AB 1613: Waste Heat and Carbon Emissions Reduction Act Guideline Development

DOCKET	
08-WHCE-1	
DATE	April 13 2009
RECD.	April 14 2009

Electricity and Natural Gas Committee Workshop

April 13, 2009

Arthur J. Soinski, Ph.D.

Topical Presentation Outline

- Development of Guidelines
- Characteristics of an Eligible CHP System
- Heating Value Definitions
- The Self Generation Incentive Program (SGIP)
- Staff Proposals on Performance Metrics, Information Requirements, and Calculations
- Verifying Compliance and Correcting Non-Compliance

Development of Guidelines

Objective

- Set Combined Heat and Power (CHP) System requirements that both reduce wasteful consumption of energy and facilitate more CHP Installations.

Process

- Address AB 1613 Requirements
- Consider legislation and other state programs related to CHP and GHG emission reductions
- Propose regulatory requirements that meet objectives of the Act
  - Specify Performance Metrics
  - Collect CHP System Characteristics and Site Load Profiles to permit independent assessments of design and operation
  - Performance Verification to assure continued compliance

Characteristics of an Eligible Combined Heat and Power (CHP) System

According to AB 1613

Produces both electricity and thermal energy for heating or cooling from a single fuel and

- Is interconnected to the grid
- Is sized to meet onsite thermal demand
- Has minimum 60% efficiency measured as useful energy output divided by fuel input at 100% load
- Meets a NO_x emission standard of 0.07 lb/MWh, with a credit for thermal output if 60% efficiency is achieved
- Meets a Greenhouse Gas (GHG) Emission Performance Standard (EPS) of 1,100 lb CO_2/MWh

Characteristics of an Eligible Customer-Generator

According to AB 1613

A customer of an electrical corporation that

- Uses a CHP system with a generating capacity not more than 20 MW (Staff Proposed: based on the generator's nameplate rating, less parasitic electric loads to operate the generator)
- First commences operation after January 1, 2008
- Uses a two way time-of-use meter

Definition: HHV versus LHV

Heating Value is the heat released when oxidizing or combusting a chemical or chemical mixture in the presence of oxygen under controlled conditions

- Higher Heating Value (HHV), which is the same as the Heat of Combustion, is the heat released when the products of combustion are at the pre-combustion temperature, usually 25^{o}C. Water is a liquid; and the heat of vaporization is included in the measurement of the heat released.
- Lower Heating Value (LHV) is the heat released when water is in the vapor state (above 100^{o}C) as are the other products of combustion.

LHV versus HHV Specification is important

- A Fuel's LHV is smaller than its HHV
  - Methane HHV = 23,900 Btu/lb; LHV = 21,580 Btu/lb
  - Natural Gas HHV = ~23,000 Btu/lb; LHV = ~19,500 Btu/lb
- In the CHP System efficiency calculation, the fuel's heating value is in the denominator. Therefore,
  - A 60% HHV efficiency requirement is ~ a 66-67% LHV efficiency requirement

Reports and equipment specifications frequently are sloppy by not specifying HHV or LHV

"Energy" (the kWh) and "Power" (the kW) are not the same either

Using the Self Generation Incentive Program (SGIP) as one Model for AB 1613 Guidelines

- AB 1613 requirements mirror those of SGIP legislation
- Some of the significant stakeholders are the same
  - The CPUC implements the SGIP legislation
  - California IOUs (PG&E, SCE, SCG, and the Center for Sustainable Energy on behalf of SDG&E) administer the SGIP
- SGIP requirements are described in a series of Handbooks, which are publicly available resources
- A Working Group (of which the Energy Commission is a member) has worked through procedures and implementation mechanisms
- The effectiveness of the SGIP has been assessed in a series of Administrator-funded studies. The Energy Commission's Evaluation required by AB 2778 is the subject of Chapter 5 of the *2008 Integrated Energy Policy Report Update*.

SGIP History

- AB 970 (Ducheny, 2000) established a program of front-end payments for distributed generation (DG) equipment serving on-site loads
- AB 1685 (Leno, 2003) defined Clean and Ultra-Clean DG and set a ≥ 60% HHV efficiency requirement for CHP
- AB 2778 (Lieber, 2006) limited the SGIP to fuel cells and wind from 1/1/2008 to 1/1/2012 and set efficiency requirements for CHP (≥ 60% HHV) and electric only DG (≥ 40% HHV)

Observations from the SGIP

- Through December 31, 2006, 342 internal combustion engine (ICE), gas turbine (GT), microturbine (MTG) and fuel cell (FC) systems with 165.5 MW total capacity had been installed
- During 2006, FC and GT based CHP systems using non-renewable fuels achieved a 60% HHV efficiency; ICE and MTG based systems did not
- During 2006, CHP system owner ("Participants") non-renewable fuel and operation and maintenance costs exceeded electric bill savings, except for FCs
- No CHP systems became operational under the 0.07 lb NO_x/MWh requirement

Caveat: SGIP's effective size limit was 1 MW (not 20 MW) and the incentive was based on rated capacity rather than energy output

Transition from
Background, Observations, and Definitions
To
Energy Commission Staff Proposals

Staff Proposal: Net Generating Capacity Shall be ≤ 20 MW

Net Generating Capacity =

[Full load continuous rated capacity of prime mover/generator at ISO (International Organization for Standardization) Conditions as packaged and delivered] minus

