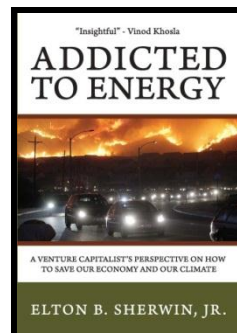
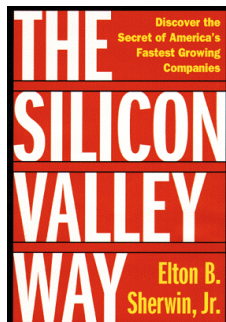
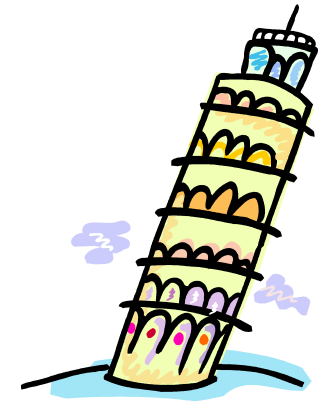


Why Asset Ratings Fail

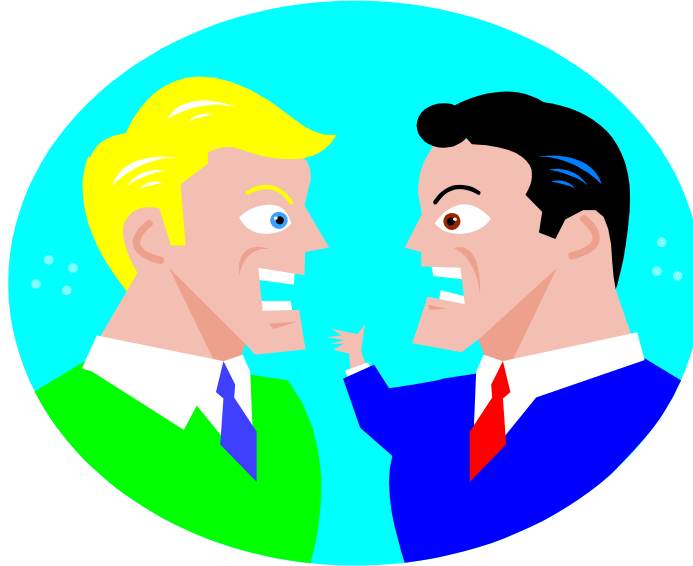
EUEC Conference
Phoenix
January 30, 2012



Elton B. Sherwin
Venture Capitalist

Author of
The Silicon Valley Way and
Addicted to Energy

Two Ways to Rate Buildings




One of the great controversies among
regulators around the world

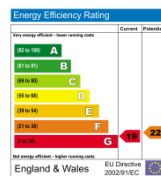
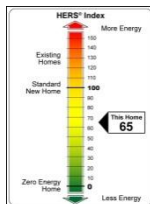
Asset Ratings vs. Operational Ratings

Two Types Building Ratings

Asset Rating



Score =
$$\sqrt{\frac{\sum_{k=1}^m \left(\sum_{i=1}^{n_k} \sum_{j=i+1}^{n_k} (x_{ki} - x_{kj})^2 \right)}{\sum_{k=1}^m \frac{n_k \times (n_k - 1)}{2}}}$$



Operational Rating



Why Do We Care?



Use building ratings to

- Lower environmental impact
- Increase private investment
- Create jobs
- Lower utility bills
- Lay foundation for net zero buildings



Asset Ratings

- Single number/grade evaluating a building's theoretical energy consumption or environmental impact
- Evaluates a building regardless of what occupants are doing
 - “Unchanging”
 - “As Built”

