U.S. Department of Energy
Gulf Coast Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Impacts of Increasing Natural Gas Fueled Combined Heat and Power from 20 to 35 Percent of Total Electricity Production in Texas

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PURPOSE

The Texas Combined Heat and Power Initiative is an association serving the combined heat and power, waste heat recovery, and district energy industries in Texas. The organization is proposing that the Legislature adopt an aggressive goal to stimulate additional development of natural gas fueled combined heat and power (CHP) in industries and buildings across Texas. To support their proposal, the organization has requested an examination of the possible impacts, implications, and practicality of increasing the amount of electrical energy produced from CHP facilities from the current 20 percent of total statewide electricity production to 35 percent of total statewide electricity production by 2025.

INTRODUCTION

Combined heat and power (CHP) is the sequential production of heat and electricity or electricity and heat from a single fuel source. CHP systems are located at a host site (such as an industrial plant or hospital) to which they provide heat and electricity to the host customer. Meeting the host's electricity requirements often require additional purchases of electricity from or sales to the utility grid, while heating deficits can be resolved by augmenting with a conventional boiler technology. In many applications, CHP results in significant efficiency of energy use, which may translate into lower costs. Because systems are located at the load, CHP does not require additional transmission and distribution lines and can result in improved energy security for the adopter.[1] CHP projects can be dispatched to provide firm capacity.

The state of Texas has a long, successful history of CHP adoption. The first CHP in Texas was a 2000 kW system built in Marshall in 1921. Since that time, the state has witness steady CHP development to reach the 125 facilities located all over the state today. While most of the existing CHP is located at industrial facilities with significant heating needs (such as the chemical and refining industries), a number of projects have also been developed at universities.[2] As shown in Figure 1, the CHP industry experienced strong growth between 1995 and 2002 due to strong policy directives from the Public Utility Commission, which took decisive steps in the development of rules supporting the growth of CHP in the 1980s, the wholesale electricity market in the 1990s, and full electric industry restructuring in 1999.

For the last 10 years, growth in CHP adoption has leveled off, because of financial instability, volatile fuel prices, and regulatory uncertainty. Even so, substantial potential exists to implement additional CHP in Texas. For example, a 2007 Public Utility Commission report estimated that 13,400 MW of additional CHP were economically feasible in the state by 2023.[3] The trend in CHP is toward smaller systems that better match the thermal requirements at smaller industrial, commercial, and institutional sites. Implementation of substantial amounts of new CHP capacity will likely require consideration of a wider range of industrial host sites, and more focus on commercial and institutional sites.

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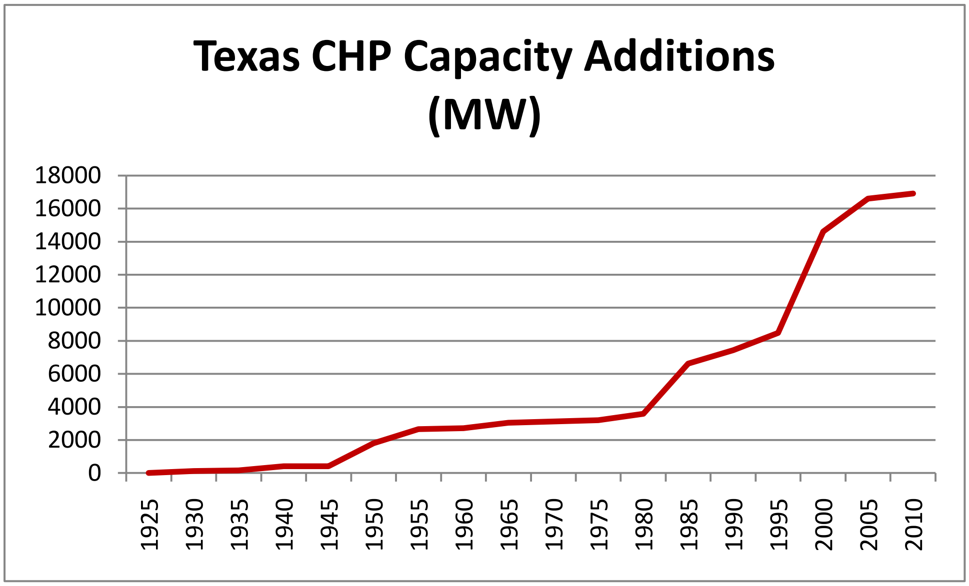
[1] The 81st Legislature requires all critical government buildings to undertake a CHP feasibility prior to construction or renovation to help determine if CHP can help improve the reliability of electricity supply. See HB1831 [2009R] or www.TxSecurePower.org.

[2] University projects include UT Austin, Texas Tech, Rice University, Texas A&M, Texas State, and UT Dallas.

[3] Summit Blue Consulting, *Combined Heat and Power in Texas: Status, Potential, and Policies to Foster Investment* (December 10, 2008).

Figure 1



Source: Gulf Coast CHP Directory

TEXAS' EXISTING CHP FLEET

With a total capacity of about 17,000 MW, Texas has the largest fleet of CHP facilities of any state in the nation.[4] In the last few years, the CHP fleet has consistently generated approximately 80 million MWh annually or about 20% of the electricity in the state. This is roughly four times the amount of energy produced by wind power. The bulk of the current fleet is located at industrial sites along the Texas coast between Corpus Christi to Port Arthur, although other CHP adopters are located across the state.

As detailed in Table 1, the existing fleet of CHP facilities in Texas includes a number of technologies that use a variety of fuels. By far, the predominant installation involves a natural gas combustion turbine with a heat recovery steam system. Many projects include a steam turbine generator, which provides an additional outlet for excess steam created by the project. In this configuration, the system is referred to as a "combined cycle CHP" approach. Some Texas CHP projects operate with reciprocating engines, fuel cells, or in a boiler/steam turbine configuration. Recovery of industrial waste heat with a waste heat recovery boiler/steam turbine configuration is another important, but currently underutilized aspect of CHP. Note that a number of existing CHP units use biomass, which classifies these units as a renewable resource. Some CHP facilities operate on industrial waste gases, waste heat, petroleum coke, and even coal, although natural gas is the predominant fuel of the existing CHP fleet and is the expected fuel for any additional CHP developed in the future.

[4] The best available database of CHP installations is maintained by ICF. The database is available at http://www.eea-inc.com/chpdata/States/TX.html.

Table 1. Texas Existing CHP Fleet

Fuel Class	Prime Mover Technology	Generating Capacity (kW)
Biomass	Boiler/Steam Turbine Combustion Turbine	8,500 10,600
Coal	Boiler/Steam Turbine	2,000
Natural Gas	Boiler/Steam Turbine Combined Cycle Combustion Turbine Microturbine Reciprocating Engine	2,016,035 12,314,830 2,106,905 325 41,035
Oil	Reciprocating Engine	2,040
Other	Boiler/Steam Turbine Combustion Turbine	74,000 20,000
Wastes	Boiler/Steam Turbine Waste Heat Recovery	294,478 20,000
Wood	Boiler/Steam Turbine	5,540
TOTAL		16,916,288

