



Texas' Clean Energy Economy

Prioritizing Jobs, Investments, and Economic Growth

Environmental Defense Fund's Report to the Texas Legislature / February 2017

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Introduction

As a result of unprecedented energy innovation and a robust, competitive market, Texas is rapidly transitioning to a clean energy economy. Texas can create new jobs, lower harmful pollution and the associated healthcare costs, and save precious water supplies by harnessing its vast potential for renewable power and energy efficiency.

The Lone Star State is uniquely positioned to benefit from the global transition to cleaner energy more than any other state or country around the world:

- Texas leads in clean energy potential. It currently produces more wind power, and has more potential for solar power, energy efficiency, and demand response—an innovative mechanism that rewards customers and businesses for saving energy—than any other state.¹
- Texas is the nation's capital of natural gas production. Innovations in drilling methods have significantly increased the production and supply of natural gas, driving down prices. Natural gas—if produced responsibly—is an important fuel source and Texas companies are embracing this and growing the Texas economy.
- Texas has the opportunity to replace coal imported from other states with homegrown energy resources, which means more jobs. Historically, Texas power companies have expended almost \$2.0 billion annually importing coal from other states.²
- More than 85 percent of Texas voters support the increased use of clean energy resources.³

Texas officials and business leaders should recognize the opportunity at hand and position the state to grow its economy from clean energy. By developing and implementing a bold, comprehensive Texas energy plan, they can create well-paying jobs, drive innovation and investment, make us more energy independent, protect our water supplies, and improve the health of Texans and the environment.

Texas' ongoing transition to a clean energy economy

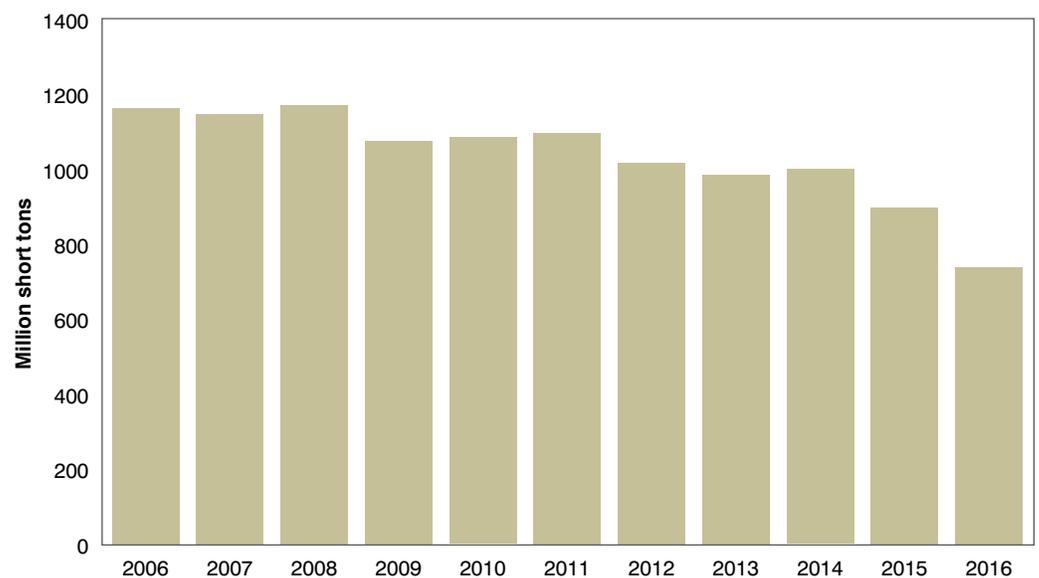
The electricity sector in Texas and across the United States is experiencing dramatic change. In the past few years, coal's share of electricity generation has fallen as it has faced increasing competition from natural gas and renewables. According to the U.S. Energy Information Administration (EIA), in 2016, natural gas-fired electricity generation surpassed coal-fired generation for the first time, accounting for an estimated 34 percent of total electricity generation compared with coal's 30 percent share.⁴