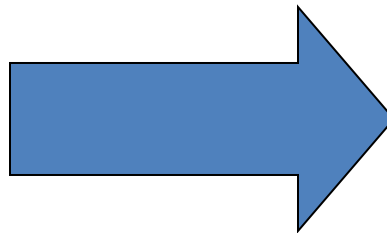
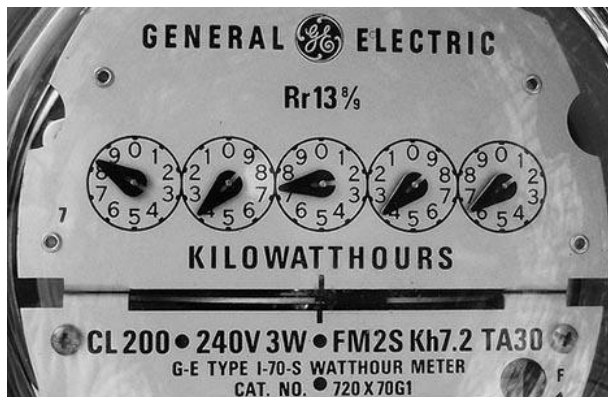


Asset Ratings

- Regulators, bankers and utilities like the simplicity
 - Before and after upgrade
 - Pay contractors based on predicted results
 - If we invest 20k, save, 5k a year.
 - Simple: add insulation → save \$3,497 / yr.
- Moto: Grade the building, not the people in it

Operational Rating

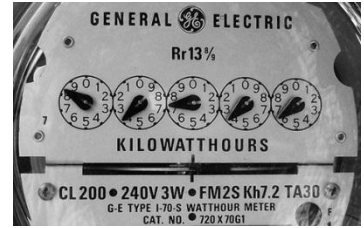
- Single number/grade ranks or scores a building's **actual** energy consumption
 - Graded based on actual performance



Energy used ÷ size of building

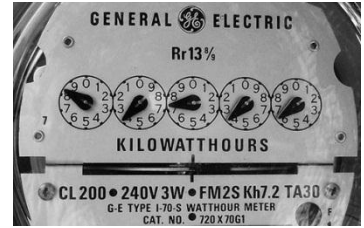
Adjusted by type: Office, hospital, etc.

Operational Rating



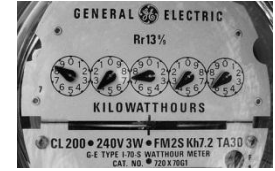
- Operational rating:
 - School grade
 - Changes every month/year.
 - Energy/ square foot
 - Similar types of buildings in similar climates.
 - “As used”

Operational Ratings



- Moto: grade real performance
- Simple to calculate
- Hard to understand
 - Old building sometimes do well
 - Green buildings sometimes do poorly
- Less expensive asset ratings
 - Update frequently

Current Situation



Asset Rating

Grade the building
not the people

LEED

- Composite

DOE

- Pilot homes
- Developing Commercial

Operational Rating

Grade the real
performance

ENERGY STAR
Commercial



How to Think About the Issue

Asset Rating

Grade the building
not the people



Score =
$$\sqrt{\frac{\sum_{k=1}^m \left(\sum_{i=1}^{n_k} \sum_{j=i+1}^{n_k} (x_{ki} - x_{kj})^2 \right)}{\sum_{k=1}^m \frac{n_k \times (n_k - 1)}{2}}}$$

Building's DNA

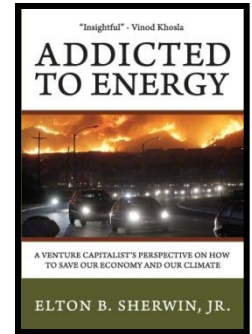
Operational Rating

Grade the real
performance



Report Card /
Grade

I Recommend Two Asset Rating Systems in *Addicted to Energy*



- Also made series of recommendations to DOE
 - All are on Slideshare
 - <http://www.slideshare.net/EltonSherwin/comments-on-doe-commercial-building-asset-rating-program>
 - See pages 5-8 of pages :
<http://www.slideshare.net/EltonSherwin/net-zero-energy-buildings-checklists-for-architects>
- Not opposed to asset ratings
 - Cautious about misleading asset ratings

Analyzed 17 Building Rating Systems



Around the World



European Unions Energy Performance Certificates

UK Display Energy Certificates

LEED – New Construction

LEED – Health Care

ENERGY STAR – Commercial buildings

ENERGY STAR homes

PlaNYC (**New York City**)