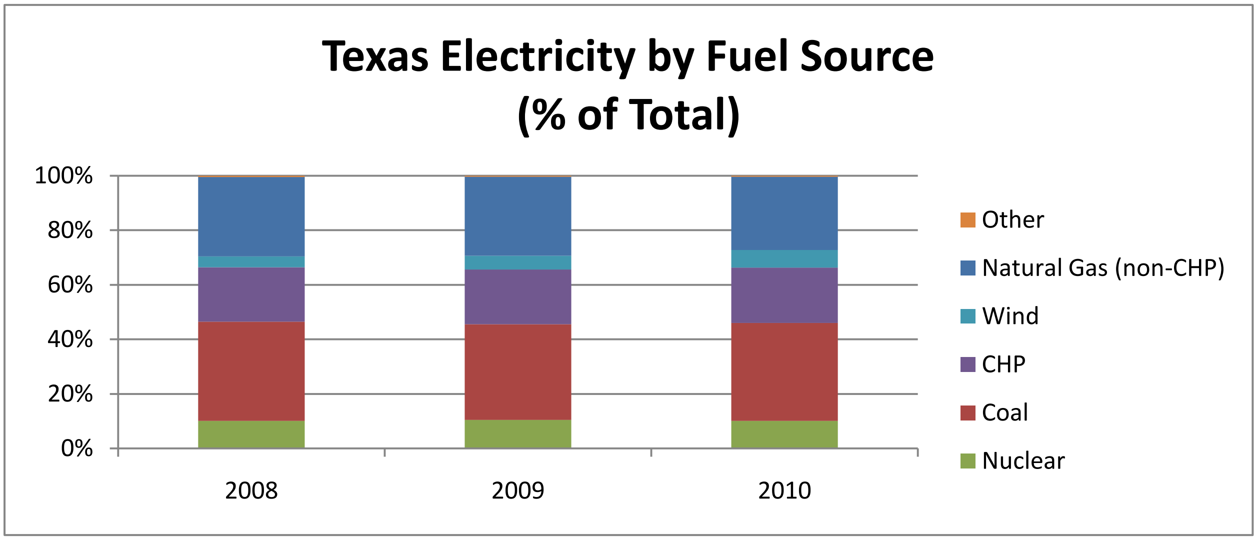
Source: Gulf Coast CHP Directory

TEXAS ELECTRCITY BACKGROUND

Texans consumed approximately 409.5 million MWh of electricity in 2010. To generate that electricity, the state relies on electricity generating units fueled by natural gas, coal, nuclear, wind, and other technologies including for example hydroelectricity and photovoltaic cells. Figure 2 presents a breakdown for each technology used in Texas on a ‘percent of total’ basis.[5] At 35 percent of the total electricity production, coal is the most common fuel. Natural gas is about 30 percent, while nuclear energy, wind and other technologies are at about 10 percent or less. Note that the use of natural gas (non-CHP) generating units has declined between 2008 and 2010 as the amount of wind power electricity has increased.

[5] Note that all CHP projects are accounted for under the CHP heading, even though these facilities use fuels listed in the figure, like natural gas or biomass for example

Figure 2



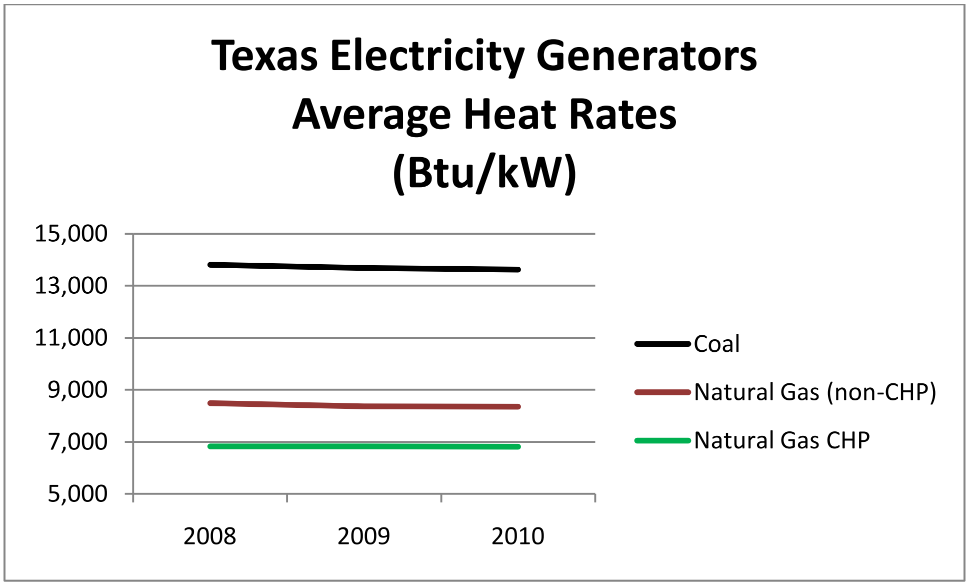
Source: U.S. Energy Information Administration

An important metric used in the electricity industry is referred to as the heat rate. Heat rate is a measure of the amount of energy required to make a given amount of electricity. Heat rate is given as the amount of energy in Btu needed to generate one kWh of electricity. Thus, heat rate is a measure of efficiency. Combining data from the U.S. Energy Information Administration on electricity generation and fuel consumption, the average heat rate for Texas fossil generators can be calculated and shown in Figure 3 below. Note that natural gas-fired CHP has the lowest heat rate, which means it is the most efficient fossil-fueled generating option. While the average CHP facility is more than 20 percent more efficient than the average non-CHP natural gas generator, it is about twice as efficient as the average coal-fired power plant.

In 2010, about 1,500 billion cubic feet (Bcf) of natural gas were consumed to generate power in Texas. The U.S. Energy Information Agency tracks natural gas consumption by utilities, independent power producers, and combined heat and power operators. As shown in the Figure 4, independent power producers use the most gas of the three, but their usage fell from about 700 Bcf to about 600 Bcf between 2008 and 2010. During this period, CHP facilities used about 500 Bcf annually. During the same time period, electric utilities[6] averaged about 300 Bcf per year.

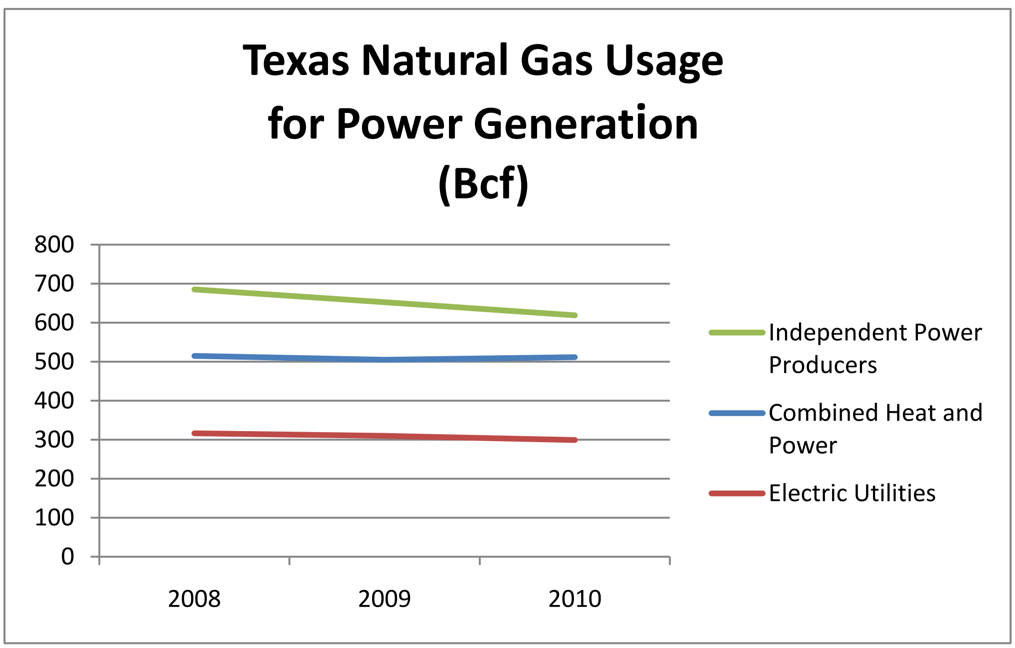
[6] Inside ERCOT, only those municipal utilities and cooperatives that have not opted into competition are allowed to own electricity generators. Outside of ERCOT, utilities can own generation.

