Expanding the Rating Score: Adding Lighting, Appliances, & On-site Power Generation

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On-Site Power Production

Objective:

Develop the method and procedures to incorporate on-site power production into HERS Ratings.

Proposal

- Apply on site power production to the total energy use of a home.
- Apply on site power production against all site fuels.
  - Convert fossil fuels to equivalent electric power using the efficiency of a modern, high-efficiency, central power plant.

Some Definitions

On Site Power Production (OPP):

Electric power produced at the site of a Rated Home. OPP shall be the net electrical power production, such that it equals the gross electrical power production minus any purchased fossil fuel energy, converted to its Equivalent Electric Power, used to produce the on-site power.

Equivalence

Equivalent Electric Power

The amount of electricity that would be produced from site fossil fuel uses when converted to electrical power using the Reference Electricity Production Efficiency.

Reference Efficiency

Reference Electricity Production Efficiency

An electric power production efficiency, including all production and distribution losses, of 40%, approximating the efficiency of a modern, high-efficiency, central power plant.

Net On-Site Power Production

- **Example:** Fuel Cell with overall efficiency of 57%:
  - Produces 10,000 kWh power (**34 MBtu**)
  - Using 600 Therm of natural gas (60 MBtu)
- Equivalent power production for natural gas used in fuel cell

  60 MBtu * 40% = **24 MBtu**
- Net on-site power production (OPP)

  34 MBtu – 24 MBtu = **10 MBtu**

Counting

Purchased Energy Fraction (PEfrac)

The fraction of the total energy consumption of the Rated Home that is Purchased Energy, wherein all site fossil energy uses are converted to their Equivalent Electric Power using the Reference Electricity Production Efficiency of 40%.

Equivalent Power

- Site energy use
  - Electricity: 10,000 kWh
  - Natural gas: 900 Therm (excluding use for on-site power production)
- Conversions:
  - Elect: 10,000 kWh * 0.0034 = 34 MBtu
  - N. Gas: 90 MBtu * 40% = 36 MBtu
- Total = 70 MBtu

New HERS Scoring Equation

$$\mathbf{100 - ((PE_{frac} * TnML / TRL) * 20)}$$

where:

PE_{frac} = Purchased Energy Fraction

$$= \frac{\text{(Total Equivalent Energy – net OPP)}}{\text{(Total Equivalent Energy)}}$$

Fuel Cell Example

- Net power production = 10 MBtu
- Equivalent energy use = 70 MBtu
- Purchased energy fraction (PEfrac):
  - (70 - 10) / 70 = 86%
- Score for “80 point home”:
  - 100 – ((86% * 48/48) * 20) = 82.8
  - Score increase = 2.8 points