VERMONT ENERGY
INVESTMENT CORPORATION

Building Rating and Residential Retrofit: From Theory to Practice

ACEEE/CEE Market Transformation Conference
March 18, 2010

Richard Faesy | *Vermont Energy Investment Corp.*
(with much assistance from Dunsky Associates and
Greg Thomas, Performance Systems Development)

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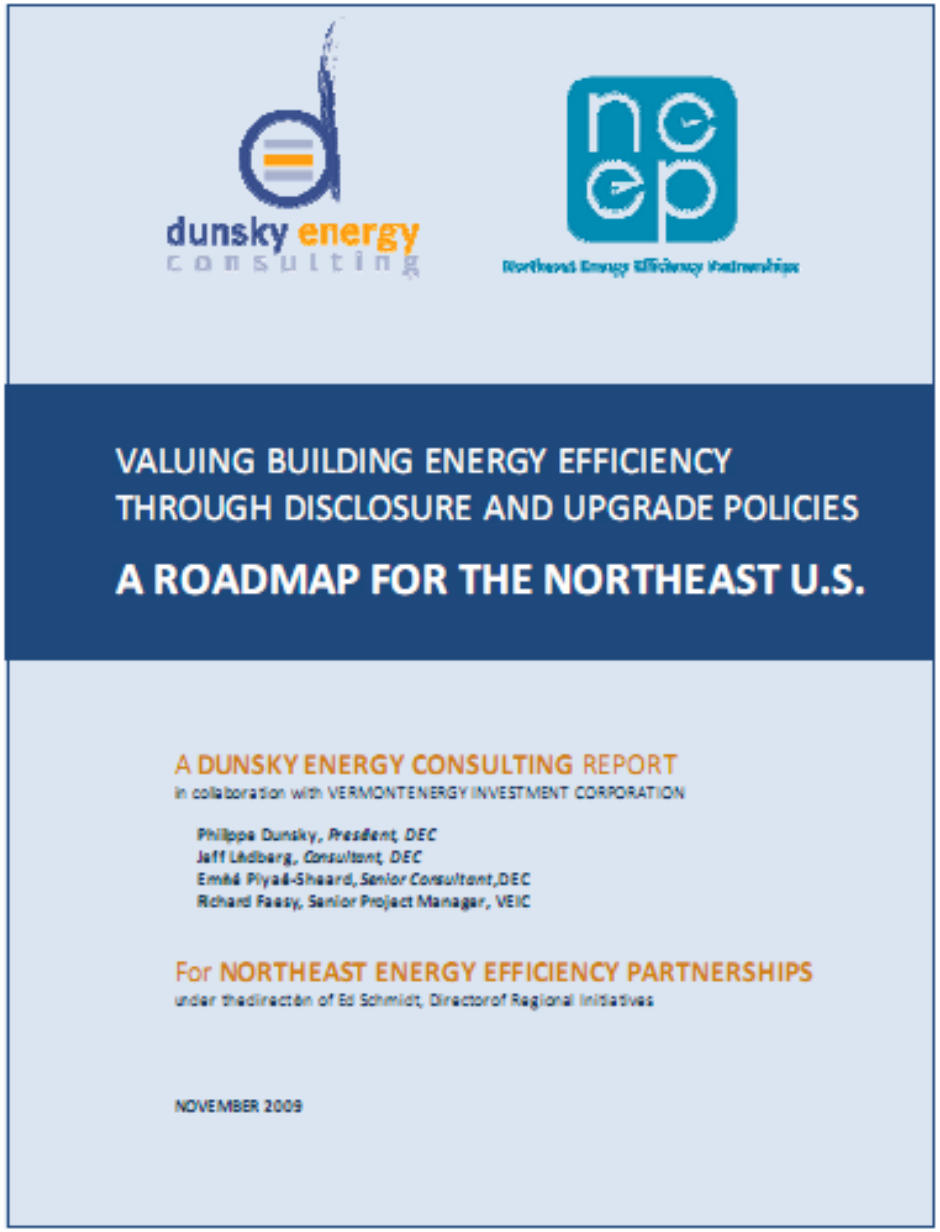
Overview

- Labeling concepts
- Some examples
- Use cases
- Suggested elements of a label



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www.neep.org

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"Framework for Residential Energy Labeling" White Paper

- Prepared by David Heslam, Earth Advantage, Portland, Oregon
- January 12, 2010 DC labeling summit
- Consensus document
- "Basecamp" discussion group
  - matt.golden@recurve.com to subscribe

Building Energy Labeling Cycle

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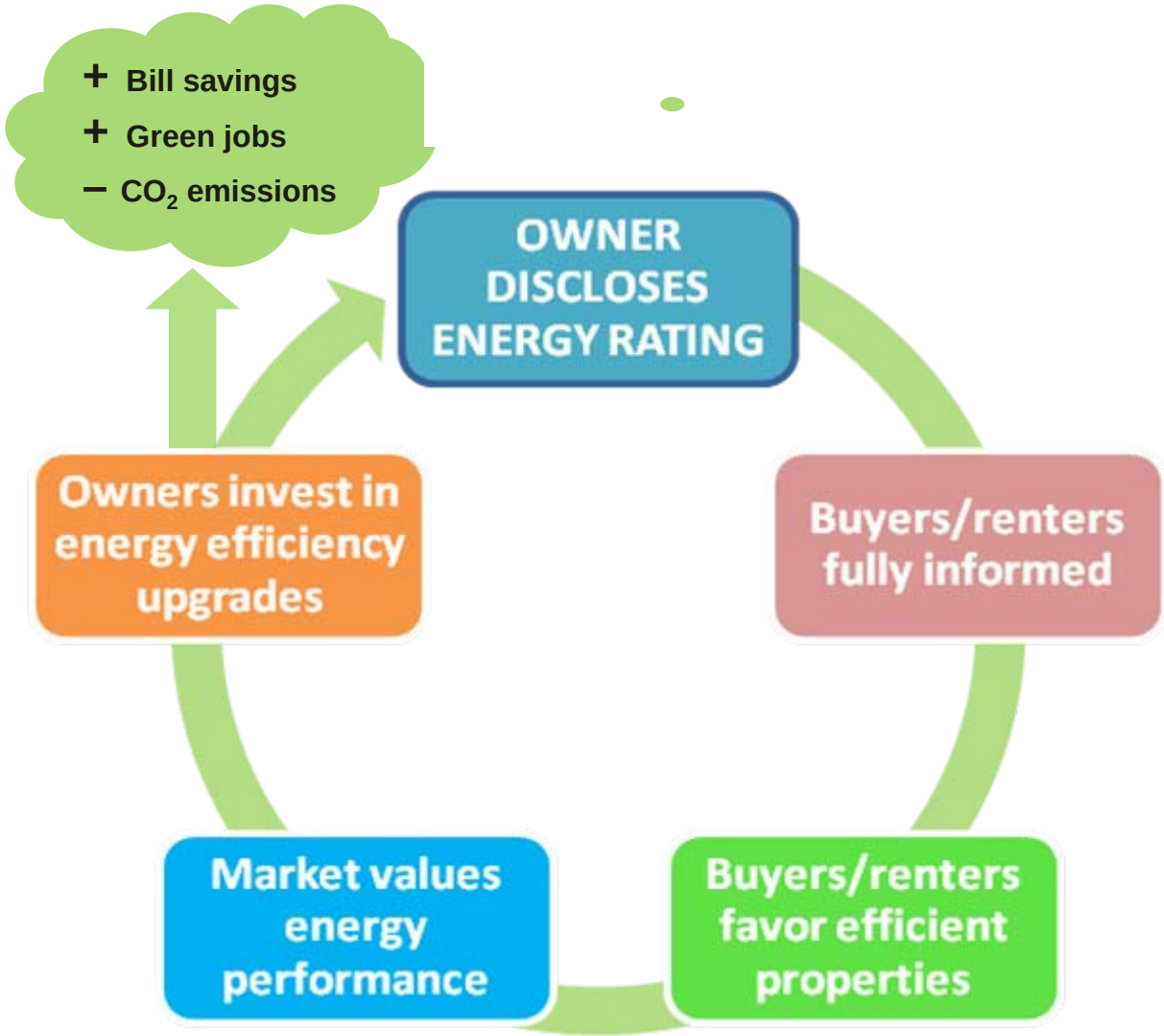