The EIA also reports that U.S. coal production in 2016 is 17 percent lower than in 2015, and the lowest level since 1978, as shown in Figure 1. In addition, 2016 U.S. coal exports declined 23 percent from the previous year. The EIA attributes this to low natural gas prices, warmer-than-normal temperatures during the 2015–16 winter that reduced electricity demand, the retirements of some coal-fired generators, and lower international coal demand.⁵

The Electric Reliability Council of Texas (ERCOT), the grid operator for approximately 90 percent of the state, also projects that under business-as-usual conditions the use of coal will continue to decline over the next 15 years. In its most recent forecasted electricity generation

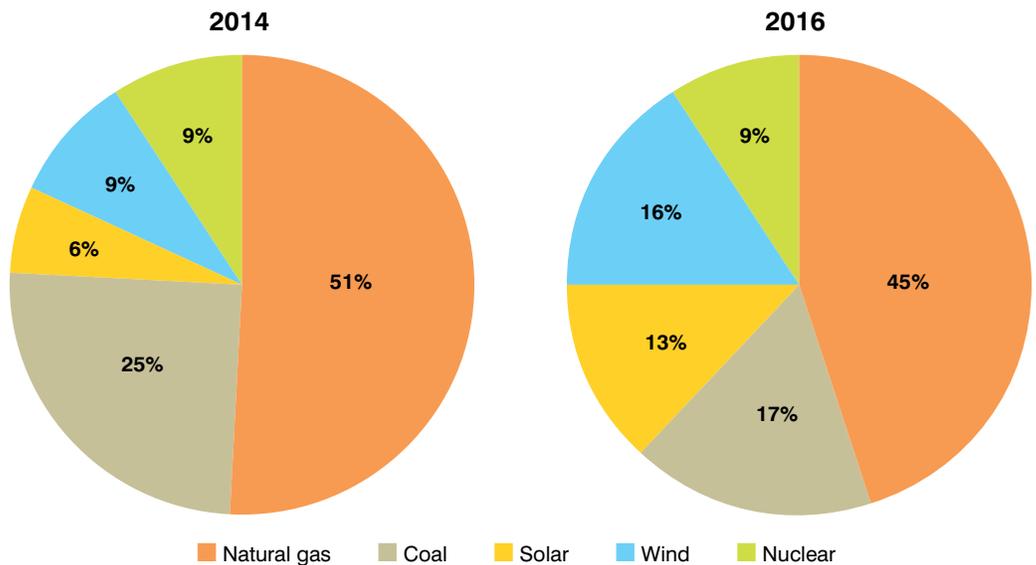
FIGURE 1
U.S. EIA coal production, 2006–2016

million short tons



Falling production in 2016 continues an eight-year decline due to low natural gas prices and fewer coal exports. Source: U.S. Energy Information Administration, Coal Data Browser

FIGURE 2
ERCOT LTSA projected generation mix for 2030



ERCOT's 2016 projections show a notably cleaner energy mix in 2030 than the projections made in 2014. Source: ERCOT, Long Term System Assessment 2014, 2016

ERCOT projects a generation mix with significantly more power from renewables and significantly less from coal.

mix for 2030, known as the Long-Term System Assessment (LTSA), ERCOT projects a generation mix with significantly more power from renewables and significantly less from coal. These projections are reflected in Figure 2.

Meanwhile increased energy efficiency is helping to slow the growth of demand for electricity, even as that growth continues at a rate higher than previously projected.⁶ And, as overall demand for power rises, the use of natural gas will increase, although the percentage of natural gas-fueled electricity in the generation mix will fall.⁷

Natural gas: The price-setter in the electricity sector

The dominant factor contributing to the reduction in the use of coal is the dramatic decline and ongoing low prices of natural gas. In 2000, the price of natural gas reached a high of \$8 per MMBTU, and climbed to a high of over \$12 per MMBTU by the middle of the decade. There were predictions at that time that gas prices would continue to sharply increase. But with advances in hydraulic fracturing, natural gas spot prices were at an all-time low around \$2–3 per MMBTU in 2016.⁸

