

AB 1613 CEC Workshop

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TOPICS

- Recent CHP Report
 - One Finding: 66 % HHV average efficiency
 - *Combined Heat and Power, Effective Energy Solutions for a Sustainable Future*, ORNL, December 1, 2008; ORNL/TM-2008-224
- LHV vs HHV
- SHP and CHP
 - Massachusetts investigation



ORNL REPORT- DATABASE

- ICF maintains a database of CHP installations for the U.S. DOE through a contract with ORNL – www.eea-inc.com
- The database includes over 3300 sites representing over 85,000 MW of CHP capacity – CHP is broadly defined including within the fence systems owned by the facility, IPP systems selling thermal energy to an adjacent steam host, and waste heat power systems.
 - The database is meant to be comprehensive – coverage of systems > 1 MW is thought to be >98%; coverage of smaller systems is most likely > 80%



ORNL REPORT- DATABASE (con't)

- Based on this analysis, overall CHP fleet performance in 2006 is estimated to be:

– Net power generation:	505,949 GWh
– Thermal energy provided:	3,776 TBtu
– Average CHP efficiency:	66.3 % (HHV)
– Average CHP system P/H ratio	0.5
– Total CO2 savings:	248 million metric tones*

(*based on avoiding national average fossil fuel generation emissions of 1,879 lb CO₂/MWh, 9% average T&D losses, and 75 to 83 % onsite boiler efficiency depending on fuel type)



LHV vs. HHV Must Always be Designated by Fuel Type

Heating values for selected fuels^[2]

Name	<u>HHV</u> (MJ/kg)	<u>LHV</u> (MJ/kg)	HHV/LHV	LHV/HHV
<u>Coal</u> ^[a]	34.1	33.3	1.024	0.977
<u>CO</u>	10.9	10.9	1.000	1.000
<u>Methane</u>	55.5	50.1	1.108	0.903
<u>Natural gas</u> ^[b]	42.5	38.1	1.115	0.896
<u>Propane</u>	48.9	45.8	1.068	0.937
<u>Gasoline</u> ^[c]	46.7	42.5	1.099	0.910
<u>Diesel</u> ^[c]	45.9	43.0	1.067	0.937
<u>Hydrogen</u>	141.9	120.1	1.182	0.846

a) [^] Anthracite, average

b) [^] Groningen (The Netherlands)

c) [^] Average gas station fuels



LHV vs HHV CONVERSION FACTORS MUST BE GIVEN FOR EACH FUEL

Heat Content Conversion factor (natural gas)

$$1.1\% * LHV = HHV \text{ or } LHV = 90\% \text{ of HHV}$$

Efficiency conversion factor (natural gas)

$$LHV = 1.1 * HHV$$



CHP AND SHP -- MASSACHUSETTS INVESTIGATION

- PACE Energy and Climate Center (PECC)
 - Comments on the Alternative Energy Portfolio Standards Program, Feb. 19, 2009

PECC is concerned about the baseline efficiency levels put forth by DOER. No credits are accumulated unless and until a CHP system meets or exceeds a 50 percent electrical efficiency level and a 95 percent thermal efficiency level¹. Evidence from several experts in this field, including project developers and equipment sales companies, have demonstrated that the effect of these very high standards will be to provide a very small incentive, or no incentive at all, to socially beneficial, high efficiency, low emissions CHP projects in Massachusetts.

CHP AND SHP -- MASSACHUSETTS INVESTIGATION (con't)

■ PECC further commented:

The average electrical efficiency from the grid to the point of end use is typically stated in the range of 30% to 33%, depending upon location, seasonal, peak day and diurnal factors. Though the newest and best gas turbine combined cycle (GTCC) system designs may approach 47% to 50% efficiency this is an inaccurate characterization of the “average” efficiency performance of the grid. Similarly, while an end user may theoretically purchase a 95% efficiency boiler, data indicates that the average boiler efficiency rating for new purchases is less than 83%. The fleet average, including all pre-existing boilers from the very old to newer models, will have an efficiency profile much lower than 83% and an emissions profile much worse than newly available models. We speculate that a substantial portion of incremental CHP systems will come first from the stock of older, perhaps very old, and inefficient boilers.² By setting an attribute standard as high as the one proposed in this instance, the incentive effect will be precluded, or greatly blunted for many otherwise potentially beneficial projects.

Recommendations

- ORNL Report
 - CEC can ask for specific analysis and the supporting data
- HHV vs. LHV
 - Ratio be stated for different fuels: eg., natural gas, landfill gas, digester gas
- CHP metrics
 - Address both topping and bottoming cycles
- SHP and CHP
 - Review investigation of Massachusetts and others



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