Australia's Greenhouse Rating

HERS

ASHRE EQ

CALGreen level 2

California AB 1103

California AB 758

DOE home energy scoring pilot

Passive Home Certification

City of **Seattle**

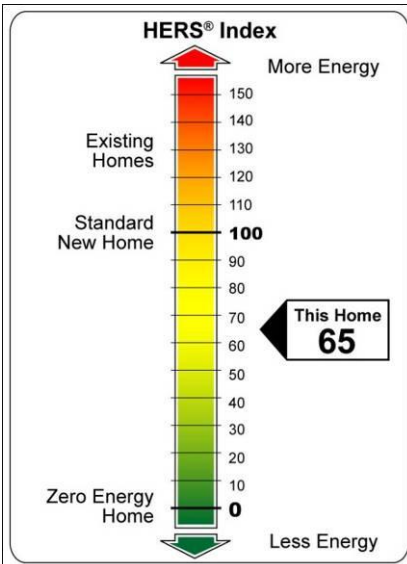
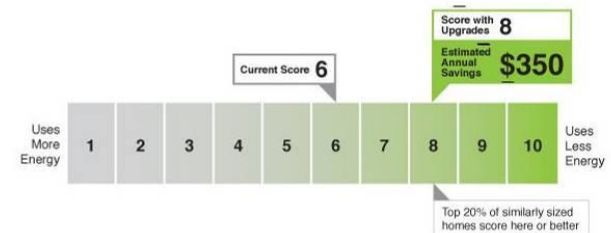
San Francisco



A-
AS DESIGNED



CALGreen



Energy Efficiency Rating

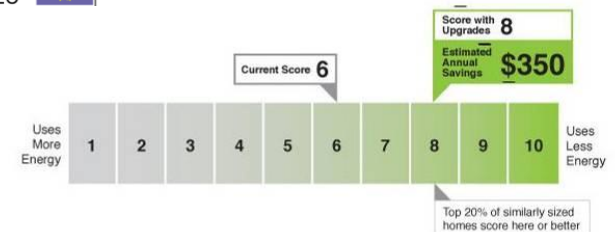
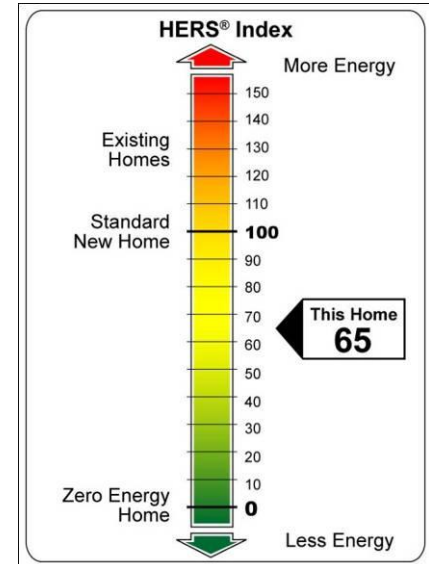
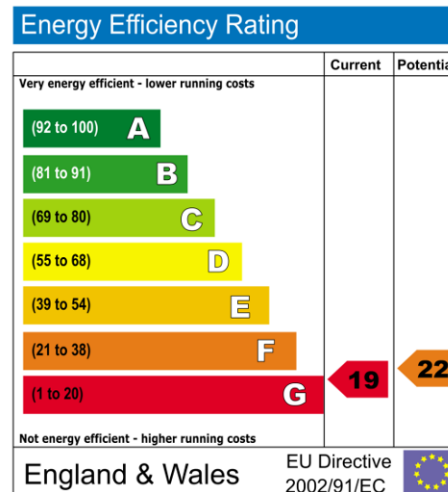
	Current	Potential
Very energy efficient - lower running costs		
(92 to 100) A		
(81 to 91) B		
(69 to 80) C		
(55 to 68) D		
(39 to 54) E		
(21 to 38) F		
(1 to 20) G	19	22
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

Details at Slideshare.com



Asset Ratings Struggled

- Misleading, limited value
- Look at two examples
 - UK
 - Holland
- Two Studies
 - Oregon
 - LBNL
- Why?
- Recommendations