In conjunction with the increasing cost of operating coal-fired power plants, low natural gas prices have created the economic conditions within Texas to stimulate transformational changes in the electricity sector. In a 2016 report, the Brattle Group concluded 85 percent of Texas' electricity in 2035 would come from natural gas and renewables, and coal's share would fall to 6 percent, if gas prices remained below \$4 per MMBTU and solar prices continued to decline as forecasted.⁹ This stands in sharp contrast to 1997, when 40–45 percent of Texas' electricity came from coal.¹⁰

Natural gas has an important contribution to make to Texas' clean energy portfolio—but only if it is produced responsibly. Gas-fired electric generation facilities not only can replace the need for coal-fired generation, but also can have much more flexible operational capabilities that support reliable operation of the electric grid. That being said, natural gas is made up mostly of methane, a powerful greenhouse gas that in the near term is over 80 times more

potent than carbon dioxide. Methane leaks from thousands of sources across the natural gas supply chain as it is extracted and transported to the end-user—making the oil and gas sector the largest industrial source of methane pollution.

Fortunately, solutions for reducing methane emissions are not costly and also can put additional dollars into the pockets of gas producers and transporters. These are simple, low-cost strategies that can quickly cut methane emissions by 40 percent or more.¹¹ Both the federal government and states like Colorado, Wyoming, and Ohio have implemented commonsense rules to reduce emissions, but Texas has yet to do so. Meanwhile, California has begun scrutinizing methane emissions associated with the natural gas purchased from outside its borders. It is not unreasonable to assume other large domestic or international consumers who are concerned with methane's impact on the climate will follow suit. Without regulations or some other transparent, verifiable methane reduction initiative, Texas natural gas producers may very well find themselves at a competitive disadvantage in the future.

Prioritizing low-cost power

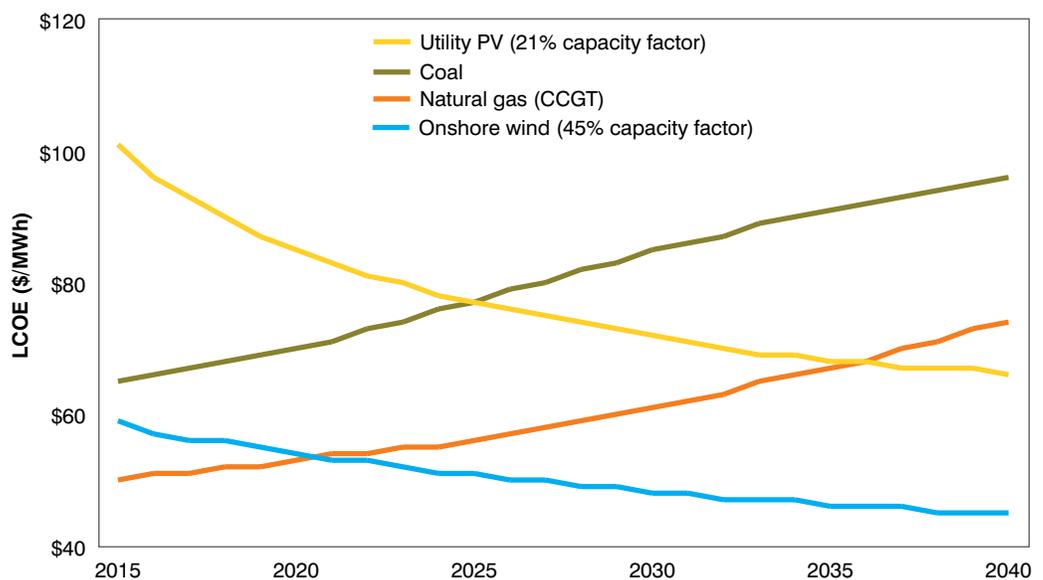
The ERCOT market is highly competitive and, during normal operations, the grid operator places lowest-cost resources on the grid first. In addition to the ongoing low price of natural gas, wind has seen cost reductions of over 66 percent and solar of over 85 percent from the years 2009 to 2016.¹² As the ERCOT LTSA indicates, it is likely that—as new generation resources are built—more wind, solar and natural gas power will be added to Texas' electric grid ahead of higher-cost coal generation.

