
 - EnergyPro 5.x + Res CalCerts module



Energy Efficiency Mortgage

- Typically done before home purchase or when refinancing
- Analysis identifies cost-effective upgrades, financing pays for them
- Utility savings weighed off against larger mortgage
- Escrow holdback to pay for upgrades
- Work gets done, inspected by Whole House Rater
- Funds released to pay contractors
- Over 4000 done by CalCERTS Whole House Raters



	CalCERTS inc.			
environment * advocacy	HERS Provider	training	*	certification

1

CalCERTS Certificate ID:	Date: 3/16/2011
CalCERTS Rater Name:	CalCERTS Rater ID:

Customer Information	
Name:	CIDATE
Address:	CalKAIEpro
City / State / Zip:	

EEM

Report

Property Details		Annual Operating	Ex	isting	Im	proved
CA Climate Zone:	3	Úsage /	Usage	Cost	Usage	Cost
Year Built:	1984	Costs				
Electric Utility:	PG&E E1	(therms)	1086.65	\$1,713.56	477.04	\$715.56
Gas Utility:	PG&E G1	Electricity (kWh)	5643.06	\$1,805.78	3699.62	\$1,183.88
Square Foot/Floor Area:	960	(KWII) Total		\$3,519,34		\$1,899.44
Conditioned Volume:	7680					
Front Orientation:	90			roperty Rat	ting	
Stories:	1	Existing H				289 133
Туре:	SingleFamily		HERS Score With Improvements: Percent Improved:			
Interest Rate:	5.25%	Percent I	mproved	•		54%
Term:	30 Years					
			-	. Life	ecycle	Estimated

Recommended STANDARD Improvements	Useful Life	Annual Savings	Savings / Present Value	Cost to Install
Roof Insulation	30	\$239.21	\$3,609.93	\$0.00
Windows	30	\$477.86	\$7,211.41	\$0.00
Building Leakage	30	\$198.54	\$2,996.18	\$0.00
HVAC Duct Leakage	30	\$254.22	\$3,836.45	\$0.00
HVAC System	20	\$283.98	\$3,511.94	\$0.00
Domestic Hot Water Heater	15	\$166.09	\$1,721.76	\$0.00

DISCLAIMER: Annual Savings estimates vary based on features installed and Occupant Behavior. Present Value estimate is based on estimated Useful Life and estimated Annual Savings. Your actual results will vary.

HUD Certification: I certify to the best of my knowledge and belief, the information contained in this report is true and accurate and I understand that the information in this report may be used in connection with an application for an Energy Efficient Mortgage to be insured by the Federal Housing Administration of the U.S. Department of Housing and Urban Development.

Signature: ____

ExcryyStar	*	Title 24	*	USNRG	*	C. E. C	
www.calcerts.com							
	• 31 N	atoma Street, Suite 120 •	Folsom, CA .	916.985.3400 . info@c	alcerts.com •		
CalPRO Rating Report						Page 1/2	



EEM Report Summary

Property Details		Annual Operating	Ex	isting	Imj	proved
CA Climate Zone:	3	Úsage /	Usage	Cost	Usage	Cost
Year Built:	1984	Gas				
Electric Utility:	PG&E E1	(therms)	1086.65	\$1,713.56	477.04	\$715.56
Gas Utility:	PG&E G1	Electricity	5643.06	\$1,805.78	3699.62	\$1,183.88
Square Foot/Floor Area:	960	(kWh)		\$3,519.34		\$1,899.44
Conditioned Volume:	7680					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Front Orientation:	90			roperty Rat	ing	
Stories:	1	Existing H				289
Type:	SingleFamily			mproveme	nts:	133 540/-
Interest Rate:	5.25%	Percent I	mproved	ī		54%
Term:	30 Years					



EEM Report Recommendations

Recommended STANDARD Improvements	Useful Life	Annual Savings	Lifecycle Savings / Present Value	Estimated Cost to Install
Roof Insulation	30	\$239.21	\$3,609.93	\$0.00
Windows	30	\$477.86	\$7,211.41	\$0.00
Building Leakage	30	\$198.54	\$2,996.18	\$0.00
HVAC Duct Leakage	30	\$254.22	\$3,836.45	\$0.00
HVAC System	20	\$283.98	\$3,511.94	\$0.00
Domestic Hot Water Heater	15	\$166.09	\$1,721.76	\$0.00