United Kingdom

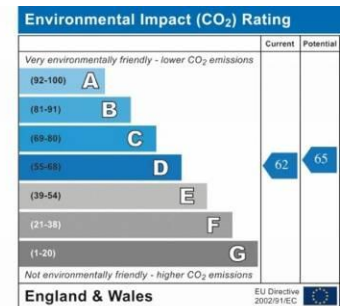
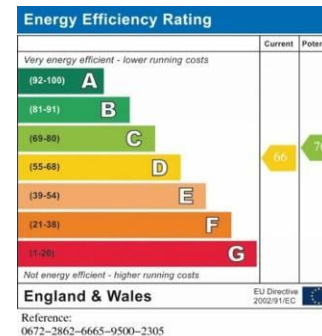
Energy Performance Certificates

Commercial and residential



$$= \sqrt{\frac{\sum_{k=1}^m \left(\sum_{i=1}^{n_k} \sum_{j=i+1}^{n_k} (x_{ki} - x_{kj})^2 \right)}{\sum_{k=1}^m \frac{n_k \times (n_k - 1)}{2}}}$$

No Meter Data



UK Label

Energy Performance Certificate

- Valid for 10 years
 - Commercial
 - Residential



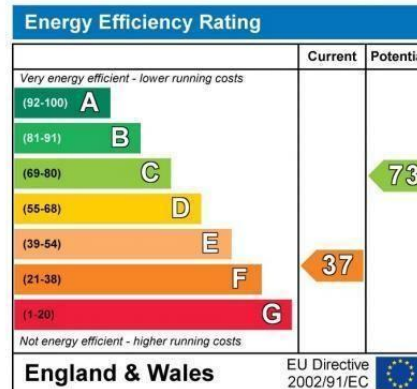
Energy Performance Certificate



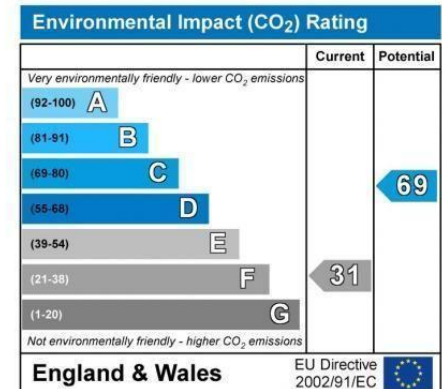
17 Any Street,
Any Town,
County,
YY3 5XX

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 (CO₂) emissions.



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.



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO₂) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m ² per year	178 kWh/m ² 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.

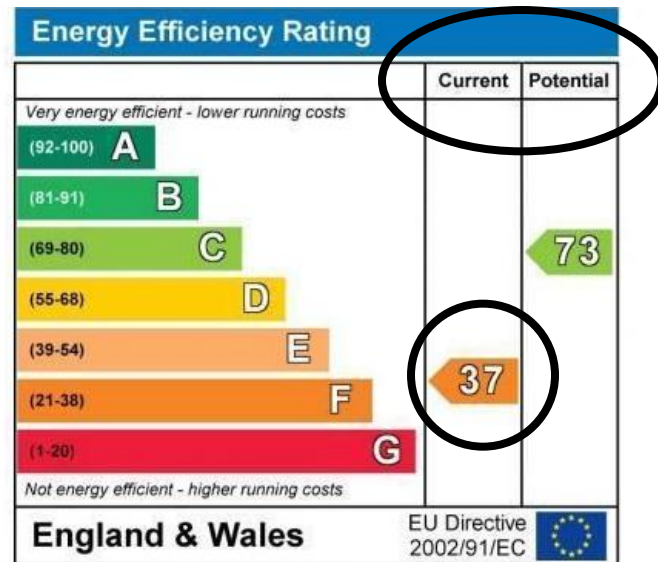
To see how this home can achieve its potential rating please see the recommended measures.