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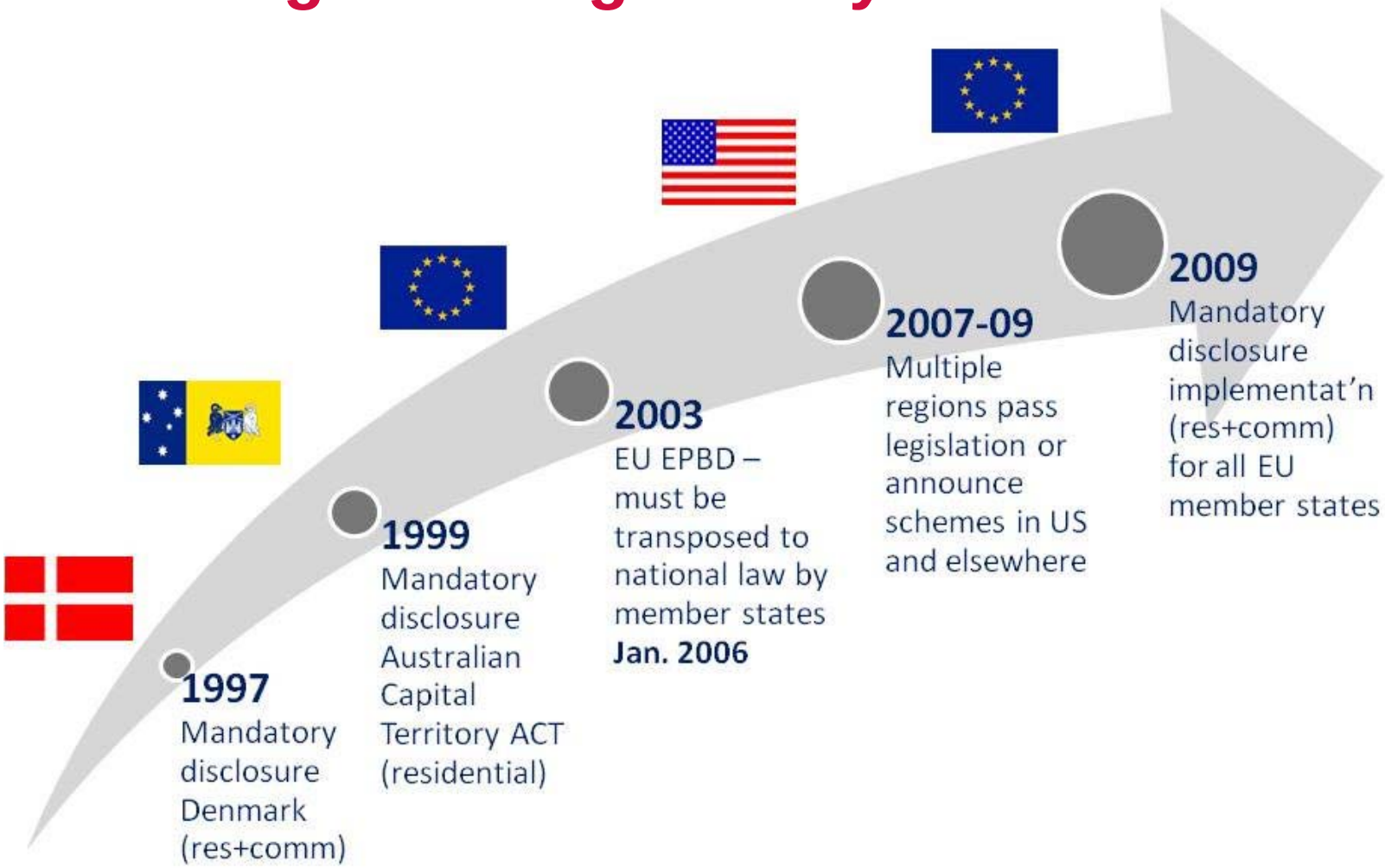
Building Labeling History



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International Labeling Initiatives

Jurisdiction	Status
Australia national	Planned for May 2011
Australian Capital Territory (ACT)	In effect
Denmark	In effect
European Union	In effect
France	In effect
New Zealand	Under consideration
Ontario	Planned for DATE TBD
Quebec	Pilots planned for 2011
Shandong China	In effect
UK	In effect

U.S. Labeling Initiatives

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Jurisdiction	Status
Austin, TX	In effect
California	Past proposal
Federal Government	Active proposal
Maine	In effect
Massachusetts	Past proposal
Montgomery County, MD	In effect
Nevada	Planned for 2011
New Jersey	Past proposals
New York City	Unknown
New York State	In effect
Oregon	In Development
Santa Fe, New Mexico	In effect
Vermont	Defeated
Washington	Unknown

KEY ISSUE
Type of Rating

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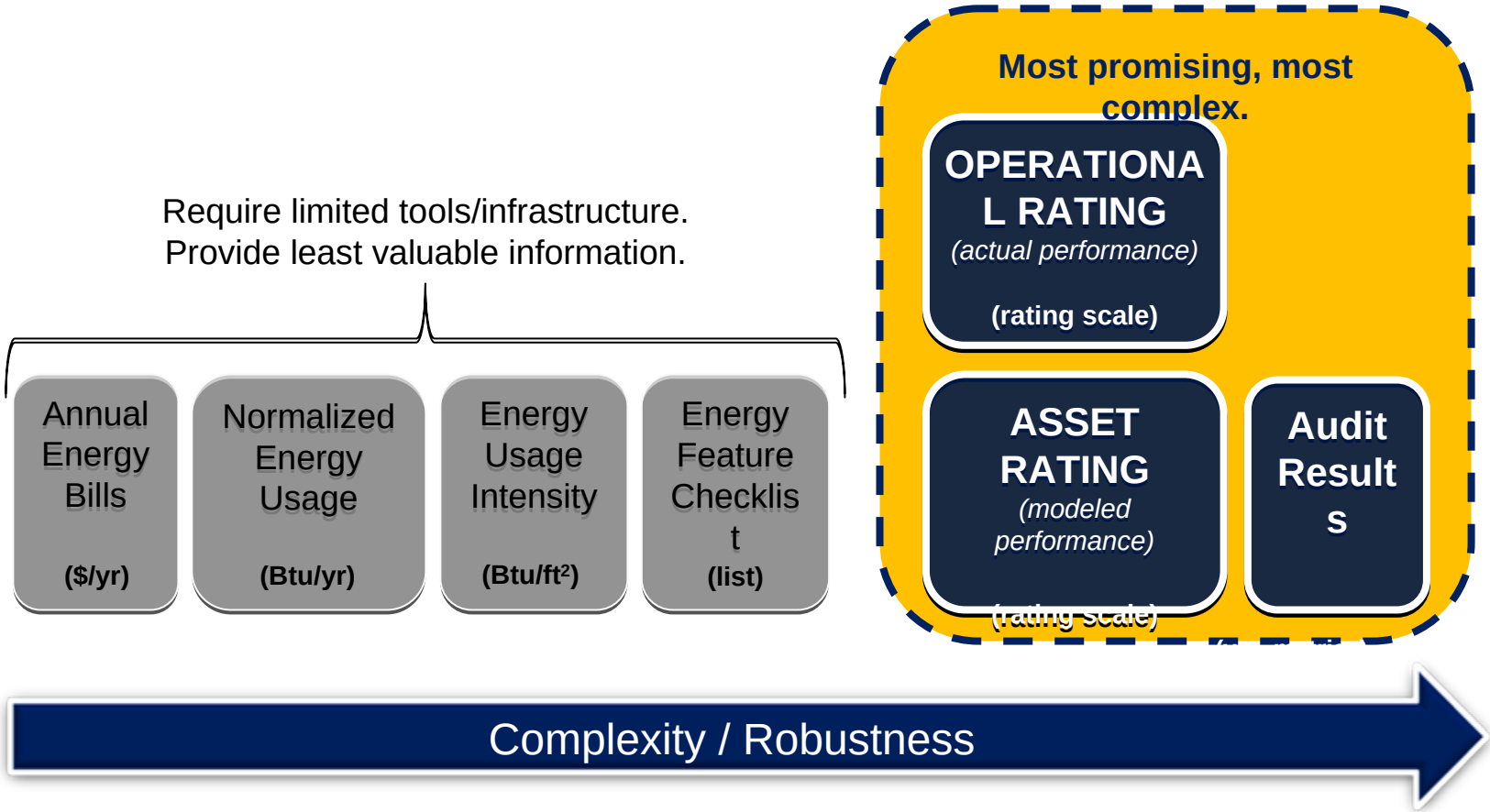

