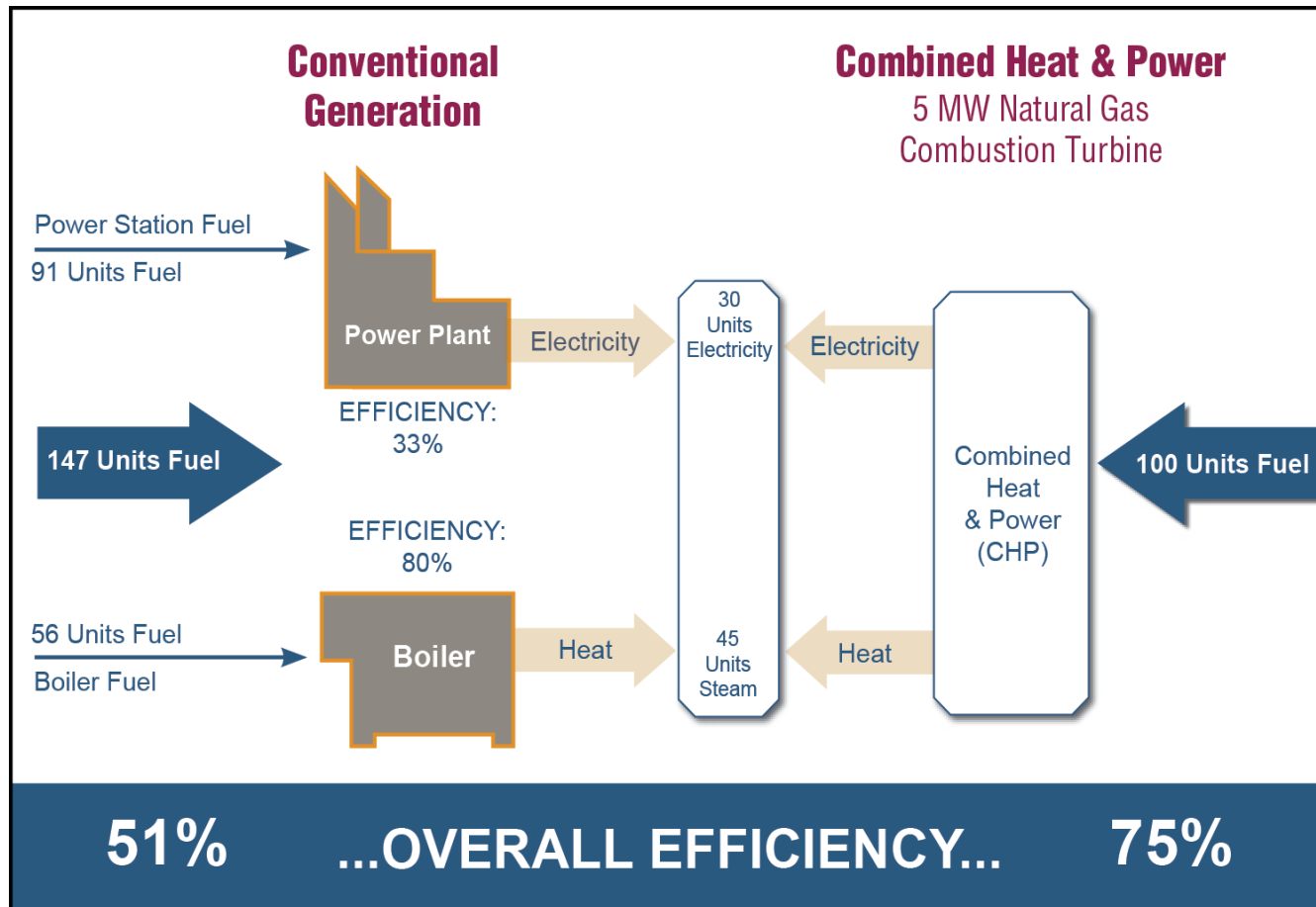


The Importance of Recognizing the Multiple Outputs of CHP

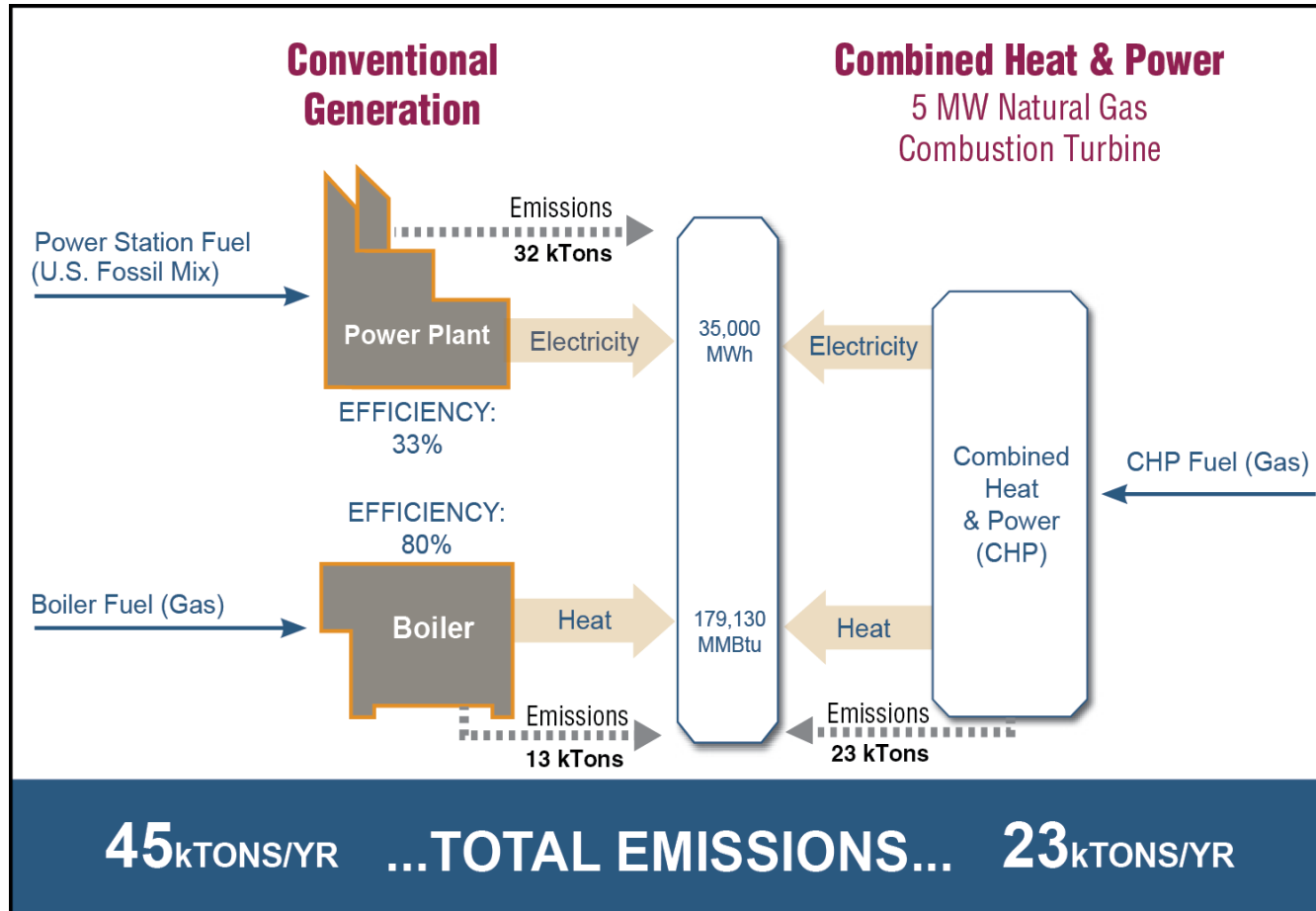
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CHP is a Clean, Efficient Method of Providing Energy Services