Figure 3



Source: U.S. Energy Information Administration

Figure 4



Source: U.S. Energy Information Administration

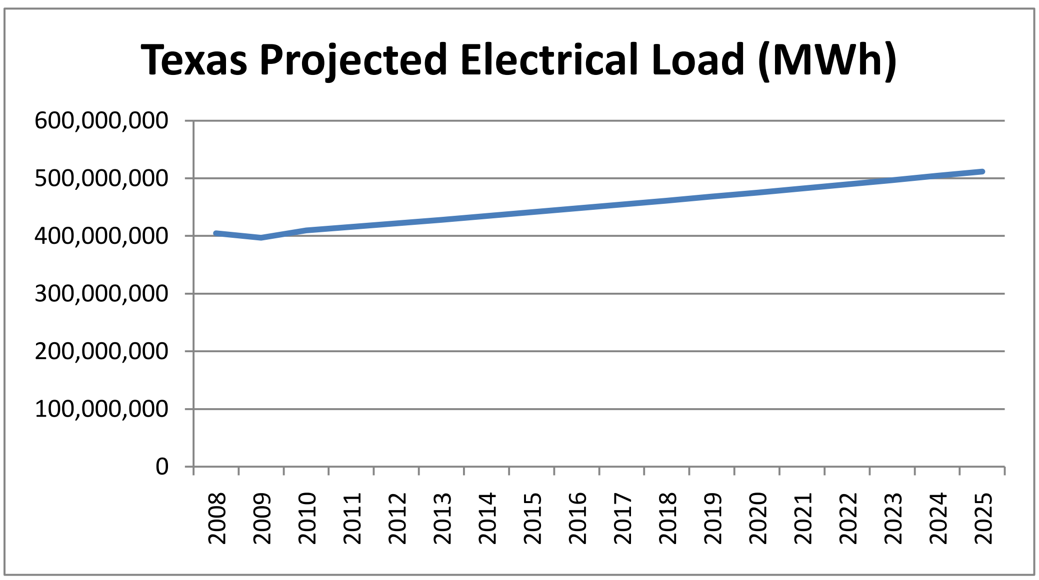
ANALYTICAL APPROACH

To determine the impacts of increasing CHP adoption to 35 percent of statewide electricity by 2025, the projected load growth in Texas was first estimated annually through 2025. The state's projected electrical load was calculated by multiplying its 2010 electricity consumption[7] by 1.5 percent annually.[8] A graph of the projected electricity consumption in the state is shown in Figure 5 below.

With the load projection in hand, the analysis was undertaken by developing and comparing two distinct cases that could meet the projected load. In both cases, the following resources were included:

- Coal-fired power plants
- Natural gas-fired power plants
- Nuclear power plants
- Wind
- Other resources (such as hydroelectric, photovoltaic, biomass)
- Combined Heat and Power facilities (including natural gas and other fuels)

Figure 5.



Source: Gulf Coast Clean Energy Application Center

The details of the two cases analyzed are described below.

[7] U.S. Energy Information Administration (http://www.eia.doe.gov/cneaf/electricity/epa/generation_state_mon.xls; preliminary consumption data in Texas for 2010 was 409,458,596 MWh, last accessed: March 29, 2011).
[8] This rate of growth is consistent with historical growth in state electricity consumption, and represents the consumption after any reductions to the growth in consumption due to the Energy Efficiency Incentive Program (EEIP) offered by the Public Utility Commission. HB 1629 [2011 RS] proposes changing the EEIP goal for electrical energy efficiency from 30 percent of growth in demand to 0.5 percent of peak demand per year.

CASE 1: BUSINESS-AS-USUAL

This case represents a continuation of the state's current policy approach throughout the duration of the planning horizon. The case assumes the existing base of generating technologies grows consistent with historical growth rates and with reasonable expectations for additional units to come on line in the future. The following assumptions are used:

- Coal-fired power plants

  Electricity production by coal-fired power plants is assumed to increase at 0.75 percent per year as currently available, but unused capacity, is brought on line to meet load growth. In this scenario, environmental pressures are anticipated to reduce the growth in the use of coal to half the rate of overall load growth. Emerging EPA regulations on air quality, water use and ash disposal could result in the retirement of some units.[9]

- Natural gas-fired power plants

  The use of natural gas combined cycle and simple cycle generators is assumed to remain on the margin in the state. The use of the state's existing fleet of natural gas generators is assumed to grow at an average rate of 0.8 percent, which is about half of the overall load growth, but slightly faster than the growth of coal.

- Nuclear power plants

  Nuclear power plants continue to run indefinitely at a high capacity factor. Now running at over 90 percent capacity factor, little room exists to increase output without enlarging the facilities. The analysis assumes zero growth in nuclear output, as safety, cost, water use, and financial issues are assumed to make an expansion of the current facilities impossible by 2025.

- Wind Power

  The average annual rate of growth for wind is 6.4 percent, although the rate is higher between 2012 and 2016. This is consistent with the current plan developed with CREZ[10] to double wind capacity to around 18,000 MW in the next 5-10 years.

- Other resources (such as hydroelectric, photovoltaic, biomass)

  Currently small, the annual growth in these resources average 17.5 percent through 2025, which reflects adoption of a 500 MW carve-out in the Renewable Portfolio Standard for non-wind renewable energy. The growth rate used is consistent with achievement of about 500 MW of non-wind renewable energy technologies prior to 2025.

- Combined Heat and Power facilities (including natural gas and other fuels)

  Combined heat and power facilities are expected to grow consistent with their historical growth rate. Significant CHP capacity was built during the 1980s and is now about 30

[9] Metin Celebi, Frank Graves, et. al, Potential Coal Plant Retirements Under Emerging Environmental Regulations, The Brattle Group, December 8, 2010. Available at http://www.brattle.com/NewsEvents/NewsDetail.asp?RecordID=882

[10] Competitive Renewable Energy Zones are regions in Texas in which transmission lines would carry wind power generated in West Texas to areas in Central Texas.

