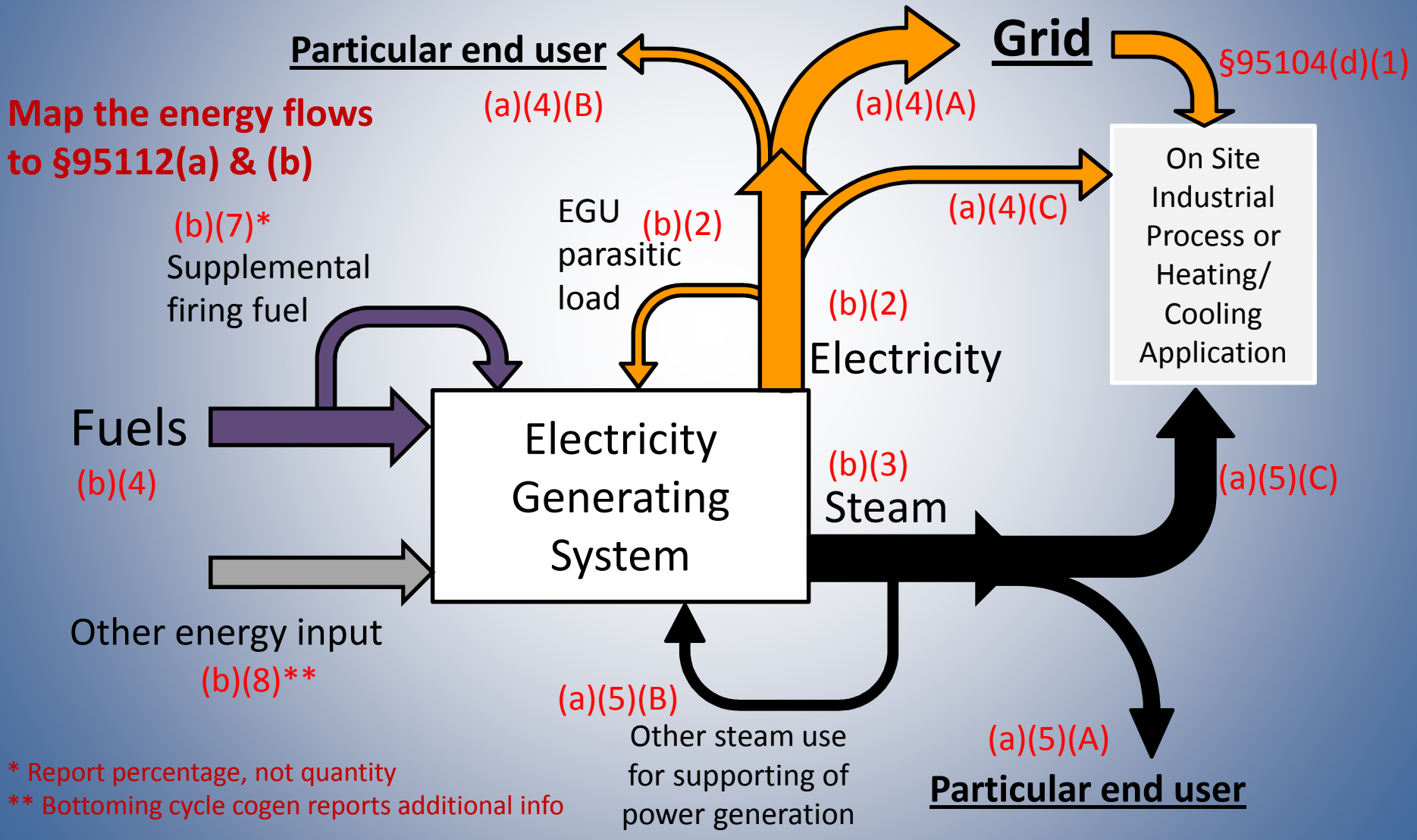
System Energy Accounting



* Report percentage, not quantity
** Bottoming cycle cogen reports additional info

System Energy Accounting

- §95112(b): accounts for the energy inputs and outputs of the EGU or the electricity generating system
- §95112(a): indicates where the generated energy flows go after they leave the system
- To ensure that system energy balance is completely accounted for, a system energy diagram is critical
- Skipping steps in system energy accounting may lead to erroneous reporting

System Energy Accounting

Follow these steps:

1. Draw a simplified block diagram. [§95112(a)(6) and §95102(a)]
2. Draw the system boundary of the electricity generating system.
3. Identify the energy flows that cross the electricity generating system boundary. (Look for "arrows" that cross the system boundary box.) Map the energy flows to the data items in §95112(b).
4. Identify the processes, operations, and destination to which generated energy is supplied. Map them to the data items in §95112(a).
5. Calculate the quantities required by §95112(a) and (b), and enter data into the reporting tool accordingly.