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

Seems Useful



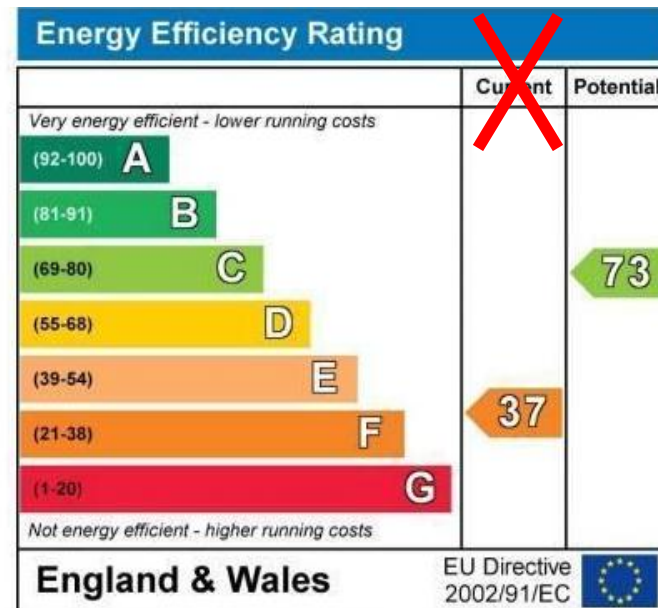
The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Estimated energy use, carbon dioxide (CO₂) emissions and fuel costs

	Current
Energy Use	453 kWh/m ² per year
Carbon dioxide emissions	13 tonnes per year
Lighting	£81 per year
Heating	£1173 per year
Hot water	£219 per year

Numbers Are Not Right

- Looks real
- Wrong



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.

Estimated energy use, carbon dioxide (CO₂) emissions and fuel costs

	Current
Energy Use	453 kWh/m ² per year
Carbon dioxide emissions	13 tonnes per year
Lighting	£91 per year
Heating	£173 per year
Hot water	£219 per year

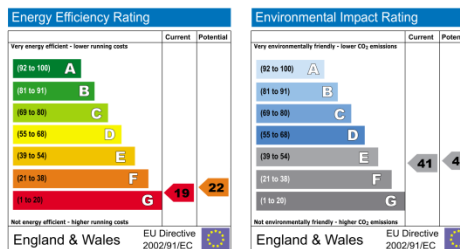
UK Energy System

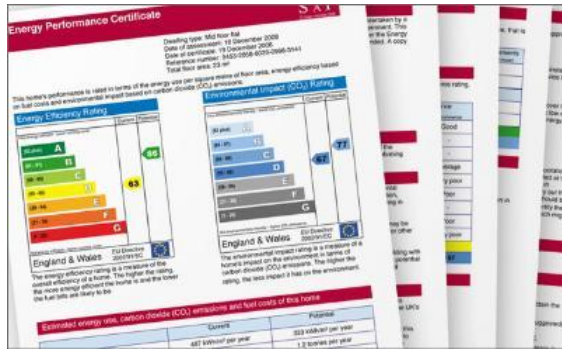
“Next to useless.”

Jeff Howell, The Telegraph

“All old buildings do poorly. Don’t worry about it. Everyone just ignores it.”

London Estate Agent (Realtor)





Holland



- A to G asset rating
- Homes with better grades sell at a premium
- Grades “very inaccurate” predictors of energy usage
- Some municipalities now want performance guarantees from contractors
 - Upgrade results have been disappointing
 - Overestimate value of furnace/boiler upgrades

LBNL Study (1999)

- “We compared Home Energy Rating Systems (HERS) ratings and actual utility billing data for about 500 houses in four states...
- “There was no clear relationship between rating score and actual energy cost.”



Accuracy of Home Energy Rating Systems.
Jeff Ross Stein, Alan Meier. 1999.
Lawrence Berkeley National Laboratory