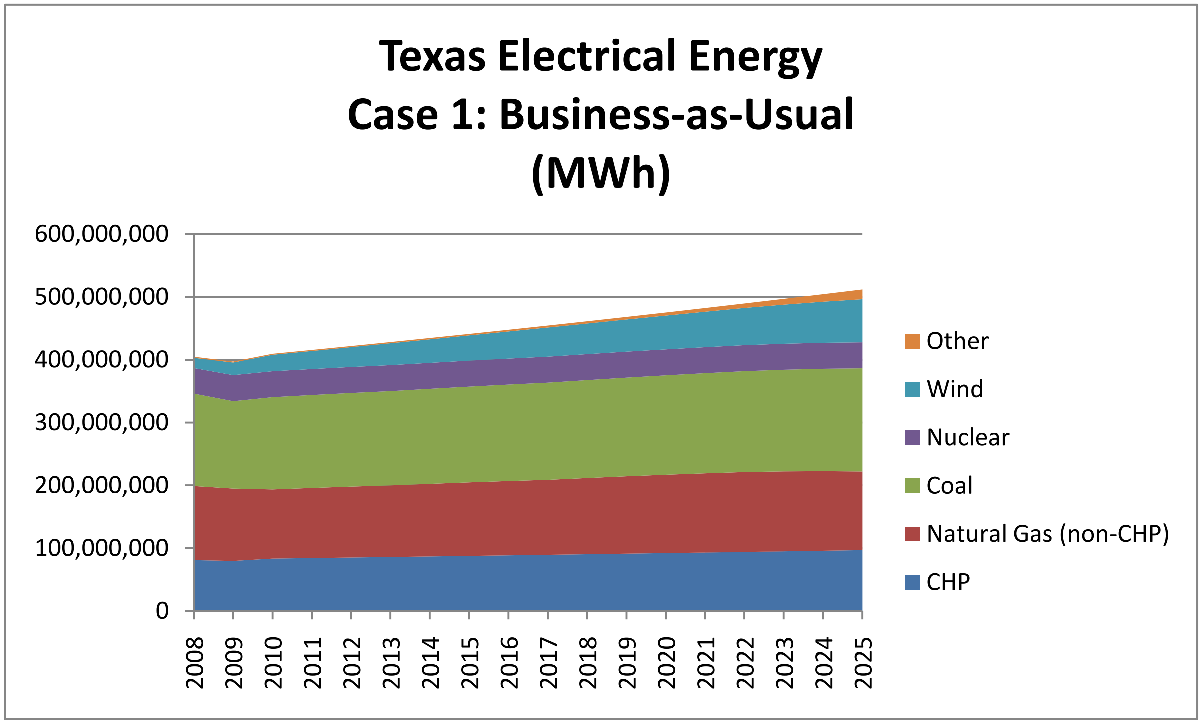
years old. These systems will likely be retired and replaced with more efficeint, newer gas tubine technology. The overall CHP growth rate is expected to average about 1 percent per year through 2025.

The results of the Case 1 analysis are shown in Figures 6 and 7 on page 10. Figure 6 shows the amount of energy provided by each resource over the planning horizon, while Figure 7 shows the same data, but depicted on a ‘percent of total load’ basis. Data for the first three years on the graph (2008-2010) respresent historical data [EIA], while the data beginning in 2011 are projection arising from the analysis.

In Figure 6, resources are shown to grow throughout the planning horizon at rates consistent with their historical deployment levels. The use of each resource remains consistent with its current relative ranking, with the exception of wind power, which eclipses nuclear power as an energy resource around 2016.

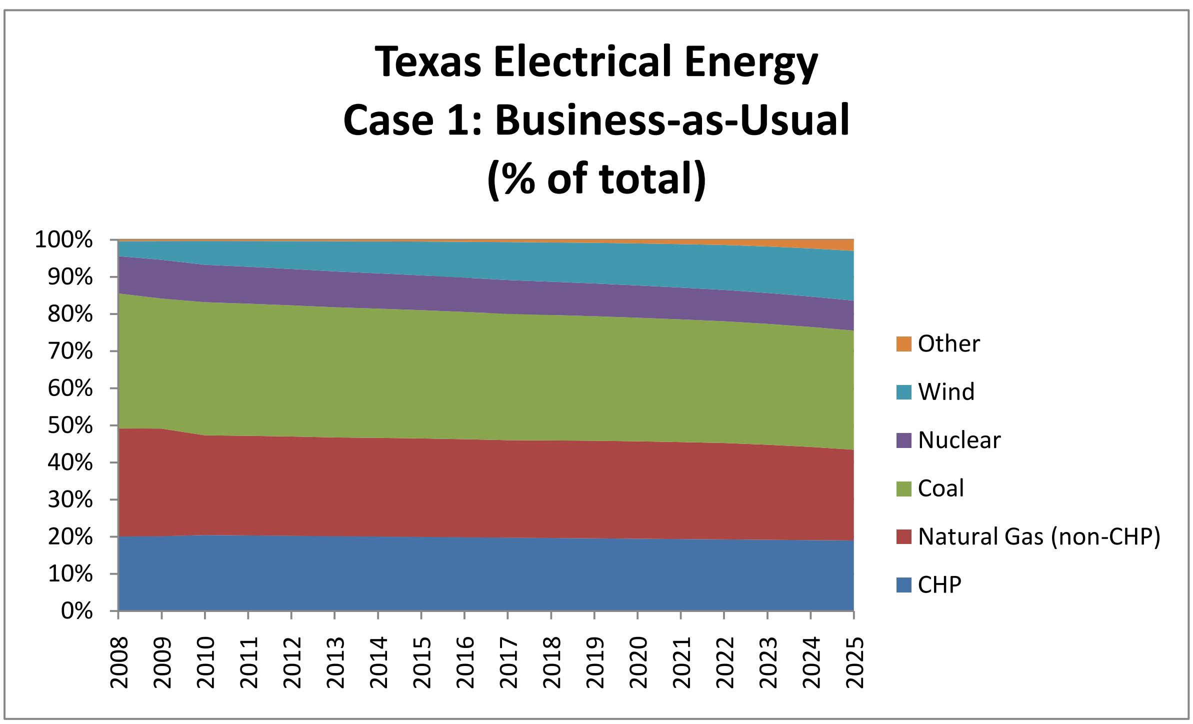
In Figure 7, notice that all conventional resources are trending toward lower percentage use, as their growth rates are lower than the overall growth in electrical load. Rapid growth in wind power and eventually in non-wind renewable energy is sufficient to meet the additional growth in demand.

Figure 6



Source: Gulf Coast Clean Energy Application Center

Figure 7



Source: Gulf Coast Clean Energy Application Center

CASE 2: NATURAL GAS CHP GOAL

This case represents a shift in the current policy approach in the state to advance natural gas-fired combined heat and power technologies. As a result of the policy change, the existing CHP resource base grows rapidly throughout the planning horizon, building from the current 20 percent of total electricity to 35 percent by 2025.

The scenario envisions strong uptake of CHP among industrials, including waste heat recovery at industrials and natural gas compressor stations. In addition, an expansion of smaller-scale CHP into the relatively untapped commercial and institutional applications using microturbines and pre-engineered or ‘packaged’ CHP systems would be anticipated. As a baseload resource implemented primarily at industrial locations, CHP implementation makes coal-fired power plants the marginal unit. As a result, growth in CHP exclusively displaces coal in the scenario, while all other resources maintain the growth rate projected in the Business-as-Usual case.

The following assumptions are used in Case 2:

- <u>Coal-fired power plants</u>

  Coal-fired power plants become the marginally dispatched unit in the state, so their production is displaced by the growth in more efficient, and cleaner natural gas-fired CHP.

- <u>Natural gas-fired power plants</u>

  The use of natural gas combined cycle and simple cycle generators continue to meet a key need for electricity in the state. Because they are less efficient than CHP and are not tied to industrial hosts (which tends to make CHP a “must run” unit), the existing fleet of natural gas generators is assumed to grow at an average rate of 0.8 percent, which is about half of the overall load growth.

- <u>Nuclear power plants</u>

  Same as Case 1 -- Nuclear power plants continue to run indefinitely at high capacity factor. Now running at over 90 percent capacity factor, little room exists to increase output without enlarging the facilities. The analysis assumes zero growth in nuclear output, as safety, cost, water use, and financial issues are assumed to make expansion of the current facilities impossible by 2025.