In addition, a September 2016 study by the Institute for Energy Economics and Financial Analysis reviewed the economic viability of seven large coal plants in Texas that represent about 40 percent of the coal-fired capacity in ERCOT. It concluded that none of the units are financially viable nor would be economic for ratepayers in the coming years.¹³

Large, old, and inefficient coal-fired power plants simply cannot compete with abundant, cheap natural gas and wind now or in the years to come, as shown in Figure 3. In addition,

Wind has seen cost reductions of over 66 percent and solar of over 85 percent from the years 2009 to 2016.

FIGURE 3
U.S. levelized cost of electricity (LCOE) forecast, 2015–2040



Natural gas and wind are forecasted to be the least-cost sources of new electricity for the next several decades. Source: Bloomberg New Energy Finance. "2015 New Energy Outlook—Americas."

if the true value of water is taken into account, transitioning away from coal to lower water-intensive natural gas and renewables makes even more economic sense in this drought-prone state.

The growth of renewable energy

Texas policy makers put in place bipartisan policies over the past 15 years which have led the state to develop a national model for the transition to a clean energy economy. The Texas Legislature adopted the Renewable Portfolio Standard, a regulatory standard for increasing the use of wind power, in 1999. It subsequently authorized the designation of Competitive Renewable Energy Zones (CREZ) in 2005, for the explicit purpose of developing transmission lines to transport power from wind-rich West Texas eastward to the state's metropolitan centers.

When Texas transitioned to a competitive electricity market in 2002, the new law recognized that utilities would have legacy costs, or the difference between the current book value of the power plants and the plants' new market value. Texans paid generation companies billions of dollars to address this issue. As a result, Texas customers have already paid the owners of these power plants for the "stranded cost" investments.

These public policy achievements, coupled with Texas' phenomenal wind power potential and dramatically falling prices, have propelled wind power growth and made the Lone Star State the largest wind producer in the country—by more than three times any other state. In fact, if Texas were its own country, it would be the sixth largest wind energy generator in the world.¹⁴ Much of the wind development has also occurred in West Texas and the Panhandle, the driest areas in the state. Maximizing wind in that region also helps reduce water stress on generation as wind power requires virtually no water, leaving aquifers available for higher uses such as drinking, agriculture, and ranching.

For the 12-month period ending October 2016, wind energy provided nearly 13 percent of all in-state electricity production, which powered 4.1 million homes.¹⁵ This past November, wind power broke records by providing almost 50 percent of electricity generation for roughly 14 hours straight.¹⁶ Further, if pending projects are completed, wind power capacity will grow to 31 percent of ERCOT's total 2017 capacity – comprising more than 25,000 MW, a nearly 60 percent increase from 2015.¹⁷ Industry experts believe existing growth will continue. The DOE Wind Vision Scenario projects that Texas could produce enough wind energy by 2030 to power the equivalent of 15.4 million homes.¹⁸

Additionally, the rapidly declining cost of solar power technology, combined with Texas' enormous solar potential, has led ERCOT to project an approximately 70-fold increase in solar energy capacity from 2015 to 2030 under business as usual conditions.¹⁹ During 2016, more than 27,000 residents and businesses of Texas procured rooftop solar at a rate of more than 4 MW per week.^{20,21}

If Texas were its own country, it would be the sixth largest wind energy generator in the world.

UTILITY SPOTLIGHT: LUMINANT

Texas' largest power-generator gets in the solar game

The largest power-generator and miner of coal in Texas, Luminant has added 116 MW of solar power to its energy mix, enough to power 58,000 homes.²²

"It's historic in that Luminant, which primarily generates its energy from coal, is buying the energy from a solar project because the solar power is actually competitive with other energy sources," Luminant chief executive Mac McFarland told the *Dallas Morning News*. "Solar energy was previously viewed as being an expensive alternative to fossil fuels. Those days are ancient history."²³

Luminant will receive solar power from the Castle Gap facility in Upton County and will then sell the electricity to the ERCOT competitive market.



istock / Knaupe

ERCOT projects an approximately 70-fold increase in solar energy capacity from 2015 to 2030.

