May 26, 2017

CALIFORNIA ENERGY COMMISSION STAFF

GENERAL METHOD FOR DETERMINING THERMAL POWER PLANT GENERATING CAPACITY

This paper describes how the Energy Commission staff assesses the generating capacity of a thermal power plant pursuant to Title 20, California Code of Regulations, section 2003. The method of calculation, the assumptions, and the information requested by the accompanying questionnaire are all based on section 2003, a copy of which is attached. The generating capacity determines whether a proposed thermal power plant falls within the Commission's jurisdiction, which begins at 50 MW.

In accordance with section 2003, the Commission staff uses a three-step process:

1. Determine Gross Rating

2. Determine Coincidental Minimum Auxiliary Load

3. Determine Net Generating Capacity

The evaluation process is carried out using specific descriptive project information requested by the accompanying questionnaire and provided by the potential project developer. The review is initiated after the CEC staff has received all information it considers necessary to conduct a complete review. The potential project developer may be requested to provide additional information to the CEC staff in order to perform a complete, independent, and thorough review. **The CEC staff encourages all potential developers to contact the CEC staff Siting Office at (916) 654-5100 and meet with them to ensure they understand the information needed and the evaluation process used.**

The evaluation process begins with a determination of the Gross Rating. This value corresponds to the maximum capacity of the system, unconstrained by such items as controls and utility intertie transformers. These items are disregarded in the analysis since they are variable and can be used as a means of artificially limiting a facility's output.

The evaluation process requires the use of numerous engineering assumptions. Every attempt is made to use values that are considered realistically conservative. Major equipment manufacturers are contacted about typical equipment performance to insure that the engineering assumptions are based on current technology, data, and design practice.

The following is a detailed description of the evaluation process.

STEP 1 – Gross Rating Determination

The Gross Rating is the gross generating capacity of the plant at site design ambient conditions. Site design ambient conditions are the average temperature, pressure, and relative humidity during the intended operating mode. The Gross Rating is determined based upon the type of project being reviewed. The four types of power generation projects and the key assumptions used in evaluation are:

1. Brayton Cycle Projects. The term Brayton Cycle refers to gas turbine powered generators. Assumptions are:
   a. New and clean conditions (typical of new equipment).
   b. Maximum mass flow conditions under site-specific ambient and operating conditions.
   c. Maximum fuel input conditions.

2. Rankine Cycle Projects. The term Rankine Cycle refers to condensing steam turbine powered generators with cooling tower(s) to cool the condenser cooling water. Assumptions are:
   a. New and clean conditions (typical of new equipment).
   b. Maximum steam flow conditions under site-specific ambient and operating conditions.
   c. Maximum fuel input conditions.

3. Combined Cycle Projects. The term Combined Cycle refers to projects that use both gas turbine (Brayton Cycle) and steam turbine (Rankine Cycle) power generation systems in combination. Evaluation of the Gross Rating of a combined cycle project includes the above listed conditions for both the Rankine and Brayton Cycle projects. In situations where two or more conditions might overlap, the overlapping conditions are evaluated in order to determine the greatest Gross Rating.

4. Unspecified Projects. The Gross Rating of a project not covered above is evaluated on a project-specific basis. Examples of projects in this category would be Diesel Cycle and Otto Cycle, which refer to compression-ignition and spark-ignition reciprocating internal combustion engine generators, respectively.

The Gross Rating of a power generation facility is further determined by one or more of the following modes of operation:

a. Peaking Load Operation. The term peaking load operation refers to a proposed facility intended to operate only during periods of utility peak electric demand. Gross Rating is determined using the average ambient conditions experienced during the peaking service. If possible, detailed meteorological data, as published in the Facility Design and Planning: Engineering Weather Data manual ("bin weather data") by the Departments of the Air Force, Army, and Navy, or equivalent meteorological date, are used for a weather station at the proposed site. If "bin weather data" are not available for the proposed site, "bin weather data" for a similar nearby site are used.

b. Base Load Operation. The term base load operation refers to a proposed facility intended to operate on a continuous year-round basis. Gross Rating is determined using the annual average ambient conditions experienced at the proposed site, obtained as stated above.

c. Dispatchable Service Operation. The term dispatchable service operation refers to a proposed facility's operation during periods when it is under the direct control of the local utility. Evaluation of Gross Rating is determined using the average ambient conditions experienced during the dispatch periods, obtained as stated above.