- <u>Wind Power</u>

  Same as Case 1 -- The average rate of growth for wind is 6.4 percent, although it is higher between 2012 and 2016. This is consistent with the current plan developed with CREZ to double wind capacity to around 18,000 MW in the next 5-10 years.

- <u>Other resources (such as hydroelectric, photovoltaic, biomass)</u>

  Same as Case 1 -- Currently small, the annual average growth rate of these resources is modelled at 17.5 percent through 2025. This growth rate reflects adoption of a 500 MW carve-out in the Renewable Portfolio Standard for non-wind renewable energy. The growth rate used is consistent with achievement of about 500 MW of non-wind renewable energy technologies by about 2025.

- <u>Combined Heat and Power facilities (including natural gas and other fuels)</u>

  The use of combined heat and power is greatly expanded from the current production level of 20 percent of total electrical load to 35 percent of total load. Growth is slower at first, but rapidly increases in the 2015-2020 time frame.

The results of the Case 2 analysis is shown in Figures 8 and 9. Figure 8 shows the amount of energy provided by each resource over the planning horizon, while the second shows the same data, but depicted on a 'percent of total load' basis. Data for the first three years on the graph (2008-2010) respresent actual data, while the data beginning in 2011 are projected.

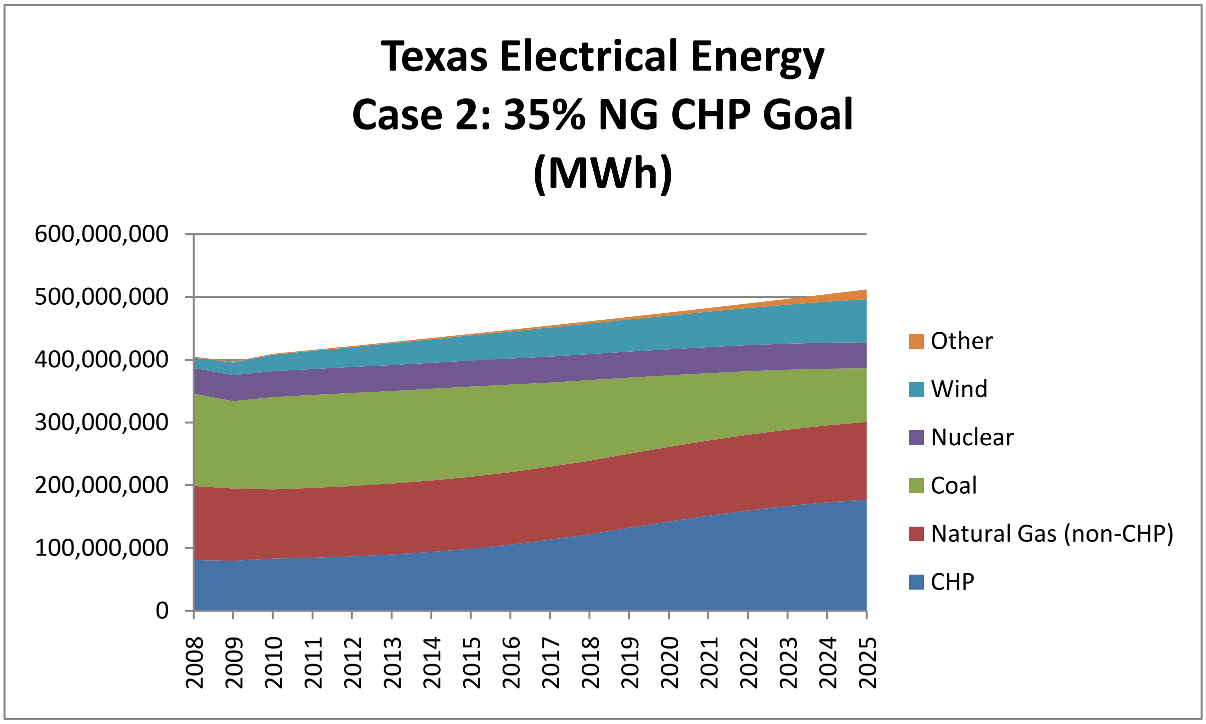
The increased use of CHP in Case 2 exclusively displaces coal-fired generation in the model, which represents a large switch in primary fuel used for power generation from imported coal and Texas lignite to Texas natural gas. The use of other resources remains consistent with its performance in the Business-as-Usual case, including wind power, which again eclipses nuclear power as an energy resource around 2016, and non-wind renewable energy, which shows substantial growth later in the decade.

In Figure 9, the percentage of load served by CHP facilities increases from 20 percent of total energy to 35 percent of total energy, consistent with the planning requirement. Natural gas and nuclear trend lower as they did in the Business-as-Usual case, while wind and non-wind renewable energy meet about 18 percent of total load by 2025. The use of coal is substantially reduced allowing many older, more inefficient facilities to be retired (See Figure 6).

The growth of CHP from 20 percent to 35 percent of load necessitates an increase in energy production from CHP facilities from the current 80 million MWh to nearly 175 million MWh, an approximate increase of 95 million MWh. This will require a large number of additional host sites and a significant investment in new facilities, possibly including expansion of CHP beyond the traditional industrial location at large refining and chemical sites to smaller pocess and manufacturing plants as well as commercial and institutional applications.

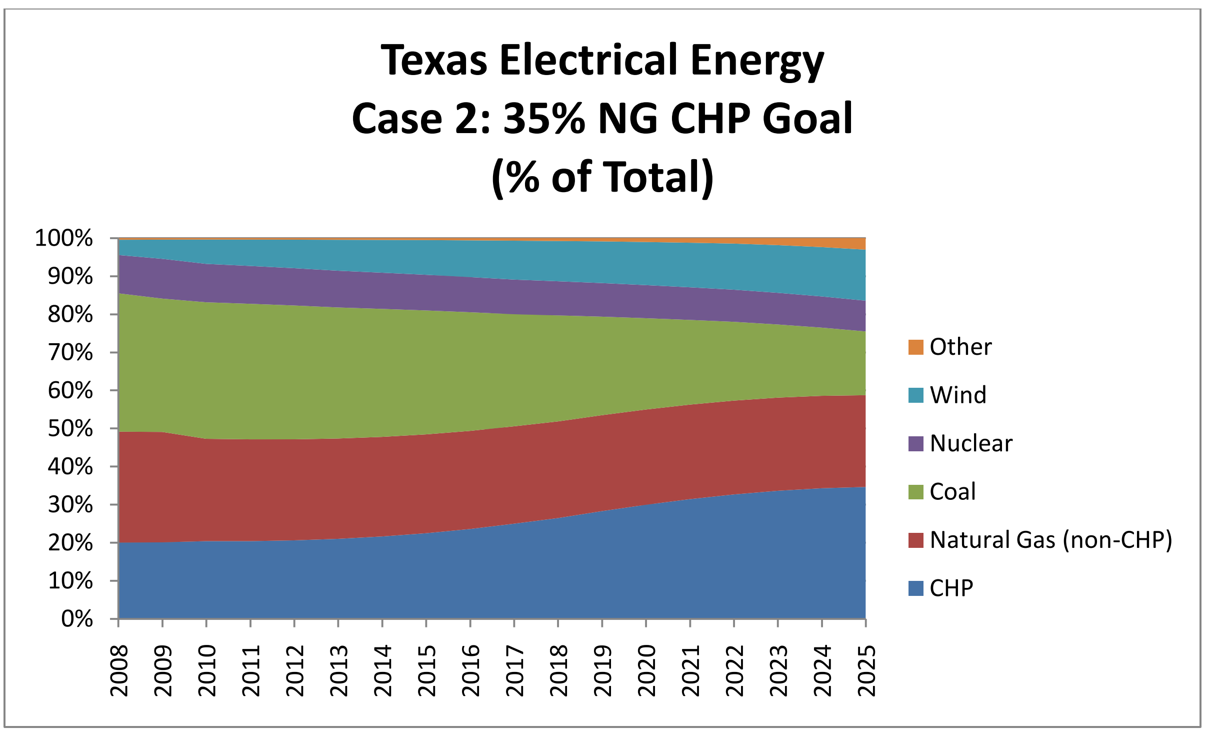
At an estimated capacity factor of 75 percent, the increase in CHP output would drive capacity additions of about 14,075 MW, which is higher than, but consistent with the 2007 Public Utility Commission report regarding CHP potential in Texas. Many new large industrial projects in the 50-100 MW range are expected, althouth significant growth is anticipated in industrial and commercial projects under 20 MW in size. Many of the smaller projects could be under the 1 MW threshold, including potential projects at nursing homes, condominiums, high schools and similar facilities may be in the 100-1000 kW range.