Opportunities to save money and energy

Energy efficiency is an extremely cost-effective resource that offsets the need to build additional power plants. According to the major private investment firm Lazard, it costs zero to 5 cents/kilowatt hour (kWh) to save energy through energy efficiency investments, making it by far the cheapest energy resource.²⁴ Additionally, technological innovations and improvements in the building sector, as well as the design of equipment and household appliances to use less energy without compromising performance, comfort or convenience, are bringing about more efficiency.

Fortunately, Texas has more potential for energy efficiency and demand response than any other state. The largest potential for energy savings is electricity used by households and businesses.²⁵ Legislatively-approved building codes and utility efficiency programs are on track to save Texans almost \$5 billion and achieve 7 percent energy savings—see table below.

Cumulative costs and benefits of a subset of energy efficiency measures in Texas, 2013–2030

Energy efficiency (EE) measure	Gross cost (million 2016 US\$)	Net cost (million 2016 US\$)	Avoided electricity sales as a percentage of forecasted retail sales for 2030
Current EE levels for Texas utilities	\$2,430	-\$2,829	3.4%
Building codes	\$11,665	-\$2,117	3.6%
Sum	\$14,095	-\$4,946	7.0%

Cost effective investments in energy efficiency will save \$5 billion for Texans. Source: EPA, Austin Energy, CPS Energy, ACEEE SUPR

In addition, a reduction of up to 10 percent of 2030 energy demand could be achieved with relatively modest changes to the Public Utility Commission of Texas’ (PUCT) requirements for utility energy efficiency programs.²⁶ Currently, there is a cap imposed by the PUCT on how much utilities can spend on energy efficiency initiatives. This hamstrings the utilities by restricting them from pursuing more innovative, transformational efficiency programs.

CITY SPOTLIGHT: GEORGETOWN

Texas city's move to 100% renewables is purely economic

In the spring of 2015 the city of Georgetown announced the decision to be powered by 100 percent renewable energy. The city owns the municipal utility that controls electrical distribution, but does not have any generating capacity. It has arranged to purchase 150 MW of solar power and 144 MW of wind energy to help power the entire city.²⁷

Jim Briggs, the city's General Manager-Utilities, said, "Georgetown Utility Services isn't required to buy solar or other renewables – we did so because it will save on electricity costs and decrease our water usage. It also provides a hedge against future fuel and regulatory risks."²⁸

Georgetown's move to renewables is a purely economic decision. "We didn't do this to save the world – we did this to get a competitive rate and reduce the risk for our consumers," Briggs said.²⁹

Removing this budgetary cap—while maintaining the current stringent standards that require a utility to prove an investment will be cost-effective – will accelerate Texas' efficiency and economy.

Additional strategies can drive energy efficiency to higher levels by 2030. In 2013, Texas legislators passed a program³⁰ allowing Texas businesses the ability to finance—at lower interest rates—building improvements that reduce electric and water consumption. Called Property Assessed Clean Energy (PACE), more than 11 regions have established the program including Brazos, Cameron, El Paso, Hidalgo, Fort Bend, Nueces, Travis, Willacy, Williamson counties and the cities of Dallas and Houston.

Another efficiency opportunity for Texas utilities to deploy is the "right-sizing" of voltage levels through voltage optimization. Studies have shown that customers routinely receive, on average, two to three percent higher voltage than they need from the utility to run their appliances.³¹ If voltage was "right-sized," customers would only get and pay for the energy they need to sufficiently power their appliances and devices, while building a cleaner, more efficient electricity system and saving money.

The rewards of clean energy

The market forces transitioning Texas are increasing the use of energy produced in the state, which will yield significant financial, economic, health, and environmental benefits to the state.