DISCI ATMER: Annual Savings estimates vary based on features installed and Occupant Behavior. Present Value estimate



2013 E+A+A Performance Modeling

 HERS Verified Existing Conditions being Altered 						
Wall/Door Construction	HVAC					
Roof Construction	Domestic Hot Water					
Floor Construction	📃 Building Leakage					
Fenestration						



E+A+A for 2013 Compliance

- Focus standard E+A+A performance modeling for permitting
 - There is currently no prescriptive option if there are HERS verifications
- Modeling requires approved 2013 residential software
 - EnergyPro 6.x/CBECC-res
- Registry project creation process is similar to any project
- Modeling can be done by anyone
- May involve existing conditions verification by Whole House Rater



E+A+A Modeling

- All building components of an E+A+A model are either "New", "Existing", or "Altered"
- Each has a different compliance baseline (Standard Design)
- "New" Package A (Table 150.1-A)
- "Existing" no affect on compliance margin
- "Altered" Standard Design is column two of Table 150.2-B **OR** column three if HERS verifications are selected by the modeler



Identifying Altered Components

	Name:	Existing Roof: Altere	ed				
	Area:	1050 ft²					
	Surface Type:	Altered	*				
	Existing Assembly:	R-19 Roof Attic	🛍 🗙	Code Compariso	n		
	New Assembly:	R-38 Roof Attic	i 🗶		U-Facto	Reflectance	
	Orientation:	0	✓	T-24	0.025	0.20	
				90.1 Baseline:	0.032	0.25	
	Slope:	4 / 12		Proposed:	0.025	0.1	
	Replacing > 50	% of Roof Surface (or	> 2,000 sqft Nonres or >1,0)00 sqft Res)			
CEDTO						2014 (CABEC Confe
CERTS inc.						20140	

Table 150.2-B

Page 244

2013 Building Energy Efficiency Standards

	50.2-B STANDARD DESIGN FOR A			
Altered Component	Standard Design Without Third Party Verification of Existing Conditions Shall be Based On	Standard Design With Third Party Verification of Existing Conditions Shall be Based On		
Ceiling Insulation, Wall Insulation, and Raïsed-floor Insulation	The requirements of Sections 150.0(a), (c), and (d)	The existing insulation R-value		
Fenestration	The U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.	If the proposed U-factor is ≤ 0.40 and SHGC value is ≤ 0.35, the standard design shall be based on the existing U-factor and SHGC values as verified. Otherwise, the standard design shall be based on the U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.		
Window Film	The U-factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Table 110.6-A and Table 110.6-B.		
Space-Heating and Space- Cooling Equipment	The requirements of TABLE 150.1-A.	The existing efficiency levels.		
Air Distribution System – Duct Sealing	The requirements of Section 150.2(b)1D.			
Air Distribution System — Duct Insulation	The proposed efficiency levels.	The existing efficiency levels.		
Water Heating Systems	The requirements of Section 150.1(b)1 without the solar water heating requirements.	The existing efficiency energy factor.		
Roofing Products	The requirem	ents of Section 150.2(b)1H.		
All Other Measures	The proposed efficiency levels.	The existing efficiency levels.		

TABLE 150.2-B STANDARD DESIGN FOR AN ALTERED COMPONENT



Table 150.2-B Summary

		No HERS	<u>HERS</u>
•	Fenestration	0.40/0.35	Existing OR 0.40/0.35
•	Heating/cooling	Package A	Existing
٠	Duct insulation	Proposed	Existing
•	DHW	Prescriptive	Existing
•	Insulation	Mandatory	Existing
•	All Others	Proposed	Existing

Duct sealing & roofing – no difference



E+A+A Modeling

- Modeler selects which assemblies are HERS verified
- That only makes sense when "Altered" component is "worse" than Standard Design conditions listed in Table 150.2-B
- You get extra compliance margin
- The items that must be verified are listed on the CF-1R-PRF-01