Figure 8



Source: Gulf Coast Clean Energy Application Center

Figure 9



Source: Gulf Coast Clean Energy Application Center

A summary of the changes anticipated in the Texas CHP industry as a result of meeting a 35% Goal as described in Case 2 is provided in the table below.

Table 2: Comparison of CHP Alternatives.

Criteria	Current CHP	CHP with 35% Goal
Year	2011	2025
Portion of Electrical Supply	20 percent	35 percent
Total CHP Capacity	16,900 MW	31,000
Avg Size of Facility	135 MW	25-50 MW, although many facilities less than 20 MW
No. of Facilities	125	200+ large industrial units, potentially 500+ smaller systems
Energy Produced	83 million MWh	177 million MWh
Ind. Waste Heat Recovery	A handful of projects	Much more common
Commercial/Institutional CHP Projects	Large universities and a hand-full of hospitals	Possibly 500-2000 projects in the 0.1-20 MW range

ANTICIPATED IMPACTS RESULTING FROM CASE 2

Implementation of combined heat and power on the scale suggested in Case 2 would shift 15% of total electrical energy consumed in the state from coal to highly efficient CHP facilities fueled by cleaner natural gas. The change would have a major impact on a number of important natural resource and environmental issues in the state. In this section, potential impacts are estimated for the following areas:

1. natural gas consumption
2. carbon dioxide emissions
3. sulfur dioxide (SO_2) emissions
4. nitrogen dioxide (NO_2) emissions
5. water used for power generation

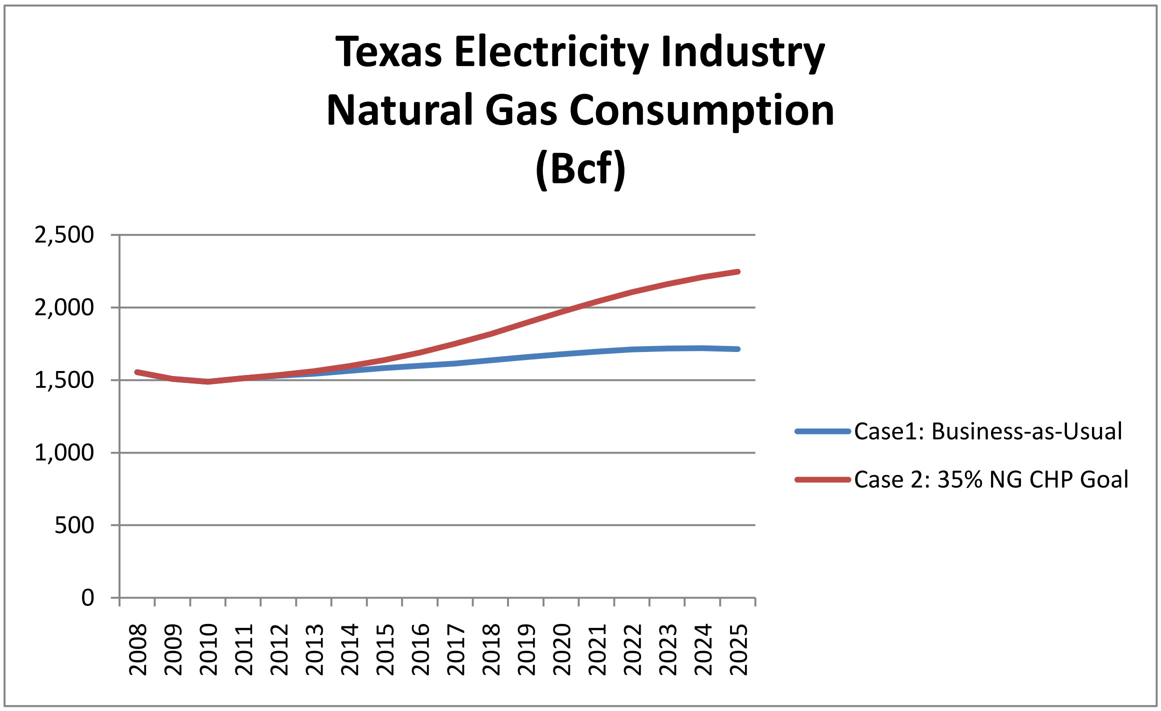
To estimate these impacts, the Gulf Coast Clean Energy Application Center conducted a comparative study between the Business-as-Usual case and the Natural Gas CHP Goal case. For each of these cases, the projected impact of each *case* on a particular resource was first determined and graphed. The difference between the lines in any single year shows the impact during that year, while the total area between the two lines shows the overall impact throughout the period from 2012 to 2025.

1. Natural Gas Consumption

Implementation of the 35% Natural Gas CHP case assumptions as described in this analysis would increase natural gas consumption for power production from about 1,500 Bcf today to about 2,250 Bcf by 2025. Compared to the Business-as-Usual case, the 35% Natural Gas CHP case would increase gas consumption by a total of about 3.3 trillion cubic feet (Tcf) between 2012 and 2025, nearly all of which would arise from additional gas used by CHP projects.

At the current price of about $4.25 Mcf, the value of this gas increase to producers would be approximately $14 billion. The State of Texas may see additional revenues through the sale of state gas into this market and through the collection of additional severance tax revenues.