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Rating Terms

- **Asset rating**
  - Based on the structure with standardized occupancy
- **Operational rating**
  - Based on the building's actual energy use
- **Statistical rating (HEY, Portfolio Manager)**
  - Based on national data collection system
    - CBECS, RECS
- **Technical rating**
  - Simulation of a sum of components (RESNET)

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Label Basis & Granularity

- **Basis for label**
  - Site Energy
  - Primary (Source) Energy
  - Site, source, cost and carbon
  - MBtu: Million British Thermal Units
- **Granularity**
  - Index (RESNET)
  - Letters (Europe)
  - Threshold (ENERGY STAR Label)
  - High (1MBtu?)
  - Low (10MBtu?)

Customized Uniformity

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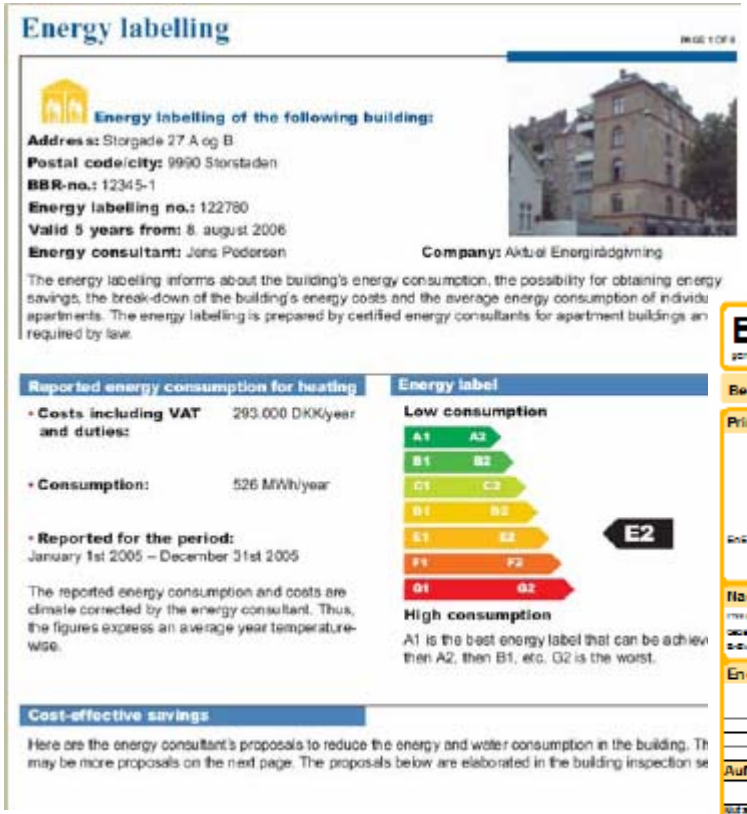


Energy labelling

Energy labelling of the following building:

Address: Storgade 27 A og B
Postal code/city: 9990 Storstaden
BBR-no.: 12345-1
Energy labelling no.: 122780
Valid 5 years from: 8. august 2006
Energy consultant: Jens Pedersen
Company: Aktuel Energirådgivning

The energy labelling informs about the building's energy consumption, the possibility for obtaining energy savings, the break-down of the building's energy costs and the average energy consumption of individu apartments. The energy labelling is prepared by certified energy consultants for apartment buildings an required by law.

Reported energy consumption for heating

- **Costs including VAT and duties:** 293.600 DKK/year
- **Consumption:** 526 MWh/year
- **Reported for the period:** January 1st 2005 – December 31st 2005

The reported energy consumption and costs are climate corrected by the energy consultant. Thus, the figures express an average year temperature-wise.

Energy label

Low consumption

A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2

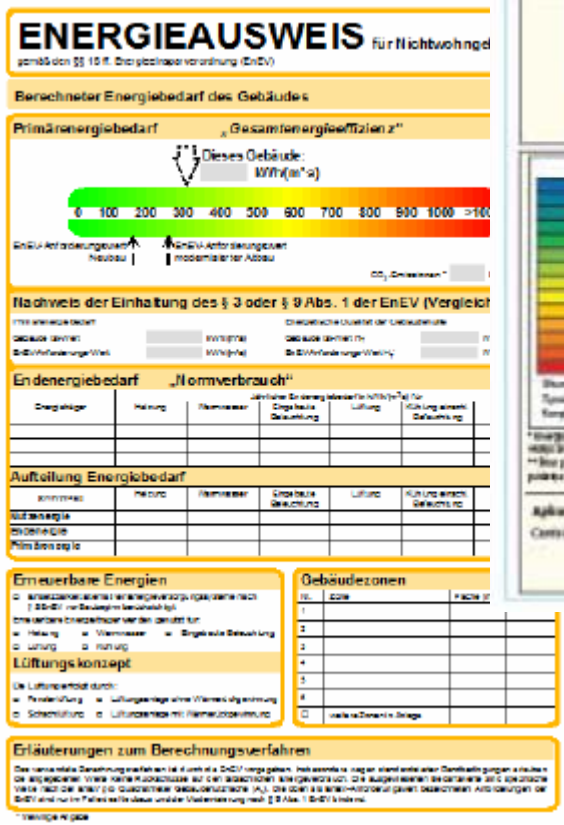
E2

High consumption

A1 is the best energy label that can be achiev then A2, then B1, etc. G2 is the worst.

Cost-effective savings

Here are the energy consultant's proposals to reduce the energy and water consumption in the building. Th may be more proposals on the next page. The proposals below are elaborated in the building inspection se



ENERGIEAUSWEIS für Nichtwohnge

gemäß den §§ 16 ff. Energieeinsparverordnung (EnEV)

Berechneter Energiebedarf des Gebäudes

Primärenergiebedarf „Gesamtenergieeffizienz"

Dieses Gebäude: kWh/(m²a)

0 100 200 300 400 500 600 700 800 900 1000 >1

EnEV-Anforderungswert Neubau | EnEV-Anforderungswert modernisierter Altbau

Nachweis der Einhaltung des § 3 oder § 9 Abs. 1 der EnEV (Vergleich

Endenergiebedarf „Normverbrauch"

Aufteilung Energiebedarf

Erneuerbare Energien

Lüftungskonzept

Gebäudezonen

Erläuterungen zum Berechnungsverfahren

DZĪVOJAMAS MĀJAS ENERGOPASE

Puškina 90, Daugavpils

Apkure

Centralizēta apkure

Decentralizēta apkure

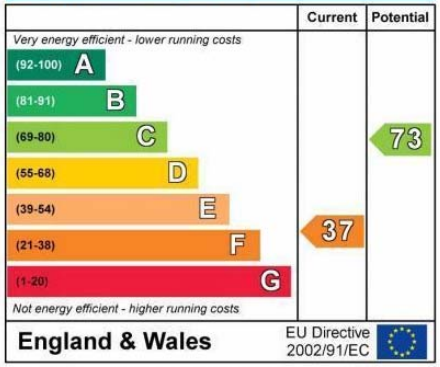
Energy Performance Certificate

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type:	Detached house
Date of assessment:	02 February 2007
Date of certificate:	[dd mmmm yyyy]
Reference number:	0000-0000-0000-0000-0000
Total floor area:	166 m²

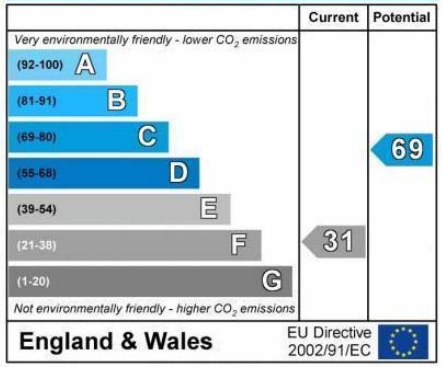
This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call **0800 512 012** or visit **www.energysavingtrust.org.uk/myhome**

Recommended measures to improve this home's energy performance

17 Any Street,
Any Town,
County,
YY3 5XX

Date of certificate:	[dd mmmm yyyy]
Reference number:	0000-0000-0000-0000-0000

Summary of this home's energy performance related features

The following is an assessment of the key individual elements that have an impact on this home's performance rating. Each element is assessed against the following scale: Very poor / Poor / Average / Good / Very good.