Oregon EarthAdvantage Study

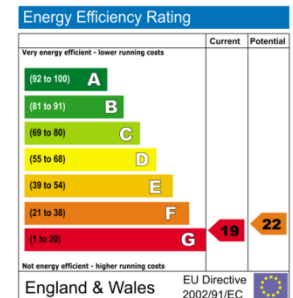
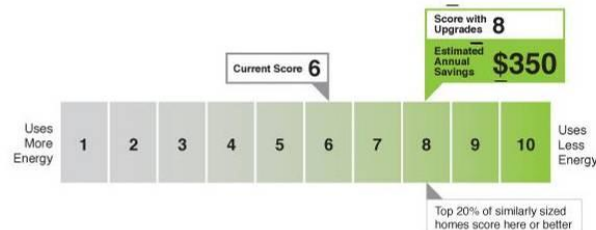
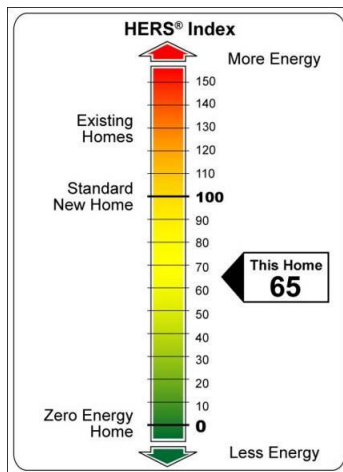
- ...HERS approved software does a **very poor job of estimating energy use for existing homes.**
- “The HERS Index is the wrong metric to compare homes, it does **not** do a good job of making apples to apples **comparisons of one home to another.**



Energy Performance Score 2008 Pilot Findings & Recommendations Report.
August, 2009. Prepared for the Energy Trust of Oregon by the Earth Advantage Institute and the Conservation Services Group. Bold added

How Do We Fix Problems with Asset Rating Systems?

Why are struggling?
Recommendations



Why Are Asset Ratings So Inaccurate?

The Three Gene Myth

- Performance of building is determined by
 - *Three genes*
 - Shell
 - Windows
 - Appliances (including HVAC)
 - *Occupant behavior*
 - *All inaccuracy must be result of occupant behavior*
- Need more than three genes to predict building efficiency



Need More Information Need More Than “Three Genes”

Top Faults Causing Energy Inefficiencies in Commercial Buildings

- Duct leakage
- HVAC left on when space unoccupied
- Lights left on when space unoccupied
- Airflow not balanced
- Improper refrigerant charge
- Dampers not working properly
- Insufficient evaporator airflow
- Improper controls setup / commissioning
- Control component failure or degradation
- Software programming errors
- Improper controls hardware installation
- Air-cooled condenser fouling
- Valve leakage

**Ignored
in
Asset
Ratings**

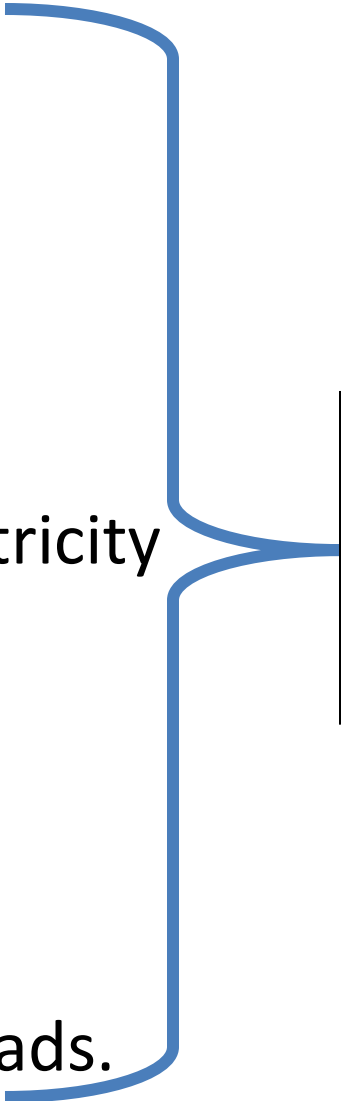
Attributes of *Great Buildings*

- Minimize unnecessary lighting
 - Use the sunlight
 - *Automatically dim or turn lights off*
- *Use the sun's heat when it is cold*
- *Block the sun's heat when it is hot*
- Provide fresh air using little/no electricity
 - *Minimize unnecessary air movement*
- Minimize unnecessary heating
- Minimize unnecessary cooling
 - *Don't use AC in empty rooms.*
- Give users feedback on their plug loads.