Figure 10



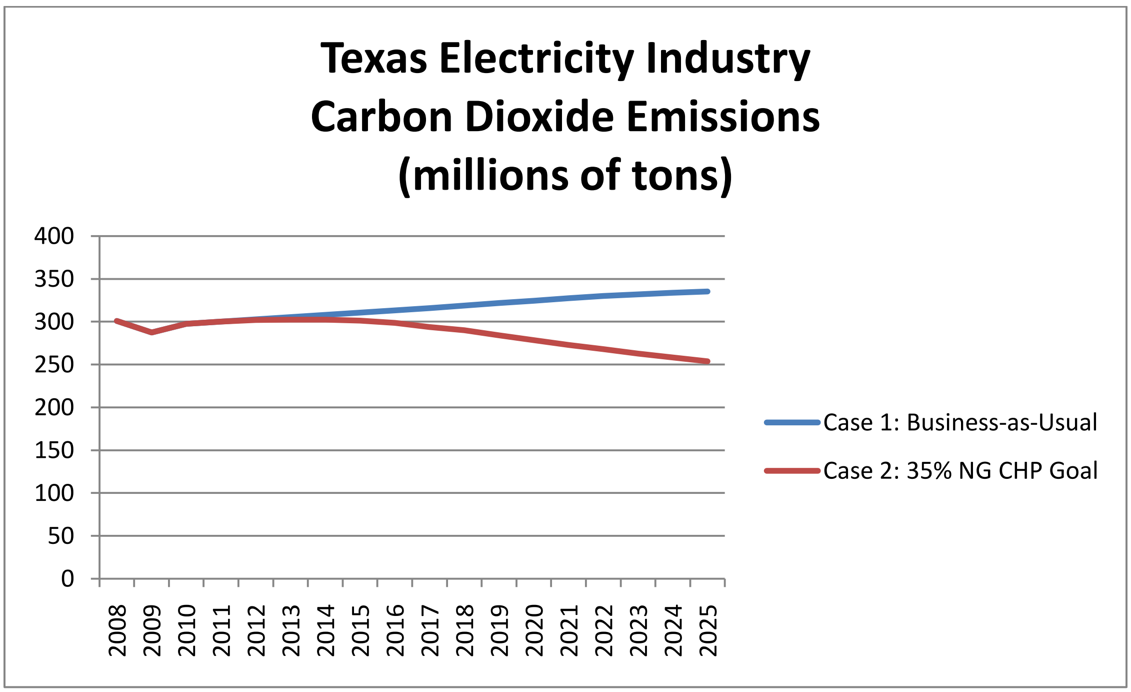
Source: Gulf Coast Clean Energy Application Center.

2. Carbon Dioxide Emissions

Implementation of the 35% Natural Gas CHP case assumptions as described in this analysis would decrease carbon dioxide emissions resulting from power production from the current level of about 300 million tons per year to about 250 tons per year. In the Business-as-Usual case, carbon dioxide emissions increase by 12 percent over the same period. Compared to the Business-as-Usual case, the CHP case reduces carbon dioxide emissions by a total of about 511 million tons between 2012 and 2025.

At full build out of the plan in 2025, annual carbon dioxide emissions would be reduced by about 81 million tons per year, an amount equivalent to the annual carbon dioxide emissions of about 13.5 million cars.

Figure 11



Source: Gulf Coast Clean Energy Application Center.

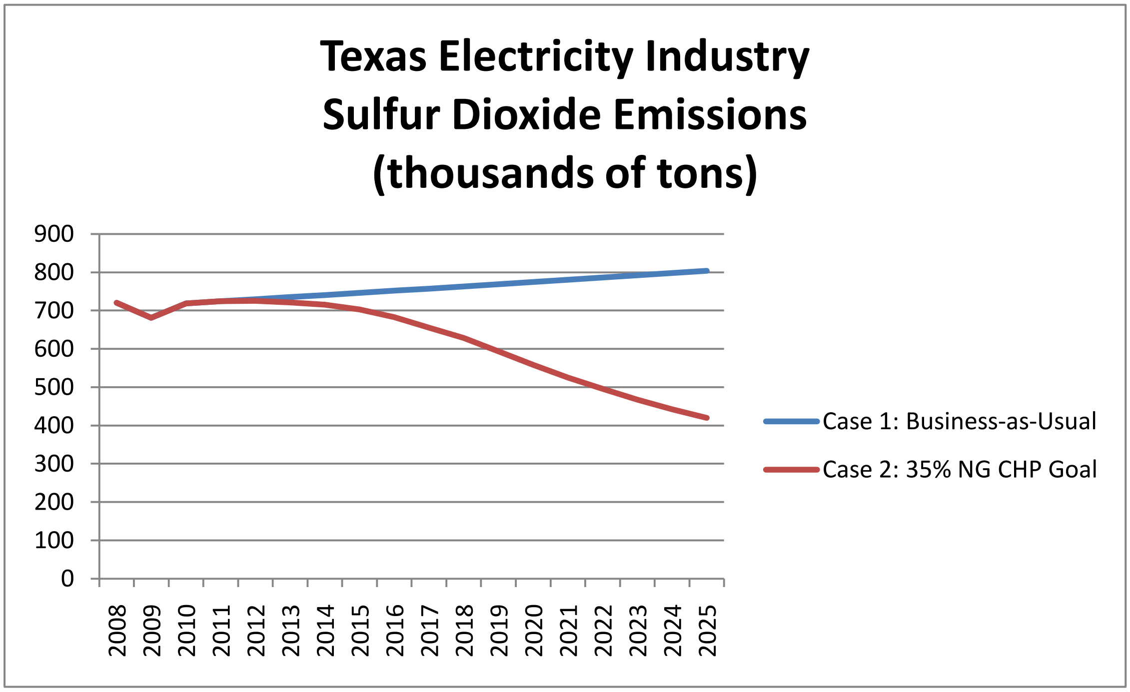
Note: This projection is based upon historical emission values, and doesn't take into account the possibility of stricter regulations from the U.S. Environmental Protection Agency.

3. Sulfur Dioxide Emissions

Implementation of the 35% Natural Gas CHP case assumptions as described in this analysis would decrease sulfur dioxide emissions resulting from power production from the current level of about 700 thousand tons per year to about 420 thousand tons per year. In the Business-as-Usual case, sulfur dioxide emissions continue to increase, reaching 800 thousand tons at the end of the planning horizon in 2025. Compared to the Business-as-Usual case, the CHP case reduces sulfur dioxide emissions by about 2,394 thousand tons between 2012 and 2025.

At full build out of the CHP plan in 2025, annual sulfur oxide emissions would be reduced relative to the Business-as-Usual case by about 384 thousand tons, which is the equivalent emissions reduction that would be achieved by retiring about twenty-one 500 MW coal plants.

Figure 12.



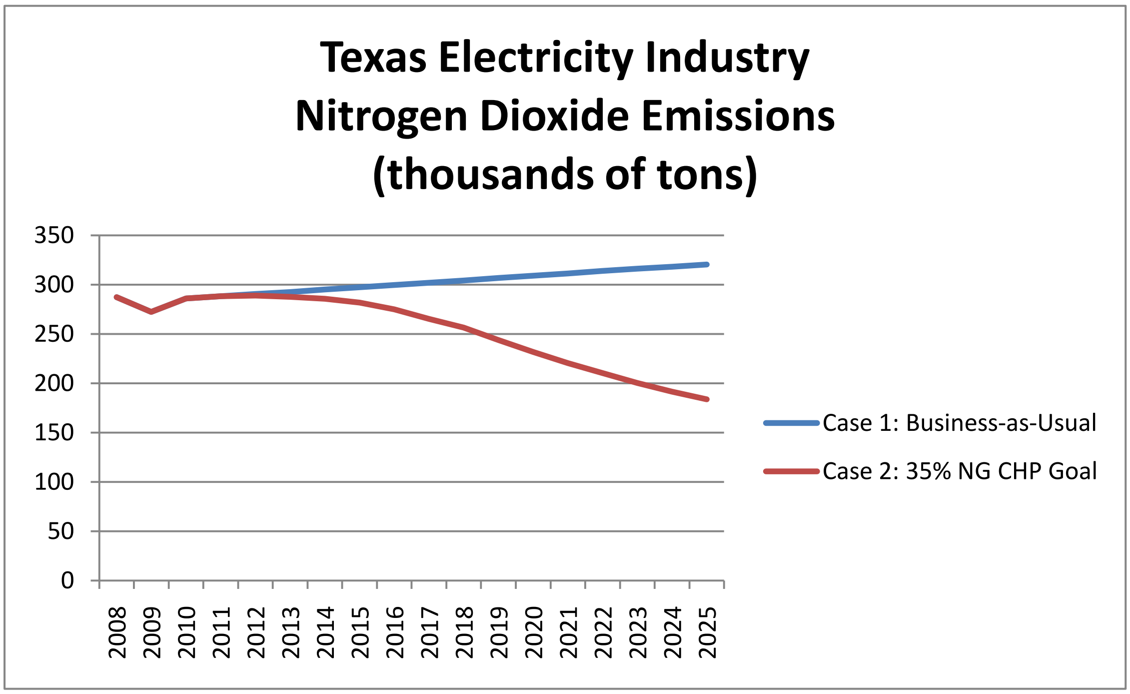
Source: Gulf Coast Clean Energy Application Center.