Element	Description	Current performance	
		Energy Efficiency	Environmental
Walls	Cavity wall, as built (no insulation)	Poor	Poor
Roof	Pitched, 250 mm loft insulation	Good	Good
Floor	Solid, no insulation (assumed)	–	–
Windows	Partial double glazing	Poor	Poor
Main heating	Boiler and radiators, mains gas	Average	Average
Main heating controls	Programmer, room thermostat and TRVs	Average	Average
Secondary heating	None	–	–
Hot water	From main system, no cylinderstat	Poor	Poor
Lighting	Low energy lighting in 75% of fixed outlets	Very good	Very good
Current energy efficiency rating		F 37	
Current environmental impact (CO_2) rating			F 31

Recommendations

The measures below are cost effective. The performance ratings after improvement listed below are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

Lower cost measures (up to £500)	Typical savings per year	Performance ratings after improvement	
		Energy efficiency	Environmental impact
1 Cavity wall insulation	£137	D 60	D 60
2 Low energy lighting for all fixed outlets	£75	D 63	D 61
Sub-Total	**£212**		
Higher cost measures (over £500)			
3 Upgrade heating controls	£56	D 64	D 63
4 Replace boiler with Band A condensing boiler	£87	D 67	D 67
Total	**£355**		
Potential energy efficiency rating		D 67	
Potential environmental impact (CO_2) rating			D 67

Further measures to achieve even higher standards

The further measures listed below should be considered in addition to those already specified if aiming for the highest possible standards for this home.

5 Solar photovoltaics panels, 25% of roof area	£188	C 71	C 73
Enhanced energy efficiency rating		C 71	
Enhanced environmental impact (CO_2) rating			C 73

Display Energy Certificate

HM Government

How efficiently is this building being used?

A Government Dept
12th & 13th Floor
Jubilee House
High Street
Anytown
A1 2CD

Certificate Reference Number:
1234-1234-1234-1234

This certificate indicates how much energy is being used to operate this building. The Operational Rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

More energy efficient

A 0-25
B 26-50
C 51-75
D 76-100

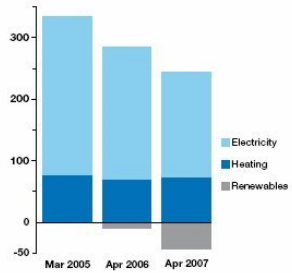
100 would be typical

E 101-125 ◀ 108
F 126-150
G Over 150

Less energy efficient

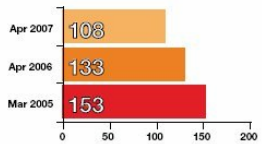
Total CO_2 Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO_2.



Previous Operational Ratings

This tells you how efficiently energy has been used in this building over the last three accounting periods



Technical information

This tells you technical information about how energy is used in this building. Consumption data based on actual readings.

Main heating fuel: Gas
Building Environment: Air Conditioned
Total useful floor area (m²): 2927
Asset Rating: 92

	Heating	Electrical
Annual Energy Use (kWh/m²/year)	126	129
Typical Energy Use (kWh/m²/year)	120	95
Energy from renewables	0%	20%

Administrative information

This is a Display Energy Certificate as defined in SI2007:991 as amended.

Assessment Software: OR v1
Property Reference: 891123776612
Assessor Name: John Smith
Assessor Number: ABC12345
Accreditation Scheme: ABC Accreditation Ltd
Employer/Trading Name: EnergyWatch Ltd
Employer/Trading Address: Alpha House, New Way, Birmingham, B2 1AA
Issue Date: 12 May 2007
Nominated Date: 01 Apr 2007
Valid Until: 31 Mar 2008
Related Party Disclosure: EnergyWatch are contracted as energy managers
Recommendations for improving the energy efficiency of the building are contained in Report Reference Number 1234-1234-1234-1234

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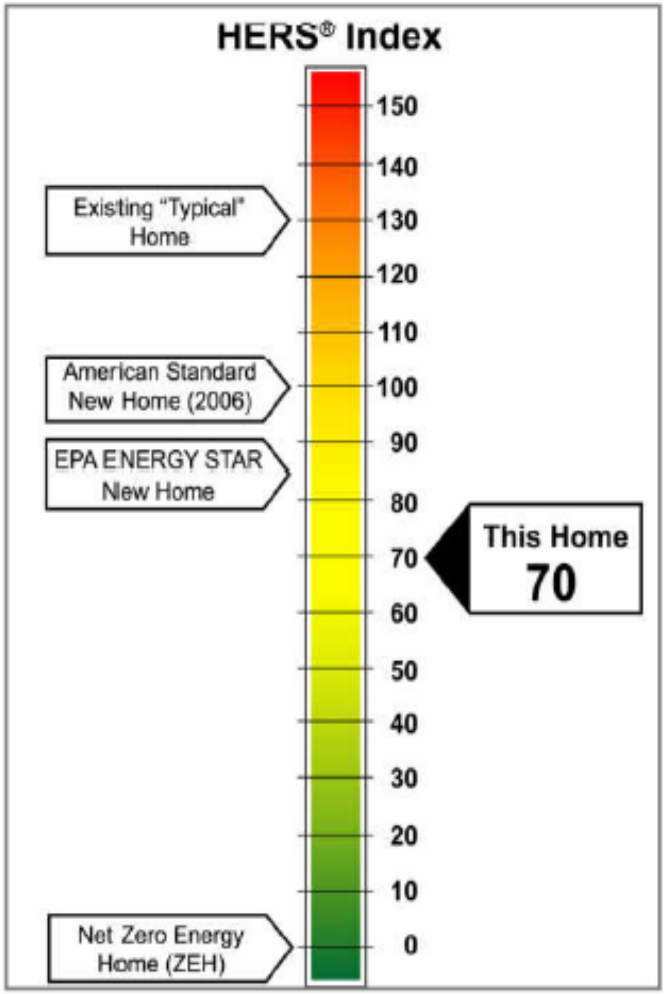
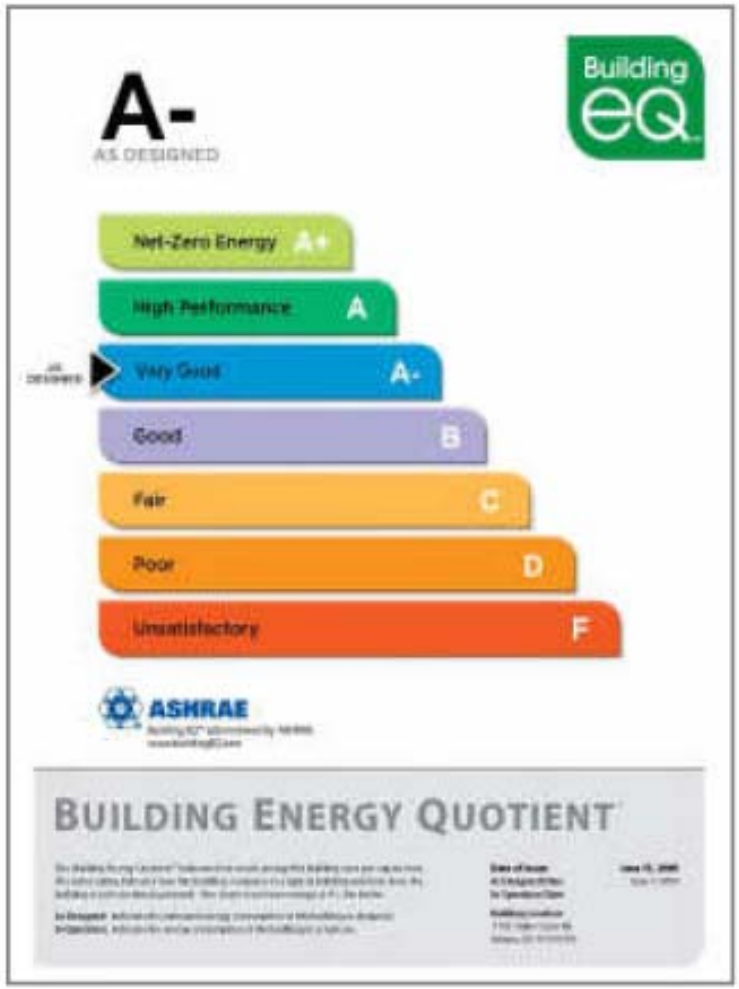
Some U.S. Options