[Ancillary equipment electrical loads needed to operate the generator]

shall be no more than 20 MW

Staff Proposal: CHP System Efficiency Shall be ≥ 60%

Higher Heating Value (HHV), 100% Load, Standard Conditions

- System Efficiency = (Useful Energy Output) / (Fuel Input)
- "Useful" means "made available for use" (FERC and ARB's Regulation for Mandatory Reporting of GHG Emissions)
- Useful Energy Output is the sum of
  - Useful Electricity output: Net, parasitic electric losses subtracted
  - plus Useful Mechanical output:
  - plus Useful Chemical output: Product enthalpy minus reactant enthalpy
  - plus Useful Thermal output: Gross thermal output minus thermal input
- Fuel Input is the quantity of fuel times its heating value or Heat of Combustion

Convert all energy outputs and the fuel input to a common unit using accepted conversion factors

Staff Proposal: Waste Heat Utilization; Preventing de facto Wholesale Generation

- At least 5 percent of the facility's total annual energy output shall be in the form of useful thermal energy
- The useful annual power output plus one-half the useful annual thermal energy output equals not less than 42.5 percent of any natural gas and oil energy input on a LHV basis

  The above requirements mirror PURPA and PUC 216.6 for the SGIP
- The CHP system shall be sized to be no smaller than the minimum connected on-site thermal load and no larger than the maximum connected on-site thermal load

Staff Proposal: Environmentally Beneficial with respect to CO_2 Emissions:

The CHP System, as designed, shall have 5% lower annual CO_2 Emissions than the Alternatives

- CHP System CO_2 emissions are

  (the Annual Fuel Consumption) times (the Emission Factor)
- For the non-CHP System Alternatives, use the methods in TIAX LLC's *Cost-Benefit Analysis of the Self-Generation Incentive Program* (Report CEC-300-2008-010-F)
  - The electricity generation alternative is a natural gas-fired power plant with an emission factor of 1,100 lb/MWh
  - The heat energy alternative is an 85% efficient natural gas-fired boiler
  - The cooling alternative, if applicable, is a 60% efficient electric chiller

Staff Proposal: Required Information about the Host Site and CHP System

- Host Site Information
- CHP System Description and Diagrams
- Annual Forecasts by Month, with Documentation
- Documentation of Compliance with Specific Requirements
- Performance Verification and Compliance Plan

Staff Proposal: Host Site Information

- Contact and Location Information
- Business Description, NAICS (North American Industry Classification System) Number
- Existing Generating and Thermal System Descriptions
- Historical (or Forecast) Electrical and Thermal Loads by Month for one year
  - Load Profiles if loads vary, or will vary, by season, month, day of week, time of day

Staff Proposal: CHP System Description and Diagrams

- Generator/Prime Mover: Manufacturer, Model Number, Nameplate Rating, Ancillary Equipment, Fuel(s) Used, Fuel Consumption Rate at 100% Load, Net Generating Capacity shown to be ≤ 20 MW
- Electrical One Line Diagram
- CHP System Diagram, including mass and energy flows (See, as an example, Figure 7 in *Distributed Generation Combined Heat and Power Long Term Monitoring Protocol* at http://www.dgdata.org/pdfs/lt_monitoring_protocol_nov08.pdf)

Annual Forecasts by Month, with Documentation

- Generator Electrical Output
- Mechanical Energy Output
- Chemical Energy Output
- Generator Fuel Consumption
- Generator Thermal Output
- Thermal Load
- Useful Thermal Output

Staff Proposal: Documentation of Compliance with Specific Requirements

- Completed Templates for Reporting and Calculating
  - Efficiency
  - Waste Heat Utilization
  - NO_x Emissions Compliance, including a Copy of Air Quality District Operating Permit
  - At least 5% Annual GHG Reductions

Staff Proposal: Performance Verification and Compliance Plan

The Plan shall describe processes for addressing

- GHG Reporting to ARB under California Code of Regulations, Title 17, Regulation Section 95112
- CPUC and CAISO requirements in the tariff
- Monitoring Procedures and/or warranties and service agreements to assure
  - Total system efficiency is ≥ 60%
  - NOx emissions are ≤ 0.07 lb/MWh
  - CO_2 emissions are ≤ 1,100 lb/MWh

Monitoring and Reporting to be performed according to accepted standards

Staff Proposal: Verifying Compliance and Corrections for Non-Compliance

- Entities that could verify Compliance
  - Applicant (self certification)
  - ARB (already responsible for GHG reporting)
  - Utility as the Buyer of Electricity
  - Energy Commission (Staff Proposal)
  - Independent Third Party (e.g., paid consultant)
- The Operator of a CHP System with a net generator capacity ≤ 1 MW shall have 3 years to bring a non-complying CHP System into compliance. Operators of a larger system shall have 1 year. If non-compliance is not corrected, utility buyers may pursue other actions as provided for in the tariff.
- During the Non-compliance period, payments for the energy portion of the tariff shall reduced by the same percentage as the system falls below the compliance level set by the applicable performance metric.

Contact Information

Arthur J. Soinski
California Energy Commission
Electricity Supply Analysis Division
1516 Ninth St, MS-20
Sacramento, CA 95814
asoinski@energy.state.ca.us
(916) 654-4674

Mahalo for your participation