STEP 2 – Minimum Auxiliary Load Determination

Auxiliary loads, sometimes called parasitic loads, are those loads that require electric power (energy) for auxiliary and accessory equipment necessary to operate the electric generation facility. The auxiliary loads of interest here are those that correspond to the Gross Rating conditions. They are determined at design ambient conditions as defined for the facility under Gross Rating determination.

The facility's total minimum auxiliary loads submitted by the project developer are reviewed to determine the appropriate coincidental auxiliary loads. Any individual loads that appear unreasonable are reviewed in more detail and compared to reasonable industrial norms for projects of similar size and type. Any discretionary loads, i.e., those which can be curtailed without precluding facility operation are not credited toward Minimum Auxiliary Load. Heat to a process in a cogeneration facility, that must be delivered in order to meet Federal or State minimums for classification as a cogeneration facility, is not credited toward Minimum Auxiliary Load, as the plant operator might curtail the supply of

heat part of the time, increasing net power output, then increase supply of heat at other times to meet the annual quota.

When determining Minimum Auxiliary Load, any expected variations in the auxiliary loads are examined. For example, if the facility contains batch type operations, the auxiliary loads are examined in conjunction with the scheduled cyclic batch operations.

STEP 3 – Net Generating Capacity Determination

The Net Generating Capacity is the Gross Rating minus the Minimum Auxiliary Load, as follows:

$kW_{GC} = kW_{GR} – kW_{AUX}$, where

kW_{GC} is Generating Capacity,

kW_{GR} is Gross Rating, and

kW_{AUX} is Minimum Auxiliary Load,

all expressed in kilowatts and determined as above.

October 3, 2011

CALIFORNIA ENERGY COMMISSION STAFF

THERMAL POWER PLANT GENERATION CAPACITY DETERMINATION

ENGINEERING QUESTIONNAIRE

The following information allows the Energy Commission staff to assess the generating capacity of a thermal powerplant in accordance with Title 20, California Code of Regulations, section 2003:

1. Provide a legible and complete mass/energy flow diagram for the system showing temperatures, pressures, flow rates and enthalpies at all state points as appropriate to system evaluation. This shall include, but not be limited to, the following components as appropriate: gas turbines, steam turbines, boilers (including superheaters and economizers), cooling towers, condensers, condensate/feedwater heaters or deaerators, and emission control equipment/systems.

2. Provide specifications for the following major equipment as appropriate: gas turbines, steam turbines, electric generators, cooling towers, and condensers. Include manufacturer and model numbers, and all appropriate performance data and/or performance curves for the average ambient site design conditions experienced during the intended mode of operation (peakload, baseload, or dispatchable service).

3. Provide complete boiler specifications and rated capacities, as appropriate, for the average ambient site design conditions experienced during the intended mode of operation.

4. Provide a complete list of individual auxiliary electrical loads, including step-up and step-down transformer losses. Provide the facility's operating minimum and minimum coincidental auxiliary electrical loads corresponding to the system generating capacity at the project site for the average ambient site design conditions experienced during the intended mode of operation.

5. Provide a complete fuel characterization and energy content analysis. Indicate minimum, maximum, and average energy content. Indicate amount on-site processed fuel storage capability in terms of days of operation while operating under design operating conditions.

6. Provide a description of the facility's intended mode of operation: baseload peakload, or dispatchable service. Provide the facility's maximum net design electric generation capacity with the intended mode of operation.

7. Provide a statement of future plans to add additional power generation capacity at the site.

8. Provide a description (type and size) of all power purchase agreements, secured or under negotiation. Provide a copy of each agreement, if available. Dollar figures may be omitted.

9. Provide the exact location and elevation of the project site (include street names when possible).

10. Provide copies of permits and/or applications submitted to other regulatory agencies (such as an application for an authority to construct) that contains sizing or other operating characteristics.

Please contact the California Energy Commission staff to ensure you understand the questions asked and the method used.

Please send the completed Engineering Questionnaire to:

Eric Knight, Manager
Environmental Office, MS 40
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

If you have procedural questions, please contact:

Eric Knight, Manager
Enviromental Office
(916) 653-1850
eric.knight@energy.ca.gov

Technical questions may be addressed to:

Shahab Khoshmashrab
Engineering Office
(916) 654-3913
shahab.khoshmashrab@energy.ca.gov