Home Energy Rating Certificate

Lot 21 Thorn Bush Road

Hinesburg, VT 05461

5 Stars Plus
Verified Condition

Uniform Energy Rating System | **Energy Efficient**

1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus	4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101	100-91	90-86	85-71	70-0

HERS Index: 55

General Information

Conditioned Area:	2146 sq. ft.	House Type:	Single-family detached
Conditioned Volume:	15473 cubic ft.	Foundation:	Unconditioned basement
Bedrooms:	3		

Mechanical Systems Features

Heating:	Fuel-fired hydronic distribution, Propane, 92.0 AFUE.
Water Heating:	Integrated, Propane, 0.85 EF, 80.0 Gal.
Duct Leakage to Outside:	NA
Ventilation System:	Exhaust Only: 169 cfm, 54.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: No

Building Shell Features

Ceiling Flat:	R-37	Exposed Floor:	R-39, R-0
Vaulted Ceiling:	NA	Window Type:	U:0.35, SHGC:0.30
Above Grade Walls:	R-19	Infiltration:	
Foundation Walls:	R-10.0	Rate:	Htg: 830 Clg: 830 CFM50
Slab:	None	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	70.00	Clothes Dryer Fuel:	Electric
Percent Fluorescent CFL:	0.00	Range/Oven Fuel:	Propane
Refrigerator (kWh/yr):	460.00	Ceiling Fan (cfm/Watt):	0.00
Dishwasher Energy Factor:	0.66		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

REM/Rate - Residential Energy Analysis and Rating Software v12.5 Vermont

Rating Number:	6038J685
Export Build Run No:	13723
Certified Energy Rater:	Sara Davie
Rating Date:	December 15, 2008
Rating Ordered For:	Collin Frisbie

Estimated Annual Energy Cost
Verified Condition

Use	MMBtu	Cost	Percent
Heating	71.7	$2276	67%
Cooling	0	$0	0%
Hot Water	3.9	$125	4%
Lights/Appliances	22.6	$868	26%
Photovoltaics	-0.0	$-0	-0%
Service Charges		$119	4%
Total		$3389	100%

This home meets or exceeds the minimum criteria for all of the following:

Federal Energy Policy Act, 2005*
Vermont Energy Star Homes Criteria*
Vermont Residential Energy Code*

* Compliance with criteria for this program is determined by the rater.

Vermont Energy Investment Corp.
255 South Champlain St.
Burlington, VT 05401
800-639-6069
Fax 802-658-1643
www.veic.org

Proposed California Label

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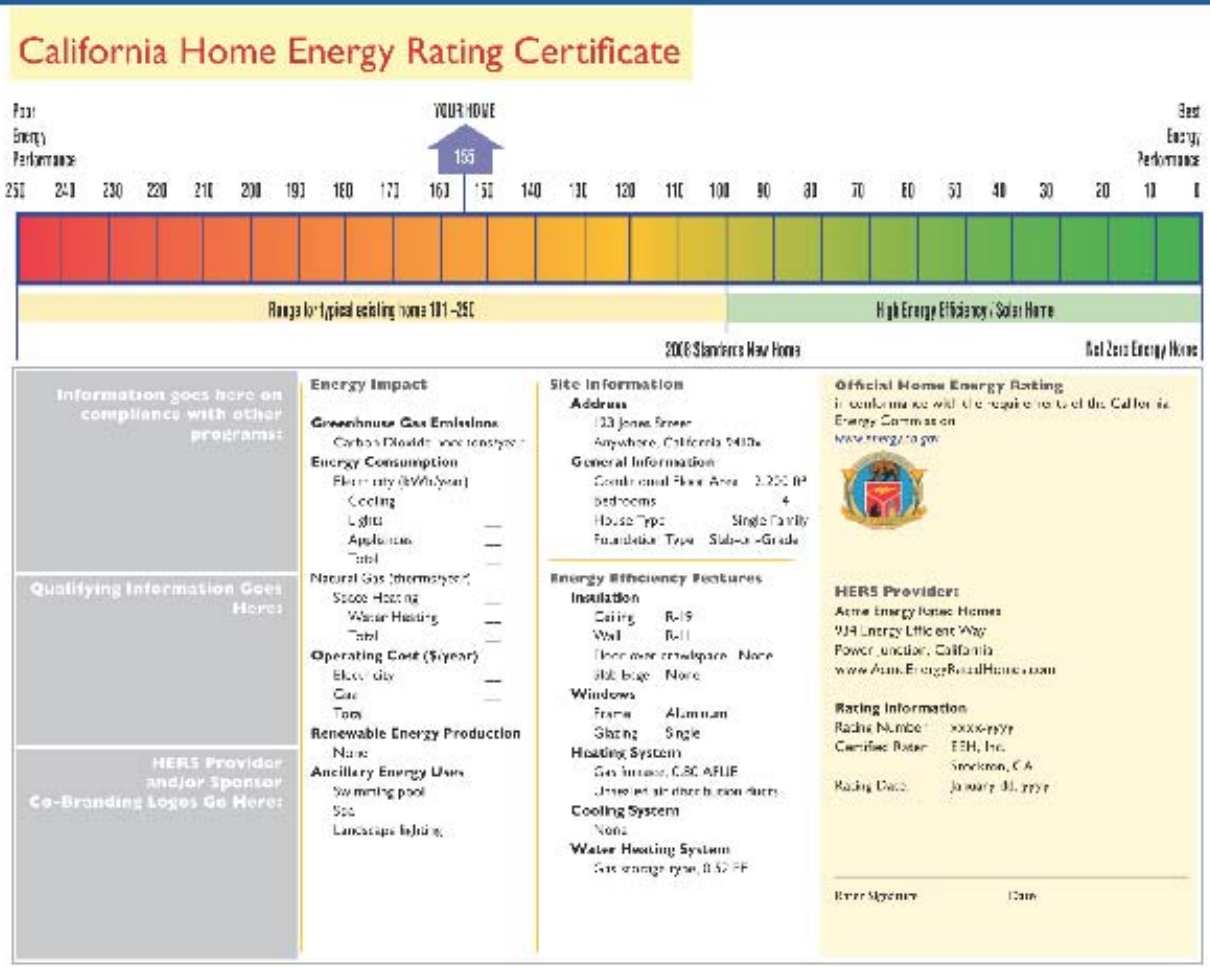
Sample Rating Certificate



