

Natural Gas Impacts of Increased CHP

Prepared by
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for

USCHPA

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Overview

- Background
- Approach
- CHP Potential
- Gas Impacts



Background

- The U.S. is seeking responses to the current tight natural gas supply/demand balance.
- Efficiency responses will be a critical component of short and long-term solutions.
- CHP is an immediately available, widely applicable efficiency measure.



This Study

- USCHPA asked EEA to evaluate the relationship between CHP and natural gas demand and infrastructure.
- The first cut looks at California, Texas, and Northeast (New York and New England).
 - Historically strong markets for CHP with price-sensitive industrial consumers.
- It finds that expanded use of CHP can achieve a significant reduction in gas demand in these regions.



Impacts of CHP on Gas Markets

- High efficiency CHP reduces demand for natural gas.
- Reduces fast-growing gas demand for power generation.
- Regional reductions in gas demand reduce national gas price.
- Moves gas consumption to consistent, base-load application - reduces price volatility.



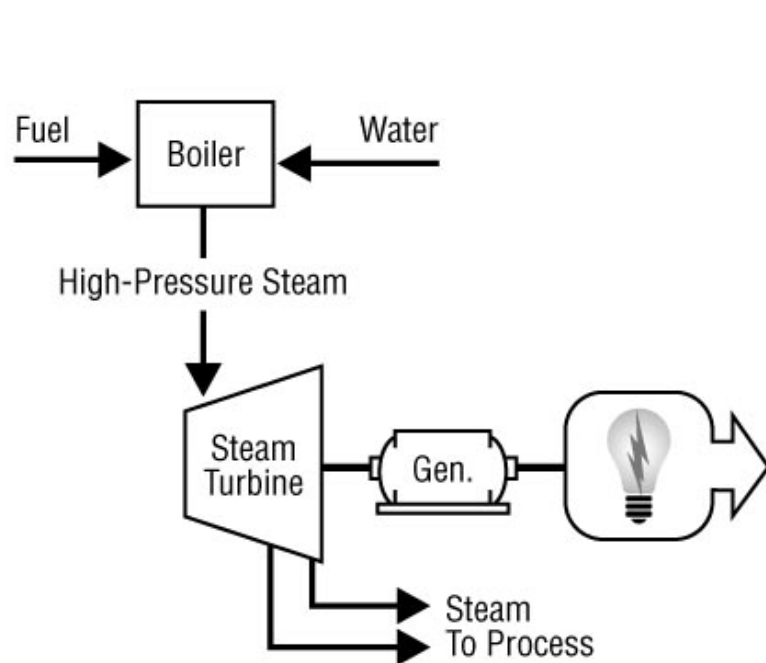
Combined Heat and Power

- CHP is the generation of electricity and heat sequentially from the same heat input.
 - Electricity primarily used on-site, but some can be sold back to grid. Grid can serve as back-up or swing provider.
 - Thermal energy used for heating/cooling or process applications.