Selecting HERS Verifications

Project Design Data	Project Title	Designer	Lighting Designer	Mechanical Designer	Residential	Res Lighting	Utility
HERS Measures				Attic			1
Date of Rating:	9/16/2014		*	Conditioned			
📃 Quality Insulatio	n Installation						
🗹 Envelope Leak	age Testing			Crawlspace			
Leakage Type:	Existing	*					
Existing Leakage:	5.0 🗢 ACH	150		Height:	2 feet		
New Leakage:	5.0 🗘 ACH	150		Ext. Perimeter:	90 feet		
HERS Verified Exis	ting Conditions	being Alter	ed				
🔲 Wall/Door Cons	struction	HVAC					
🔽 Roof Constructi	on 📃	Domestic H	lot Water				
🔲 Floor Constructi	on 📃	Building Le	akage				
Fenestration							
<pre></pre>							
Central Laundry	Facility L	ocation:				~	



Identifying HERS Verifications

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

CF1R-PRF-02-E Page 1 of 10

Project Name: Existing+Alterations+Addition Calculation Description :Title 24 Analysis

Calculation Date/Time: 10:01, Mon, Feb 17, 2014 Input File Name: Existing+Alterations+Addition.xml

GENERAL	INFORMATION								
01	Project Name	Existing+Alterations+Addition	ting+Alterations+Addition						
02	Calculation Description	Title 24 Analysis	24 Analysis						
03	Project Location	123 Main St.	Main St.						
04	CA City	San Francisco	05	Standa	ards Version	Compliance 2014			
06	Zip code		07	Compliance Mana	iger Version	BEMCmpMgr 2013-1e (532)			
08	Climate Zone	CZ12	09	Softw	are Version	EnergyPro 6.1			
10	Building Type	Single Family	11	Front Orientation (de	eg/Cardinal)	0			
12	Project Scope	Addition and/or Alteration	13	Number of Dwelling Units		1			
14	Total Cond. Floor Area (FT2)	1275	15 Number		er of Zones	2			
16	Slab Area (FT2)	0) 17	Numb	er of Stories	1			
18	Addition Cond. Floor Area	NA	19	Natural G	as Available	Yes			
20	Addition Slab Area (FT2)	NA	21	Glazing Per	centage (%)	14.3%			
		COMPLIANCE RESULTS				d help on using the CF-1R Certificate of			
01	Building Complies with Computer Perfor			nce is available via the Internet by either anning the QR code or browsing to					
02 This building incorporates features that require field testing and/or verification by a certified HERS rater under the supervision of a CEC-approved HERS provider.						w.title24energycode.org/t24help/cf1r.aspx			
03	This building incorporates one or more	Special Features shown below							
		ENEDGY LIGE SUMMADY							



Identifying HERS Verifications

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

CF1R-PRF-01

Project Name: Existing+Alterations+Addition

Calculation Date/Time: 16:35, Tue, Sep 16, 2014 Input File Name: Existing+Alterations+Addition.xml Page 3 of 8

Calculation Description: Title 24 Analysis

QUE SURFACES									
01 02		03	04	05	06	07	08	09	10
Name	Zone	Construction	Azimuth	Orientation	Gross Area (ft ²)	Window or Door Area (ft ²)	Tilt(deg)	Status	Verified Existing Condition
Front: To Remain	Existing Home	R-0 Wall	0	Front	180	50	90	Existing	No
Left: To Remain	Existing Home	R-0 Wall	90	Left	135		90	Existing	No
Left: New	Existing Home	R-15 Wall	90	Left	135	30	90	New	N/A
Rear: To Remain	Existing Home	R-0 Wall	180	Back	135	20	90	Existing	No
Right: To Remain	Existing Home	R-0 Wall	270	Right	405	42	90	Existing	No
Existing Roof: Altered	Existing Home	R-30 Roof Attic			1050			Altered	Yes
Existing Floor: Remains	Existing Home	H-U Floor Crawispace			1050			Existing	NO
Front	New Addition	R-15 Wall	0	Front	54		90	New	N/A
Left	New Addition	R-15 Wall	90	Left	135	20	90	New	N/A
Rear	New Addition	R-15 Wall	180	Back	135	20	90	New	N/A
New Roof	New Addition	R-38 Roof Attic			225			New	N/A
New Floor	New Addition	R-22 Floor Crawlspace			225			New	N/A