Source: EPA CHP Partnership - 2012

That Efficiency Generally Results in Lower Emissions



Source: EPA CHP Partnership - 2012

Overall Fuel Savings from CHP

$$\text{Fuel Savings} = \text{Fuel SHP} - \text{Fuel CHP}$$

- + Fuel use from avoided on-site thermal energy production
- + Fuel use from avoided purchased grid electricity
- Fuel use by the CHP system

Total Fuel Savings

$$(56 + 91) - 100 = 47 \text{ units}$$

Overall CO₂ Savings from CHP

$$CO_2 \text{ Savings} = CO_2 \text{ SHP} - CO_2 \text{ CHP}$$

- + CO₂ emissions from avoided on-site thermal energy production
 - + CO₂ emissions from avoided purchased grid electricity
 - CO₂ emissions from the CHP system
- Total CO₂ Savings

$$(13k + 32k) - 23k = 22k \text{ tons } CO_2$$

Recognizing CHP Savings

- CHP systems produce both power and thermal outputs using a single fuel input
- Fuel and CO₂ savings come from displacing on-site boilers/furnaces and central station generation (including T&D losses)
- CHP may result in increased fuel use and/or emissions at the site
- Critical to recognize multiple outputs of CHP, and impacts beyond site, in order to properly credit efficiency and emissions benefits

Approaches to Crediting CHP

- Two common approaches to credit both CHP outputs
 - Equivalence approach
 - Avoided emissions approach
- The two approaches can result in different levels of emissions rates based on CHP system characteristics and emissions rates of avoided separate heat and power
- Which approach to use would be influenced by the overall regulatory structure and objectives

Equivalence Approach

- Directly adds the thermal output to the electric output of the CHP system in consistent or equivalent units
 - Example: Total output = (30 units + 45 units) = 75 units
- The value of the conversion factor depends on the underlying regulatory objectives
 - Can be based on straight unit conversion (i.e., 3412 Btu equals 1 kWh – credit 100% of thermal output)
 - Can incorporate a factor for the relative value of the outputs (credit 75% of thermal output)
 - Example: Total output = (30 units + 0.75*45 units) = 63.75 units
- Results can vary substantially based on the ratio of power and heat output of the CHP system

Avoided Emissions Approach

- Credits the CHP system with the avoided emissions that a conventional separate heat and power system would otherwise emit to provide the same energy services
- The approach relates the value of the thermal output to the emissions actually avoided by the displacement of the on-site boiler/furnace
- Results can vary based on thermal unit displaced (e.g., replacing new gas on-site boiler or old coal boiler)
 - $\text{CHP electric emissions} = (23\text{K} - 13\text{K}) = 10\text{K tons CO}_2$

Regulatory Experience

Entity	Equivalence Approach	Avoided Emissions Approach
California	DG and conventional emissions limits (100% thermal credit)	
Connecticut		Small DG Rule
Delaware		Conventional emissions limits
Massachusetts		Small DG Rule and performance standards
Rhode Island		Conventional emissions limits
Texas	DG Permit by Rule and Standard Permit (100% thermal credit)	
US EPA	Electric Utility Steam Generating Unit NSPS, Subpart Da (75% thermal credit)	
	Gas Turbine NSPS, Subpart KKK (100% thermal credit)	
	Proposed rule for GHG emissions from New Electric Generating Units 11(b) (75% thermal credit)	

Resources

- Crediting CHP
 - *Fuel and CO₂ Savings Calculation Methodology for CHP Systems* - http://www.epa.gov/chp/documents/fuel_and_co2_savings.pdf
 - *Accounting for CHP in Output-Based Regulations* - <http://www.epa.gov/chp/documents/accounting.pdf>
 - *CHP Emissions Calculator* - <http://www.epa.gov/chp/basic/calculator.html>
- Calculating Avoided Emissions
 - *EPA Roadmap for EE/RE in SIPs* - <http://epa.gov/airquality/eere/>
 - *Emissions & Generation Resource Integrated Database (eGRID)* - <http://www.epa.gov/cleanenergy/energy-resources/egrid/>
 - *AVERT emissions quantification tool* - <http://epa.gov/statelocalclimate/resources/avert/index.html>