California Home Energy Rating System Program Phase II

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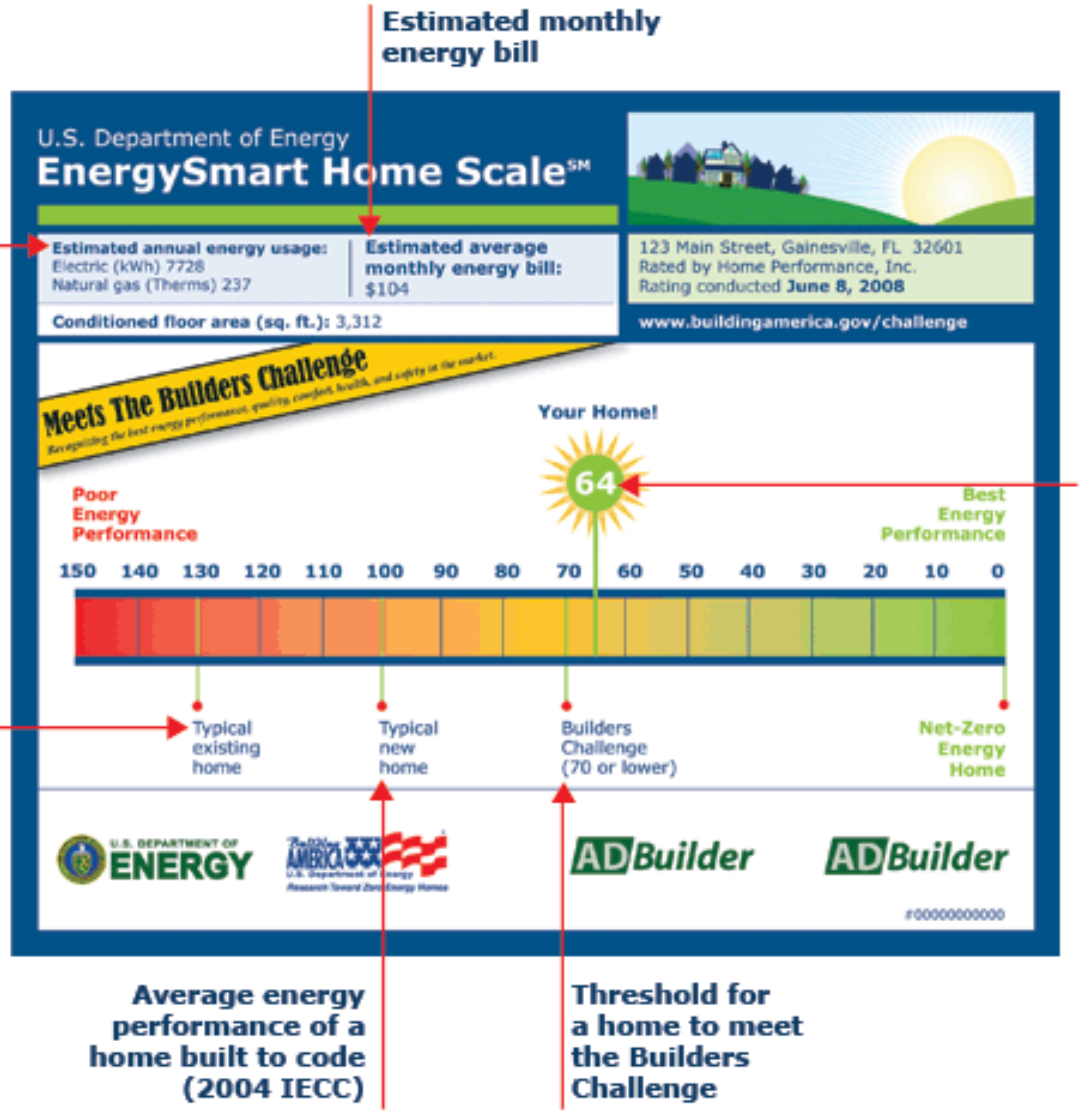

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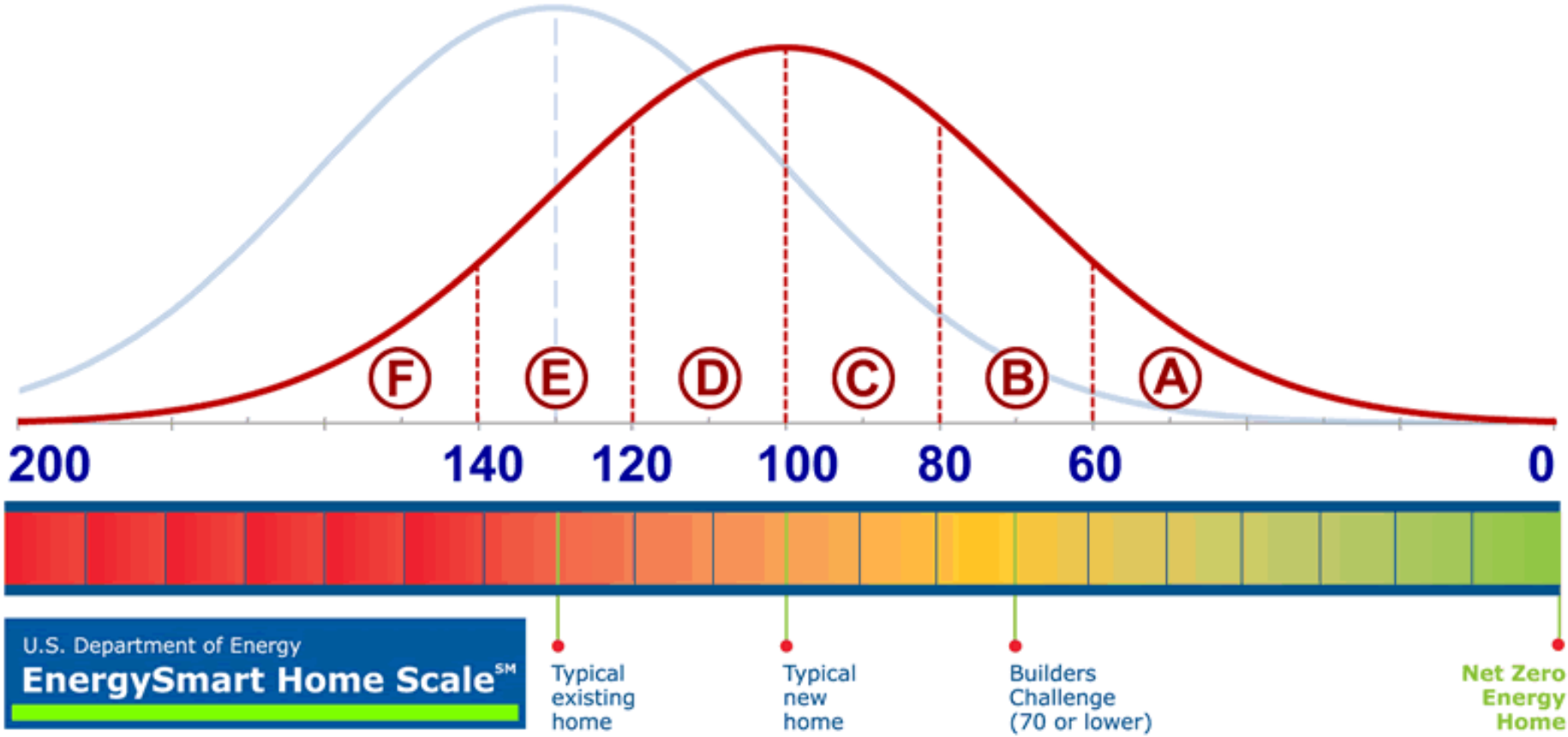
The Fairey Model