**Missed
in
Asset
Ratings**

The Assets of ***Net Zero Buildings***

- Minimize unnecessary lighting
 - Use the sunlight
 - *Automatically dim or turn lights off*
 - *Use the sun's heat when it is cold*
 - *Block the sun's heat when it is hot*
 - Provide fresh air using little/no electricity
 - *Minimize unnecessary air movement*
 - Minimize unnecessary heating
 - Minimize unnecessary cooling
 - *Don't use AC in empty rooms.*
 - Give users feedback on their plug loads.
- 

**Missed
in
Asset
Ratings**

Blacklisting of Silicon Valley Products

Most asset ratings omit:

- Adaptive motor controls
- All microprocessors
- All software
- Smart windows
- Smart materials
- Sensors
- Most innovation



Key to Success

Asset ratings—like DNA decoding—

Need lots of data

Need data that researchers can use

Public data

Transparency

Innovation

What to Do?

Recommendations

Data and Transparency

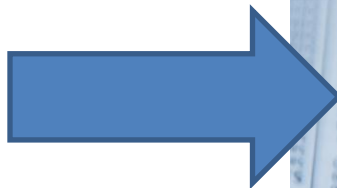
A whimsical illustration of a small, cozy house with a red tiled roof and a chimney emitting a wisp of smoke. The house is surrounded by green grass and a path leading to the door, with a small garden area featuring red flowers.