Economic growth and job creation

Clean energy is already bringing economic development to Texas. In 2014, the Texas Workforce Commission reported that there are more than 100,000 Texas jobs related to renewable clean energy and energy efficiency.³² Texas has the unique opportunity to further leverage its plentiful clean energy assets to grow the economy, resulting in savings, investment, and new jobs, while lowering costly pollution.

- **Wind:** Texas' thriving wind industry, which already supports nearly 25,000 jobs, will continue to bring economic benefits as capacity grows. The wind energy industry in Texas has provided nearly \$33 billion in capital investment and is home to at least 38 manufacturing facilities, including tower manufacturers and numerous component suppliers.³³ In addition, wind projects produce lease payments of over \$50 million for landowners and increase the tax base of rural communities.
- **Solar:** As the third-fastest growing solar market in the nation,³⁴ Texas is just beginning to tap into solar's economic potential. Studies have found that solar power creates nearly twice as many jobs as coal and three times as many as natural gas.³⁵ Right now, solar power provides less than 1 percent of Texas' total electricity. Currently, there are nearly

COMPANY SPOTLIGHT: H-E-B

Leading grocery chain invests in cleaner, more reliable power

H-E-B, Central Texas' leading grocery chain, is the largest private owner of solar power systems in the region. With current energy production of an impressive 12.1 million kilowatt-hours a year at 23 locations, H-E-B continues to add solar panels to its stores and distribution centers.³⁶

"Part of H-E-B's responsibility in being a good steward to the community is to improve our use of natural resources which we hope will also lower energy costs," said George Presses, H-E-B vice president of fuel and energy.³⁷

In addition to the commitments to solar, H-E-B will install natural gas backup generators to power 45 stores in the Houston area. Due to the city's proximity to the Gulf Coast, weather-related events that are capable of jeopardizing the power grid are a real threat. For instance, flooding paralyzed Houston last April and cost businesses more than \$1.3 billion in losses.³⁸ The backup generators will allow the stores to provide service to the community during and after weather events that normally cause intermittent power outages.

500 Texas-based solar companies distributed throughout the value chain, employing more than 7,000 people.³⁹ California's solar industry currently employs over 75,000 workers, in comparison. Yet Texas' solar potential far outshines California's—by a margin of four to one.⁴⁰ With ERCOT forecasting that 17 percent of power will come from solar by 2030, significant economic and employment opportunities await.

- **Energy efficiency:** As noted above, Texans will save almost \$5 billion from the modest energy efficiency levels that are expected to be achieved by 2030. A recent report from the U.S. Department of Energy shows nearly 150,000 Texans work in energy efficiency-related jobs.⁴¹ Texas businesses would benefit from a commitment to reaching the full potential of efficiency in Texas.

Demand for low-price natural gas has enabled Texas to increase its exports to other states—which grew more than four times from 2009 to 2015.⁴² And, consistently low natural gas prices are increasing its use in the electricity sector not only in Texas, but across the country. Since 2009, natural gas use in Texas' power sector has increased by 19 percent.⁴³ Moreover, the Center for Strategic and International Studies issued a report in 2014 concluding that, as states across the U.S. shifted their power generation from coal to natural gas, Texas and two neighboring states' net natural gas revenues would increase almost \$20 billion annually.⁴⁴ In addition, Texas electric utilities can avoid spending \$2 billion to import coal from other states by shifting to homegrown natural gas and renewables.

Given that Texas has the most potential of any state for natural gas, wind, solar, and efficiency, policymakers should increase Texas' leadership role and work to attract clean energy jobs.

Reduce harmful pollution

Coal-fired power plants are the primary source of air pollution in the state, emitting massive quantities of carbon dioxides, sulfur dioxides, nitrogen oxides, and particulates.