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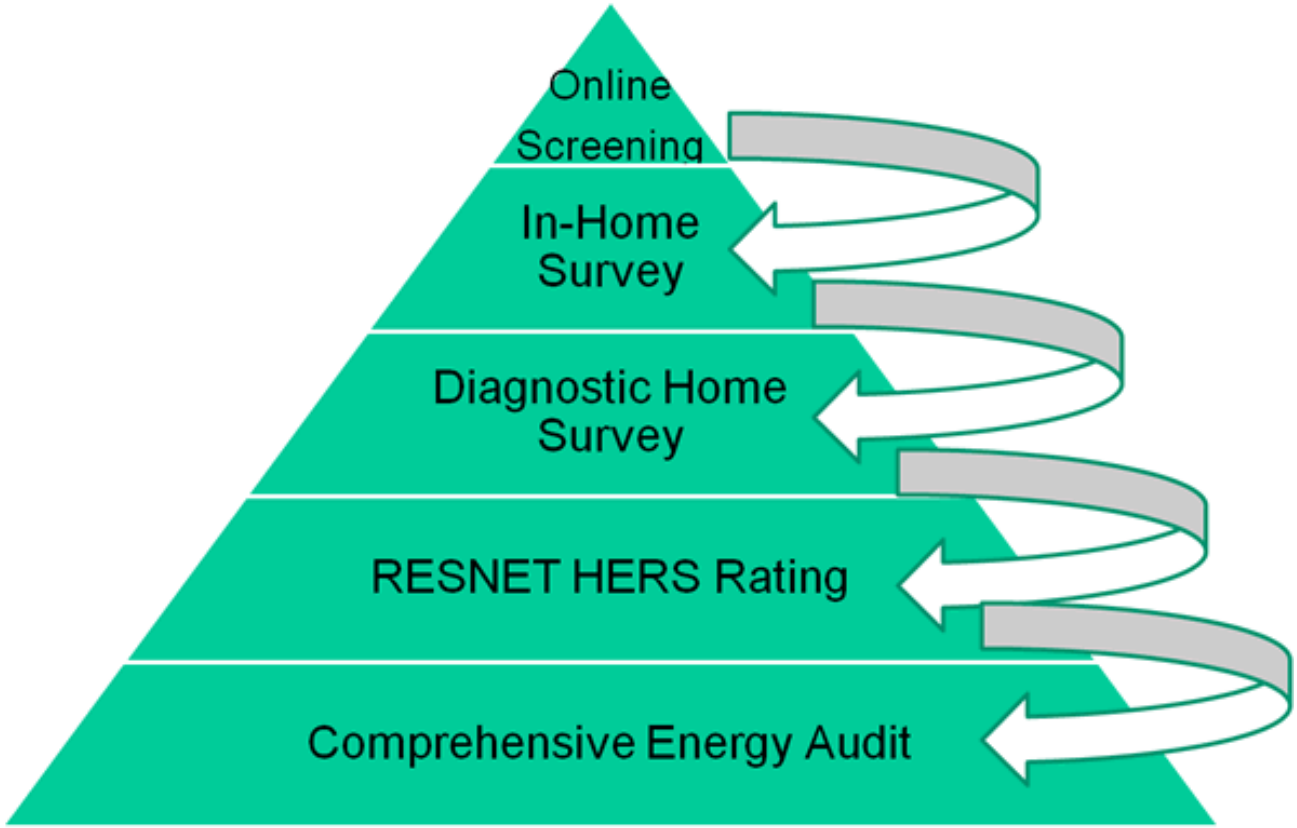
U.S. DOE Proposed Data Hierarchy for "Integrated Rating Tools"



Labeling Characteristics at Building Intervention Points

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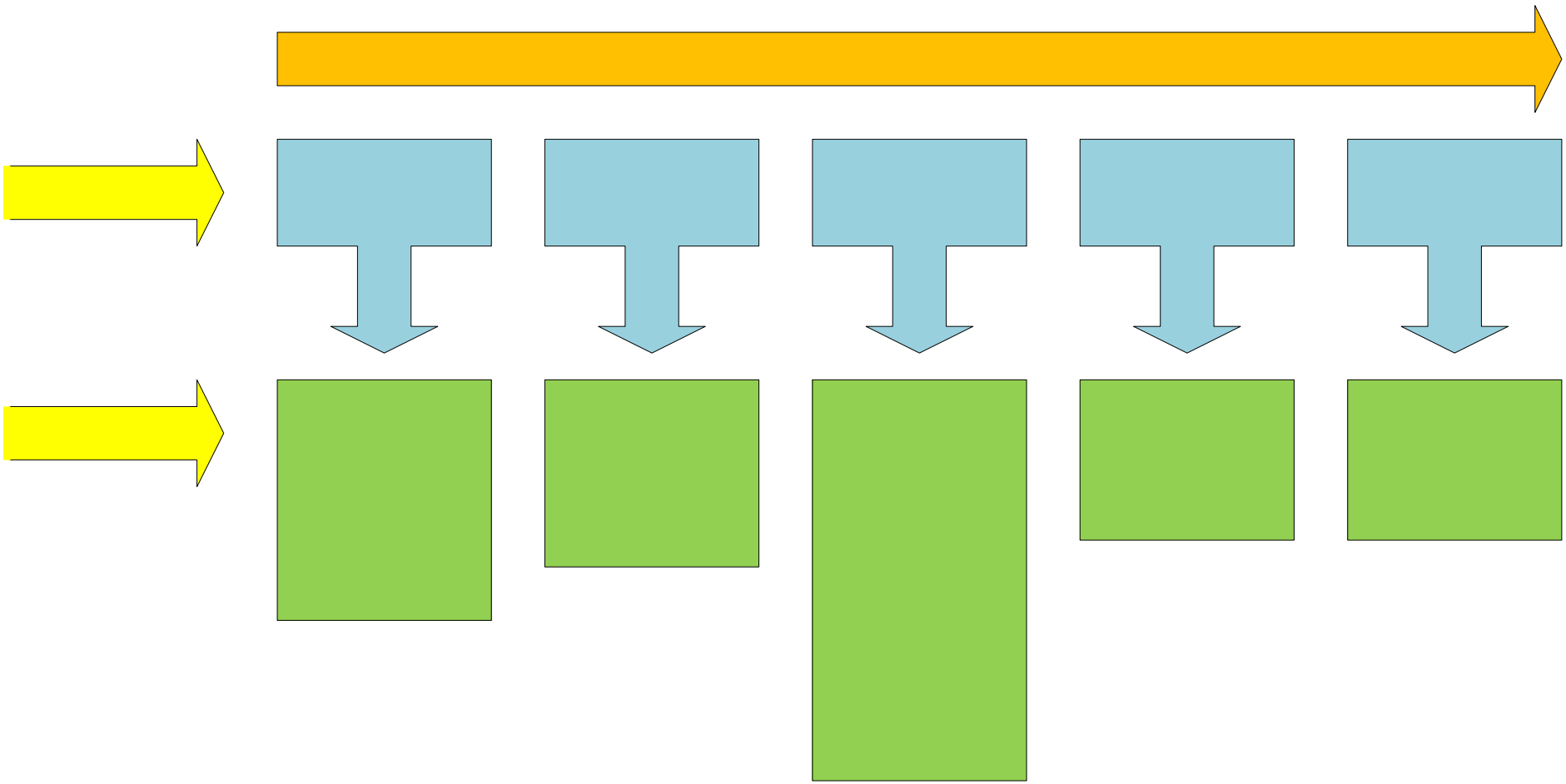

Label Use Cases

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House Lifetime ---------->

Use Case		What			Who			Certificate / Report
		Simplified Audit	Detailed Audit / Rating	Scope of Work	Home Inspector Type	HP or WAP Contractor	HERS Rater	
New Construction - Program	From Plans		✓	✓			✓	HERS Rating
	Verified		✓				✓	HERS Rating / ENERGY STAR Label
New Construction – EEM	From Plans		✓	✓			✓	HERS Rating Mortgage Forms
	Verified		✓				✓	HERS Rating / ENERGY STAR Label / Mortgage Forms
Tax Assessment		✓			✓			Simplified A-F Label
Weatherization Assistance Program	Pre		✓	✓		✓		Audit with Report
	Post	✓				✓		Simplified A-F Label
Remodel – HPwES	Pre		✓	✓		✓		Audit with Report
	Post	✓				✓		Simplified A-F Label
Remodel – Refinance/EIM	Pre		✓	✓			✓	HERS Rating with Report / Mortgage Forms
	Post		✓				✓	HERS Rating
Remodel – Home Star (Gold)	Pre		✓	✓		✓ or	✓	HERS Rating or Approved Audit Tool
	Post	✓				✓ or	✓	HERS Rating or Approved Audit Tool
Time of Listing		✓			✓			Simplified A-F Label
Purchase & Remodel/EIM	Pre		✓	✓			✓	HERS Rating / Mortgage Forms
	Post		✓				✓	HERS Rating / Mortgage Forms

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Principles

1. Provide energy information at the right time in the ownership/transaction process to influence behavior
2. Whenever you do energy work, leave a label behind for the next buyer
3. Establish national guidance/standards, but allow for local flexibility
4. Consider the different use cases; one size doesn’t fit all

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Proposed Label Features

Simplified Label	Detailed Rating
A - F Efficiency Scale	0 - 100+ (HERS?) Scale
Carbon Scale	Energy Improvement Recommendations
	Projected Energy Use/Cost/Savings
	Carbon Scale

- Come up with a pretty national uniform customer-facing label
- Allow for local additions to national minimum