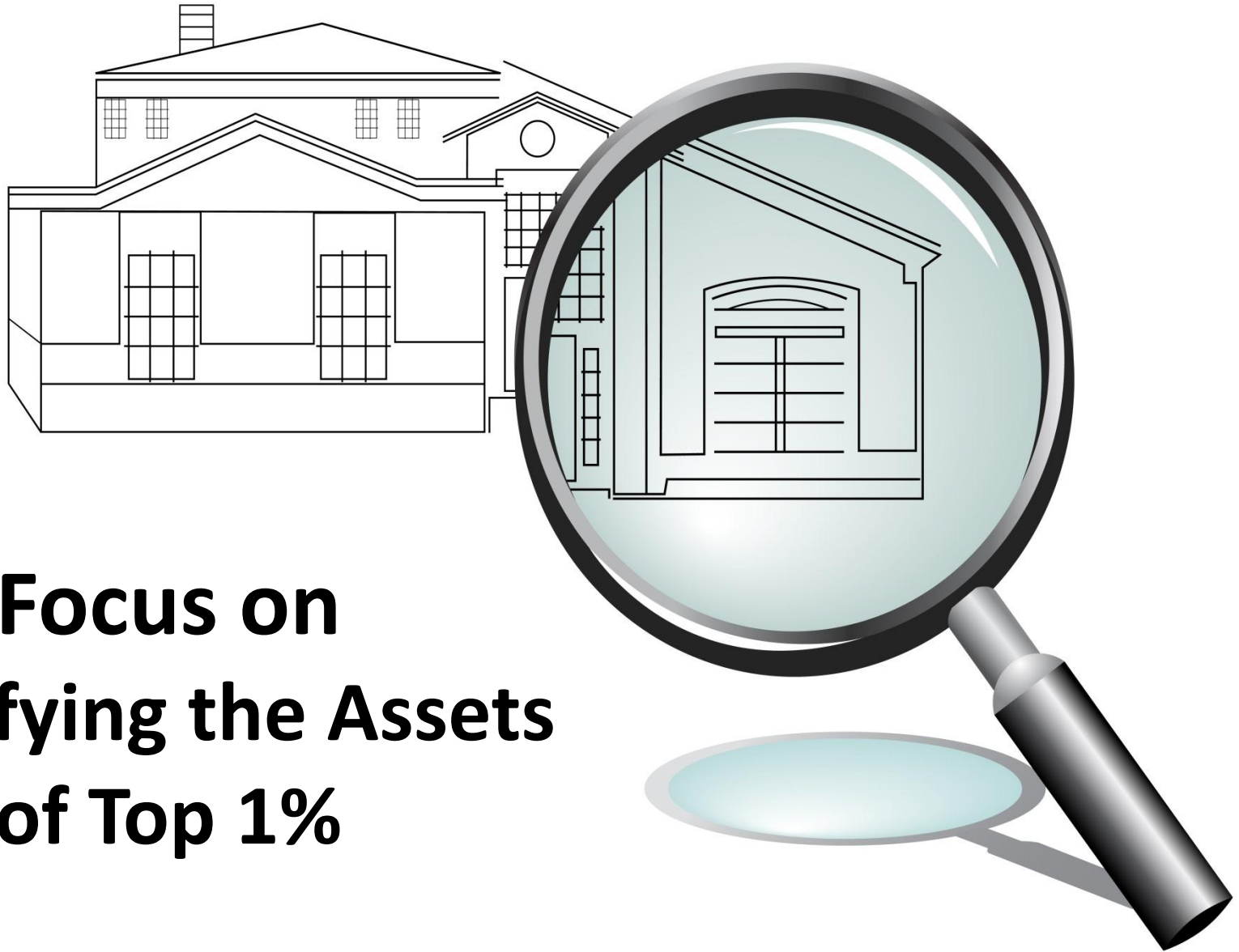


Publish Performance Data for Buildings Making Green Claims



Publish Performance Data for Buildings with Asset Ratings



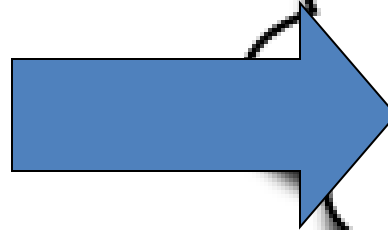
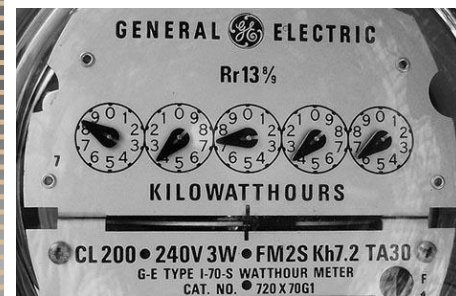
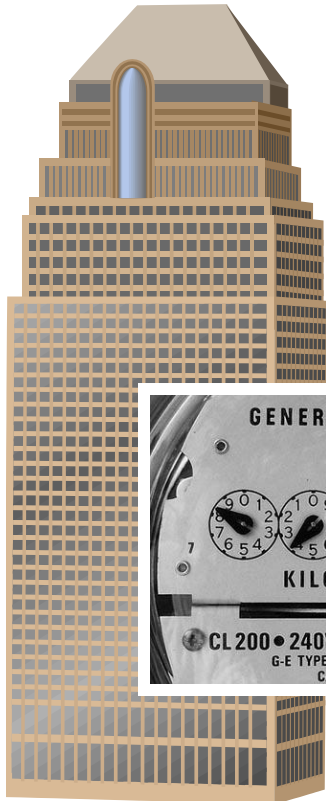


Focus on Identifying the Assets of Top 1%

Why do they perform so well?

Test asset [scoring proposed in *Addicted to Energy*](#)

Institute Benchmark and Disclose Laws



High = 100

Low = 1

**Disclose the ENERGY
STAR Ratings of All
Government-funded
Buildings and
Post the Scores on
Their *Front Doors***
Release all input data



**Require the Last
Two Years of Total
Energy Costs in the
Residential MLS
When Homes Are
Sold**



**Send Window Stickers
to all ENERGY STAR
Buildings Scoring 80
or Above**

Posting is optional

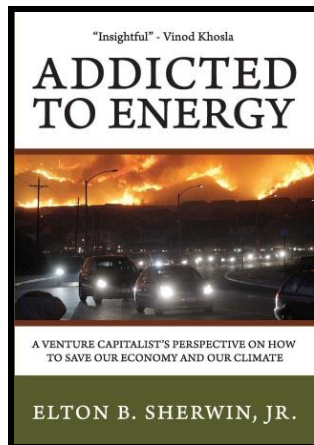


Encourage Innovative Products

Separate innovation score for:

- Adaptive motor controls
- Smart windows
- Smart materials
- Sensors
- Adaptive fans
- Micro-zoning





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