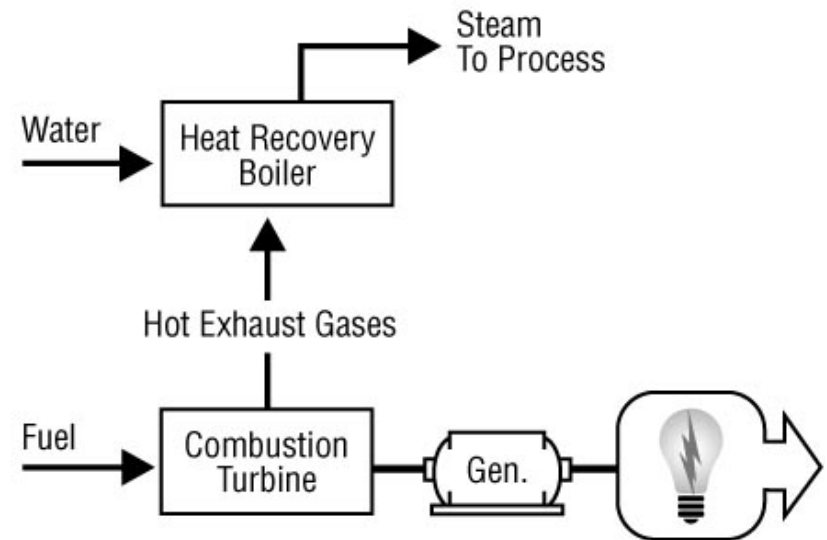


Typical CHP Systems

Steam Boiler/Steam Turbine:



Gas Turbine or Engine/Heat Recovery Unit:

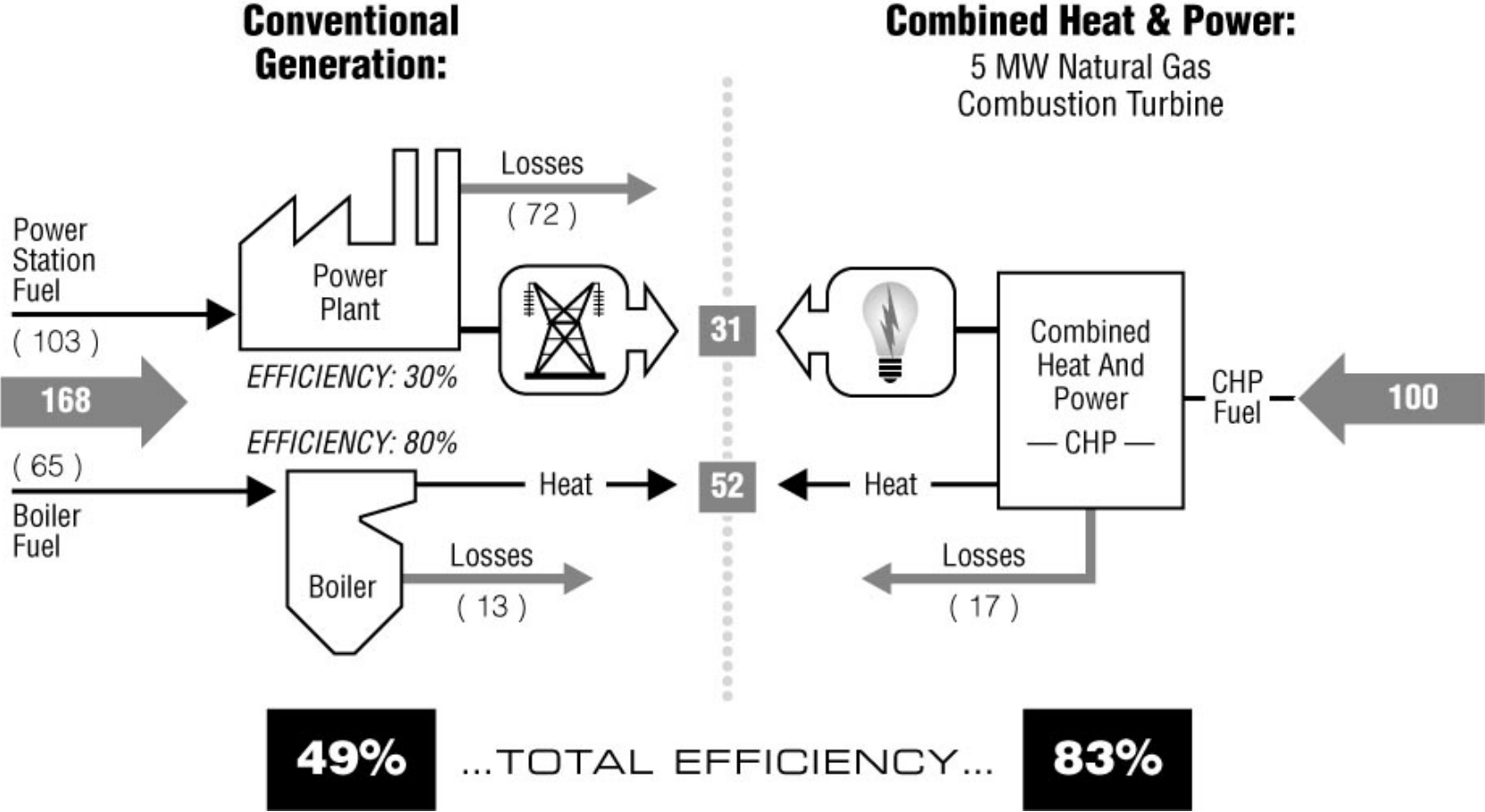


Advantages of CHP

- CHP is more efficient than separate generation of electricity and heat.
- Higher efficiency translates to lower operating cost, but requires capital investment.
- On-site electric generation reduces grid congestion and avoids distribution costs.
- Higher efficiency reduces emissions of all pollutants.
- Increased reliability and power quality can also add significant value.



Efficiency Advantages of CHP



Reducing Demand for Gas

- CHP uses less energy than conventional systems
- Specific fuel impacts depend on what fuel the CHP system uses and replaces.
- Gas CHP systems generally replace gas boiler but at higher efficiency.
- Fuel replaced for grid electric generation is highly variable.
- This analysis is a first order cut of a complicated analysis.



CHP Market Penetration

- Assumed a mix of technologies, sizes and applications:
 - 500 kW to >20 MW
 - Reciprocating engines and turbines
 - Industrial and commercial application
 - All gas-fired
 - Assumed market penetration ranging from 5 to 50 percent of technical potential - not a detailed economic analysis



Assumed CHP Market Penetration

	Northeast		Texas		California	
	Units	MW	Units	MW	Units	MW
Existing Grid	2,032	68,354	504	39,508	1,442	54,574
Existing CHP	414	8,708	135	15,639	795	9,438
Assumed CHP Additions	3,503	4,238	2,284	5,297	3,190	5,071