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Questions

- Relative (HERS) scale or absolute MBtu (Oregon) scale?
- Include operational rating to encourage behavior change or is it too confusing?
- Carbon:
  - National, regional, by utility?
  - Average annual or time-specific?

kWh Carbon Intensity to Cost Comparison

EIA 2006

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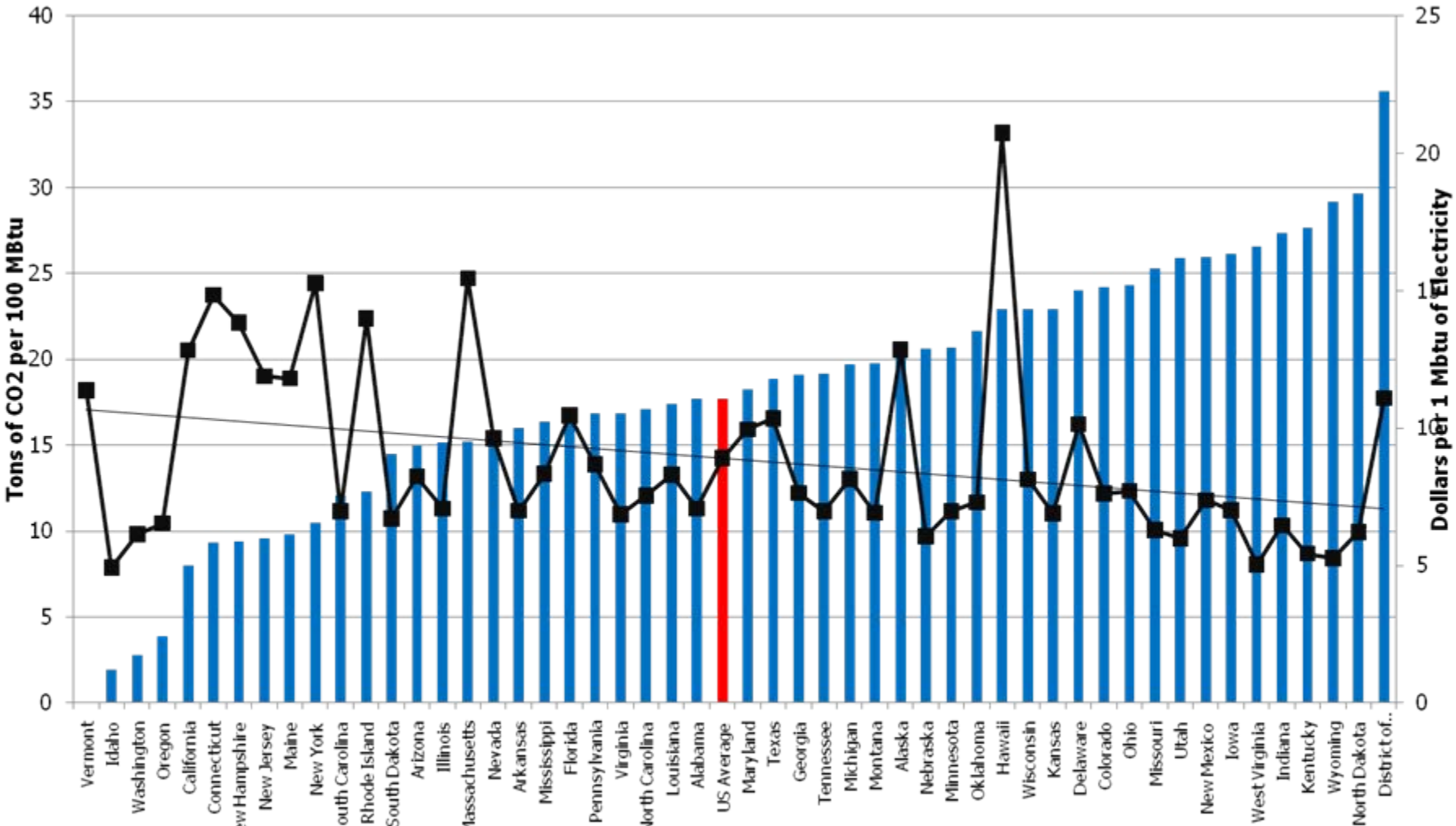

National Carbon per kWh Intensity - 2006

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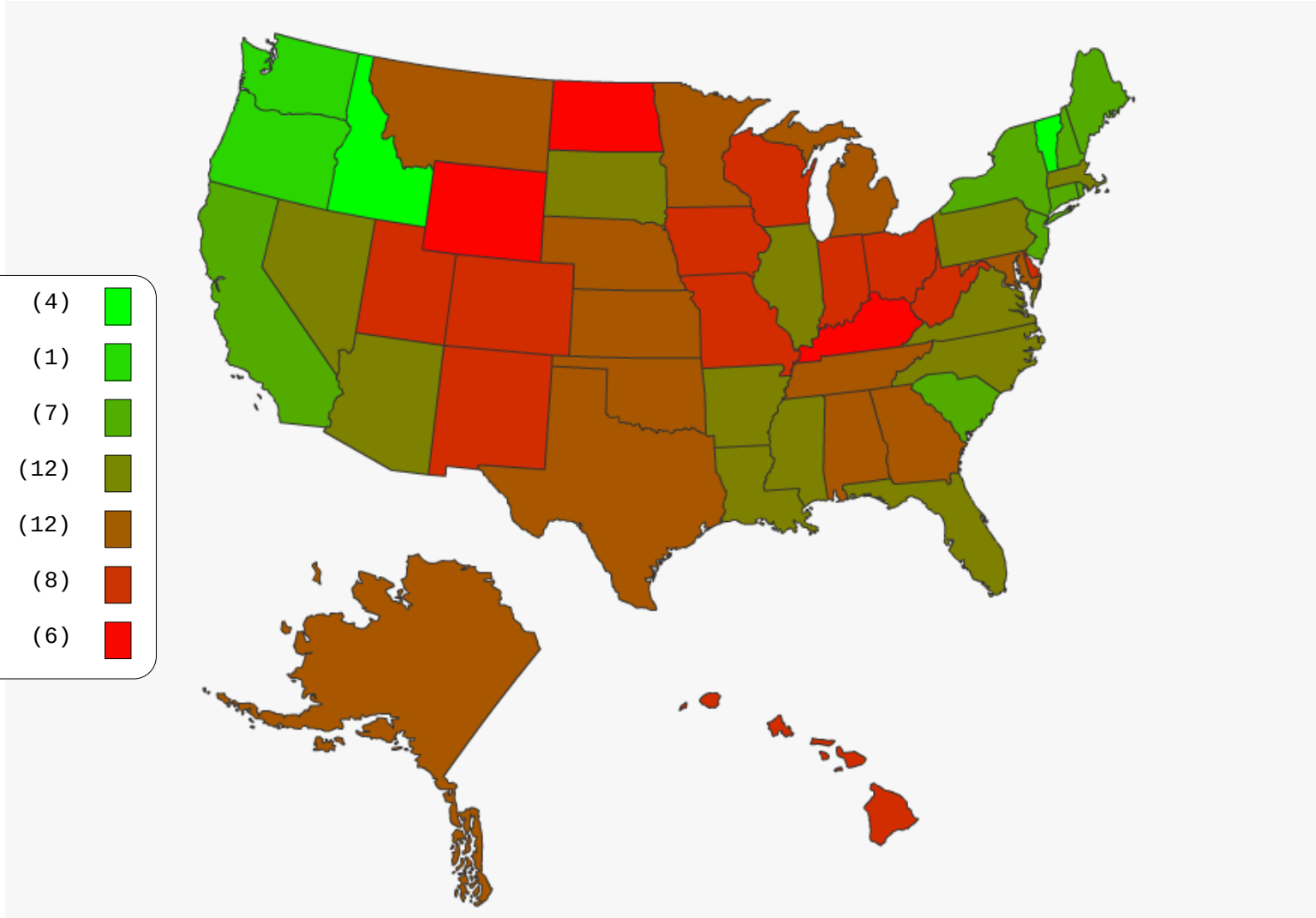

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Final Question…

- Can DOE *really* figure all of this out by September?

Thank You

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