Identifying HERS Verifications

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

Project Name: Existing+Alterations+Addition Calculation Description: Title 24 Analysis Calculation Date/Time: 16:35, Tue, Sep 16, 2014 Input File Name: Existing+Alterations+Addition.xml CF1R-PRF-01

Page 7 of 8

Н	HVAC - COOLING SYSTEMS								
	01	02	03	04	05	06	07		
Г			Efficie	ncy	Multi-speed				
	Name	System Type	EER	SEER	Zonally Controlled	Compressor	HERS Verification		
Γ	Cooling Component 1	SplitAirCond - Split air conditioning system	7.06	8	No	No	Cooling Component 1-hers-cool		

H	HVAC - DISTRIBUTION SYSTEMS									
Γ	01	02	03	04	05	06	07	08	09	08
Γ	Name	Туре	Duct Leakage	Insulation R-value	Supply Duct Location	Return Duct Location	Bypass Duct	Status	Verify Existing Condition	HERS Verification

HERS RATER VERIFICATION OF EXISTING CONDITIONS

OPAQUE SURFACES - VERIFIED & ALTERED

01	02	03	04	05
Name	Zone	Existing Construction	Surface Type	Total Cavity R-value
Existing Roof: Altered	Existing Home	R-19 Roof Attic	Wood Framed Ceiling	R 19



E+A+A Project Registration

- Project is created like any other registry project
- Documentation author and designer sign the CF-1R
- HERS rater verifies existing conditions, completes CF-3R-EXC-20H
- Registered CF-1R is available after designer and documentation author sign it
- <u>Registration (i.e., permitting) can't be completed until HERS rater</u> <u>does verifications</u>



E+A+A Example

- 150.2-B lists 150.0(a) as Standard Design for roof insulation
 - Mandatory minimum of R-30
- Existing roof = R-19, insulate to R-30
- Don't select HERS verification, Standard Design = R-30
- No compliance credit merely upgrading the roof to mandatory minimum

TABLE 1	50.2-B STANDARD DESIGN FOR A	N.
Altered Component	Standard Design Without Third Party Verification of Existing Conditions Shall be Based On	
Ceiling Insulation, Wall Insulation, and Raised-floor Insulation	The requirements of Sections 150.0(a), (c), and (d)	
		1



E+A+A Example

- If you select HERS verification, Standard Design = R-19 (existing condition)
- Compliance credit for the increase from R-19 to R-30
- 5% on 1000 SF roof

Project Design Data Proje	ct Title Designer	Lighting Designer	Mechanical Designer	Residential	Res Lighting Utility
HERS Measures			Attic		
Date of Rating: 9/1	6/2014	*	Conditioned		
🔲 Quality Insulation Insta	allation				
🔽 Envelope Leakage Te	esting		Crawlspace		
Leakage Type: Exis	ting 💌		Ciampaco		
Existing Leakage: 5.0 :	CH50		Height:	2 feet	
New Leakage: 5.0 ;	ACH50		Ext. Perimeter:	90 feet	
HERS Verified Existing Co	onditions being Alte	red			
🔲 Wall/Door Constructio	on 🔲 HVAC				
Roof Construction	📃 Domestic I	Hot Water			
Floor Construction	📃 Building Le	eakage			
Fenestration					
C Multi-Family					
Central Laundry Facilit	y Location:				~



E+A+A Timing

- You can't build an accurate model without knowing the existing conditions
- Logical/realistic sequence:
 - The HERS rater does their analysis BEFORE the modeling is done
 - Project is created in the registry, model is uploaded
 - Author and designer sign it
 - HERS rater enters the verification results
 - Registration happens and permit documents are submitted



Whole House Ratings (and Raters)



Thank you!