System Energy Accounting

Simplified Block Diagram:

[§95112(a)(6) and §95102(a)]

- Equipment associated with the electricity generating system, and any equipment or industrial processes outside of the system that may inform energy flows.
- Flows of energy (fuel input, electricity output, heat/steam output) shown with arrows and labels.
- Relative location of fuel meters and other fuel quantity measurement devices. (If necessary, use more than one diagram for legibility.)

Total Thermal Output

- Total amount of usable thermal energy that can potentially be made available for use in industrial/ commercial processes, heating/cooling applications, or delivered to other end users. It includes:
  - Thermal energy provided or sold to a particular end-user [§95112(a)(5)(A)];
  - Thermal energy used for supporting power generation that has been included in the §95112(b)(3) quantity but is not accounted for in either §95112(a)(5)(A) or (C) [§95112(a)(5)(B)];
  - Thermal energy used in other on-site industrial processes or heating/cooling applications that are not electricity generation [§95112(a)(5)(C)];
  - Thermal energy that is vented, radiated, wasted, discharged, or otherwise not utilized

Total Thermal Output

The Sum of: §95112(a)(5)(A), §95112(a)(5)(B), §95112(a)(5)(C) ≤ §95112(b)(3)

- The difference between the two sides of the comparison is the thermal energy that was generated by cogen/bigen units but was not utilized for any useful purpose (e.g., vented and radiated steam).
- Do not include thermal energy not generated by a cogen/bigen system in these quantities.
- Engineering estimation is acceptable, but the facility operator must demonstrate to the verifier that the chosen method is reasonable and based on good engineering principles.

Total Thermal Output

If there is more than one EGU or electricity generating system (EGS) at the facility and in the reporting tool configurations:

The Sum of:
- §95112(a)(5)(A)
- §95112(a)(5)(B)
- §95112(a)(5)(C)

$\leq$

The Sum of:
- §95112(b)(3) for EGU/EGS 1
- §95112(b)(3) for EGU/EGS 2
- etc…

Steam generated by boilers that are not an integral part of the cogen/bigen system are not included in these quantities. Such steam is not reported unless it is sold to other entities outside of the facility boundary. (§95104(d)(4))

Gross and Net Generation

- Gross generation = total electrical output of the EGU
- Net generation = gross generation minus parasitic load

The Sum of:
- §95112(a)(4)(A)
- §95112(a)(4)(B)
- §95112(a)(4)(C)

= Net Generation §95112(b)(2)

Gross and Net Generation

If there is more than one EGU or EGS at the facility and in the reporting tool configurations:

The Sum of:
- §95112(a)(4)(A)
- §95112(a)(4)(B)
- §95112(a)(4)(C)

=

The Sum of:
- Net gen for EGU/EGS 1
- Net gen for EGU/EGS 2
- Net gen for EGU/EGS 3
- etc….

Electricity used within the facility boundary that is not generated by the EGU/EGS should not be included in §95112(a)(4) quantities. Such electricity is accounted for in section §95104(d)(1).

Gross and Net Generation

- Electricity consumed at the facility when the EGUs were not generating electricity should not be counted against net generation, as doing so would make the EGU appear less efficient.
- Electricity acquired from outside of the facility boundary should be accounted under §95104(d)(1)
- EGU with low capacity factor: it is especially important to distinguish between parasitic load during EGU operation and internal electricity load during EGU downtime
- EGU with high capacity factor: reporter may exercise judgment if the gain in the system efficiency figure is insignificant

Returned Condensate and Makeup Water

- To avoid double counting of the energy in the steam-water loop, the enthalpy of the generated thermal energy must not include the enthalpy of the feedwater to boilers or HRSGs
- This can be done by simply using the temperature of the feedwater as the reference temperature for the enthalpy calculation of the generated thermal energy
- If the computerized data recording system is set up such that the reference temperature of the generated steam is different from the temperature of the feedwater, an adjustment calculation is needed

Reporting of Supplemental Firing

- If reporting as an aggregated-units configuration (such as in a “system”), the amount of supplemental firing fuel must be aggregated into the total fuel consumption number of the aggregated-units configuration (in the Fuel-Specific Emissions Information sub-module)
- New reporting tool feature added: new data fields for reporters to indicate what percentage of the total fuel consumption of the system is supplemental firing (in the Configuration Information sub-module in the unit configuration)

Unit/System Energy Balance

Energy Inputs **>** Energy Outputs

The Sum of: §95112(b)(4), §95112(b)(8) **>** The Sum of: §95112(b)(2), §95112(b)(3)

Helpful Web Sites

- Email reporting questions to: ghgreport@arb.ca.gov
- Reporting Guidance: Applicability, Metering
  http://www.arb.ca.gov/cc/reporting/ghg-rep/guidance/guidance.htm
- Cal e-GGRT Tool Training: Registration, Subparts
  http://www.arb.ca.gov/cc/reporting/ghg-rep/tool/ghg-tool.htm
- Cal e-GGRT Main Help Page
  http://www.ccdsupport.com/confluence/display/calhelp/Home
- U.S. EPA Detailed Sector Training Slides
  http://www.epa.gov/climatechange/emissions/training.html
  (use as a supplement to ARB summary slides)