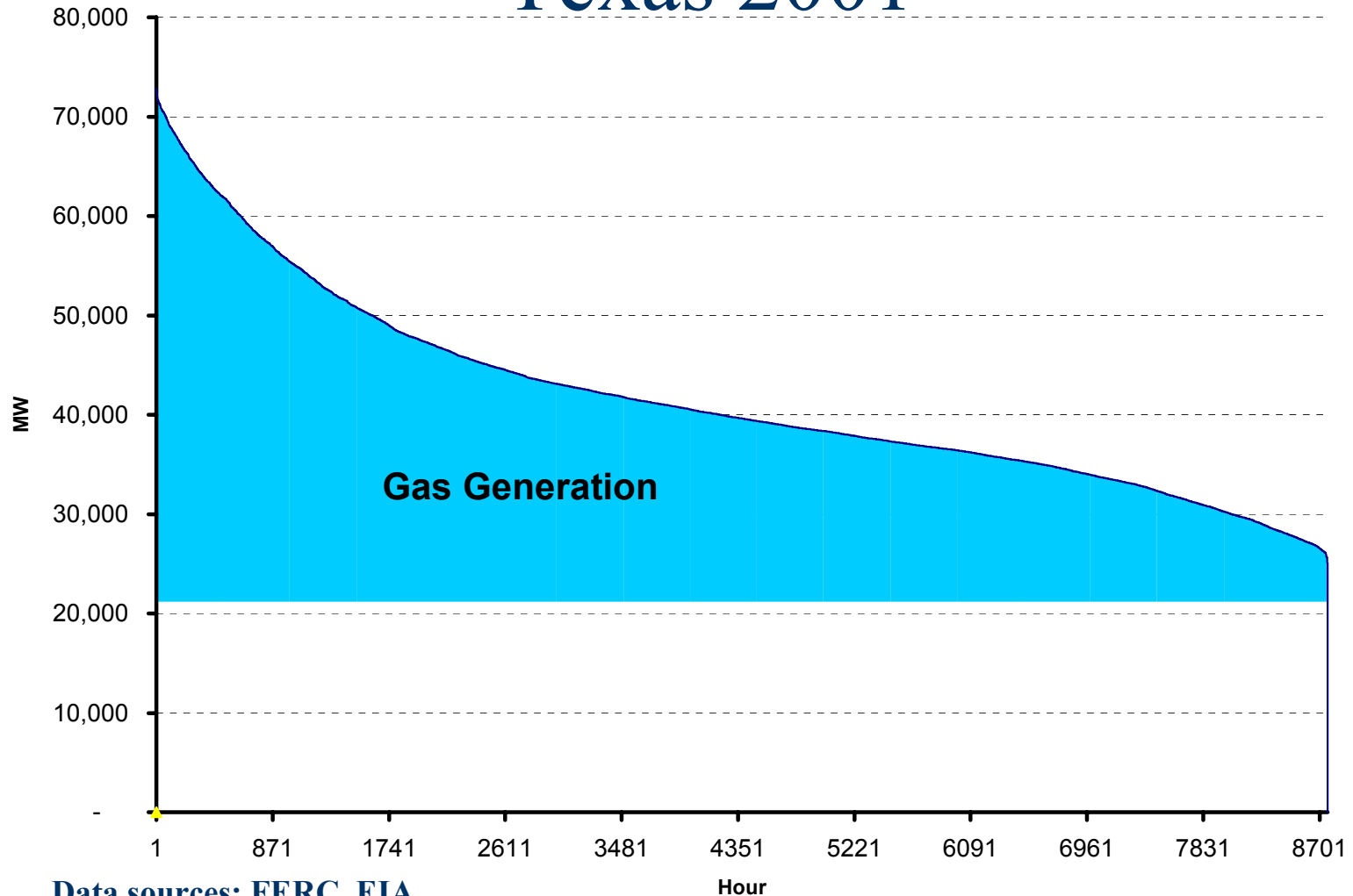


Calculating Gas Demand Impacts

- On-site thermal system is assumed to be gas replacing gas, except 1/3 oil replaced in NE.
- Displacement from grid depends on marginal fuel over operating period.
- Utility data used to estimate when gas is on margin in each region.
- Gas on margin all the time in Texas and California, 85% of the time in Northeast.



Gas Role In Generation Texas 2001



Data sources: FERC, EIA

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Calculation of Gas Demand Reduction (MMcf)

	Northeast	Texas	California
On-Site Gas Consumption Displaced by New CHP	106,440	206,631	196,147
Gas Consumption for Grid Electricity Displaced by New CHP	295,047	448,521	412,450
<u>Total Displaced Gas Consumption</u>	<u>401,488</u>	<u>658,152</u>	<u>608,597</u>
Gas Consumption for New CHP	322,942	422,626	393,350
Net Gas Reduction	78,546	235,526	215,247



Gas Impacts of Increased CHP (MMcf)

	Northeast	Texas	California
Current Gas Consumption ('01)	1,892,059	3,915,959	2,404,176
Gas Displacement from CHP	78,546	235,526	215,247
Percent Reduction	-4.2%	-6.0%	-9.0%



Conclusions

- CHP is a readily available efficiency option that could achieve significant reductions in gas use in the near-term.
 - Small gas use reductions in this range can have large national gas price effects.
 - Modest CHP implementation can produce these effects.
- A variety of policy measures can be used/will be needed to encourage this development of CHP.



Caveats

- This analysis assumes aggressive market penetration, but presents a reasonable goal.
- Results may not be the same in all regions, particularly depending on marginal fuel in electric sector.
- More detailed analysis of electricity fuel displacement could be useful.

