Home Energy Score responses to CEC Whole-House Home Energy Rating and Labeling Pre-Rulemaking - September 18 Workshop Questions

Additional submitted attachment is included below.

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Calculation Methods

What can be used for calculation procedures and modeling rules for each end-use?

Home Energy Score relies on ANSI/RESNET/ICC 301 to guide the calculation procedures and modeling rules in the software.

What can be used for Calculating Solar PV?

Home Energy Score uses NREL's PVWatts library integrated into EnergyPlus for PV calculation for site-energy based values.

To calculate net source energy (which is used as a basis for the Score) PV generation is subtracted from total source energy consumption with a nationally representative site to source factor applied to the consumption by fuel type but not to the PV generation because that energy is generated on site.

What can be used for standard assumptions that must be made for occupancy and operational?

For assumptions and defaults not covered in ANSI/RESNET/ICC 301, Home Energy Score has a set of defaults documented here.

What can be used for reference data sources?

Home Energy Score uses several external data sources:
- NREL's Residential Efficiency Measures Database
- NREL's ResStock building stock modeling tool
- LBL's Residential Diagnostics Database for infiltration assumptions based on year built, location and other factors.
- EIA energy cost data and Monthly Energy Review for utility costs and site to source factor calculations
- EPA eGrid for average carbon emissions

Utility Cost Estimates

Should asset rating programs be relied upon to provide reliable utility cost estimates?

Our past research shows that an asset model with appropriate standard occupancy assumptions can predict the utility bills correctly *on average*. However, there is significant variance house to house. It's very much the same as the disclaimer that "your mileage may vary" in a miles per gallon rating for a vehicle. It's useful for comparing between similar houses when the occupants are different, but less useful for predicting one's own utility bills with great accuracy.

What resolution of energy rates is good enough?

What are potential challenges and consequences to using more granular rates?

- It can be difficult to correctly map the correct specific rate structure to an address. Data about utility connections is not a straightforward GIS join. There can also be several possible rates available to a particular address. Additionally, in publicly available databases, such as OpenEI's Utility Rate Database, the rates are often out of date.
- One consequence is that using complex time of use rates makes the energy cost calculation more driven by the occupancy assumptions. For example, hot water use is determined by an assumed number of showers that standard occupants are taking at assumed times each day. With a single, fixed rate the time those showers are scheduled doesn't affect the utility cost calculation, but with time of use rates those arbitrary schedule choices can drive up or down the cost calculation artificially.

Leveraging the Existing Landscape

Are there any other vetted standards that can be investigated?

As mentioned previously, Home Energy Score tries to use ANSI/RESNET/ICC 301 as much as is possible while filling in gaps to make a low-cost assessment.

Has there been any analysis comparing existing calculation methods, tools, or standards?

What are some of the key differences?

Comparing the Home Energy Score to the RESNET Home Energy Rating System (HERS) rating, the energy calculations are quite similar because they both rely on the 301 standard, but the consumer facing metric is different in some key ways:

Home Energy Score	RESNET HERS
1-10 score, 5 is median home	100 basis rating, lower is better than code, higher is worse than code
Compares to homes in the area.	Compares to a code-built reference home.
Larger homes score worse since the score is based on total energy.	Normalizes for house size. It's possible for a large home to rate well.

Incorporating CA Elements and Decarbonization

What other elements should be considered and possible methods to incorporate into program?

Would a similar source energy method be applicable and valuable to an asset rating program?

The Home Energy Score team is developing a carbon emissions score based on the [RESNET Carbon Rating Index](#) methodology, which is in turn based on NREL's Cambium future looking grid scenarios and marginal carbon emissions rates.

Can an hourly source energy be easily incorporated into existing tools?

Home Energy Score reports out hourly energy use by fuel type through the API and as a CSV file export. Some partners are already using this to calculate utility bills using complex rates and to do emissions calculations.

Balancing Program Complexity

What are known key variables affecting building energy modeling?

The Home Energy Score [required inputs were developed](#) based on the result of a sensitivity analysis, balanced with considerations of audit time.

What studies or sensitivity analysis exist that identify most influential factors?

Among other resources, there was a sensitivity analysis performed in 2010 by ICF covering this:

> ICF International, Nov. 2010, Task 1 – Sensitivity Analysis: Existing Home Asset Rating Sensitivity Analysis, Existing Software Tool Comparison, and Methodology for Estimating Home Characteristics, Report to the Department of Energy.

How has other existing programs or tools approached balancing accuracy against complexity?