4. Nitrogen Dioxide Emissions

Implementation of the 35% Natural Gas CHP case assumptions as described in this analysis would decrease nitrogen dioxide emissions resulting from power production from the current level of about 285 thousand tons per year to about 185 thousand tons per year. In the Business-as-Usual case, nitrogen dioxide emissions continue to increase, reaching 320 thousand tons at the end of the planning horizon in 2025. Compared to the Business-as-Usual case, the CHP case reduces nitrogen dioxide emissions by about 854 thousand tons between 2012 and 2025.

At full build out of the CHP plan in 2025, annual nitrogen dioxide emissions would be reduced relative to the Business-as-Usual case by about 137 thousand tons, which is the equivalent emissions reduction that would be achieved by retiring about twenty-two 500 MW coal plants.

Figure 13



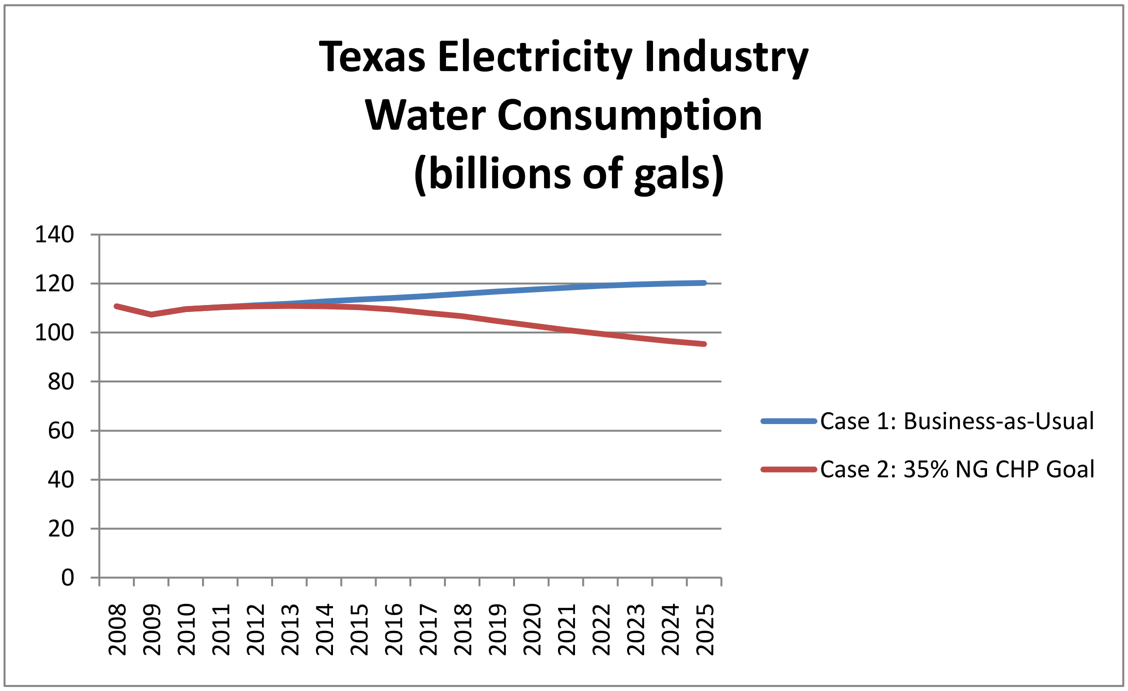
Source: Gulf Coast Clean Energy Application Center.

Note: This projection is based upon historical emission values, and doesn't take into account the possibility of stricter regulations from the U.S. Environmental Protection Agency.

5. Water Use

Implementation of the 35% Natural Gas CHP case assumptions as described in this analysis would decrease water consumption used for power production from the current level of about 110 billion gallons per year to about 95 billion gallons. In the Business-as-Usual case, water consumption would continue to increase, reaching 120 billion gallons at the end of the planning horizon in 2025. At full build out of the CHP plan in 2025, annual water consumption would be reduced relative to the Business-as-Usual case by about 25 billion gallons per year. Between 2012 and 2025, the CHP case reduces water consumption by a total of about 161 billion gallons.

Figure 14



Source: Gulf Coast Clean Energy Application Center.

CONCLUSIONS

Combined heat and power (CHP) facilities currently generate 20 percent of the electricity in Texas. The systems are located near host facilities to which they supply heat and electricity. On average, the technology was found to be twice as efficient as coal-fired power plants, and about 25 percent more efficient than the natural gas-fired generator fleet (non-CHP).

This paper examined the implications and impacts of expanding the use of CHP in the state from 20 percent to 35 percent of electrical energy by 2025. To achieve the higher output, the amount of installed CHP capacity would need to increase from 17,000 MW to 31,000 MW, an increase of about 14,000 MW. Gas consumed by CHP facilities would more than double from 500 Bcf per year to about 1050 Bcf per year. To the extent that electricity generation from CHP displaced coal-fired generators, the following environmental benefits were found.

- Carbon Dioxide

At full build out of the plan in 2025, annual carbon dioxide emissions would be reduced by 48 million tons per year, an amount equivalent to the annual carbon dioxide emissions of about eight million cars. Cumulative reductions in carbon dioxide emissions totaled 297 million tons.

- Nitrogen Oxide Emissions

At full build out of the CHP plan in 2025, annual nitrogen oxide emissions would be reduced by 137 thousand tons, which is the equivalent emissions reduction that would be achieved by retiring about twenty-two 500 MW coal plants. Cumulative reduction in nitrogen oxide emissions totaled 854 thousand tons.

- Sulfur Oxide Emissions

At full build out of the CHP plan in 2025, annual sulfur oxide emissions would be reduced by 384 thousand tons, which is the equivalent emissions reduction that would be achieved by retiring about twenty-one 500 MW coal plants. Cumulative reduction in sulfur oxide emissions totaled 2,394 thousand tons.

- Water Consumption

At full build out of the CHP plan in 2025, annual water consumption would be reduced by 25 billion gallons per year. Cumulative water savings between 2012 and 2025 totaled 161 billion gallons.

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Texas Electricity Profile http://www.eia.doe.gov/cneaf/electricity/st_profiles/texas.html

- Table 1. 2008 Summary Statistics
- Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 Through 2008
- Table 7. Electric Power Industry Emissions Estimates, 1990 Through 2008
- Consumption_state_mon.xls
- Generation_state_mon.xls
- Sept04tx.xls
- Sept05tx.xls
- Sept07tx.xls