In 2015, coal plants supplied 28 percent of the electricity used in Texas, but accounted for more than 50 percent of the state's carbon pollutants, as well as sulfur dioxides.⁴⁵ Natural gas power plants provided substantially more of the state's 2015 electricity than coal—approximately 50 percent—but emitted the same amount of carbon pollution and only limited levels of sulfur dioxide.⁴⁶ Nuclear, wind, and solar power accounted for 21 percent of Texas' power, but emitted virtually no air pollution. Energy efficiency, by its nature, does not produce emissions.

By 2030, under a business-as-usual scenario, ERCOT projects a significant decline of coal power (from 28 percent in 2015 to 16 percent in 2030), which will reduce the disproportionately

COMPANY SPOTLIGHT: TOYOTA

HQ to be 100 percent powered by Texas renewables

Toyota's new North American headquarters—2.1 million square-foot set to open in May 2017 in Plano, Texas—will use 100 percent renewable energy.⁴⁷

The campus will include a 7.75 MW solar array that will provide a quarter of the building's power needs, and Toyota will receive full retail credit for their excess solar generation. The remaining electricity will come from offsite solar and wind.

"The Plano solar system will not only reduce our environmental footprint and educate team members about renewable energy, it moves us closer to Toyota's 2050 global environmental challenge to eliminate carbon emissions in all operations," said Kevin Butt, Regional Director, North American Environmental Division of Toyota Motor North America.⁴⁸



large impact coal generation has on the power sector's emissions. This transition will make it possible for Texas to more readily meet existing and future environmental standards, like the Regional Haze Program, the Cross State Air Pollution Rule, the Clean Power Plan and various ozone standards.

Billions in healthcare savings

Less coal-fired power, which is primarily fueled by imported coal, means healthier Texans. For example, particulates, which are emitted from these facilities in large quantities, cause premature mortality.⁴⁹ Other pollutants, including sulfur dioxide and nitrogen oxides, are the forerunners of soot and smog and can cause heart and lung disease, as well as contribute to asthma attacks.

It is estimated that 2,300 lives could be saved along with \$20 billion in associated costs, plus 790 hospitalizations and 140 heart attacks could be avoided by lowering coal power plant emissions by approximately 30 percent.⁵⁰ Texas will likely go beyond the estimates above, reaping even greater health rewards, when taking into account ERCOT's projections for coal in 2030, combined with the energy efficiency Texas is on track to achieve.

Huge water savings

Coal is a highly water-intensive power source, requiring 580 gallons per MWh of water to create electricity.⁵¹ Natural gas uses 310 gallons per MWh of water. Wind and solar panels, on the other hand, require no water to generate power.⁵² Energy efficiency also uses no water. Consequently, the declining use of coal means large water savings now and even more in the future.

The Texas Water Development Board (TWDB), the state's water planning agency, determines how much water the power sector needs and allocates resources accordingly. The TWDB releases a new State Water Plan (SWP) every five years, the most recent being the 2017 plan. In the five years since the last SWP, Texas has gone from one extreme to the other in terms of water: from a severe, multi-year drought to fatal flooding in parts of the state.

In the 2017 SWP, the TWDB forecasts annual steam-electric water demand, or water needed for fossil fuel-fired power generation, will increase from 733,179 acre-feet in 2010 to 953,000 acre-feet in 2020 and 1,108,000 acre-feet in 2030.⁵³ These numbers are based on Texas' forecasted economic and population growth and the associated increase in electricity and water demand.

Yet, the Brattle Group concluded that market forces will reduce coal's share of Texas' electricity market to 6 percent in 2035.⁵⁴ Under this scenario, the power sector would require just 40.4 percent of the water designated for this purpose in the 2017 state plan.

If Texas were operating with the same energy resources it deployed in 2010, the TWDB's estimates would be accurate. However, the estimates do not include the state's evolving energy reality outlined in this report. Understanding this, the TWDB has an effort underway to improve those estimates for the 2022 SWP. However, for current planning purposes, using their estimates, it is worth noting that if all coal-fired electric generation facilities were replaced with natural gas and renewables over the next 20 years, Texas water planners could completely eliminate the need for those additional water supplies, which the TWDB estimated would have a 2012 price of \$2.3 billion.⁵⁵

By transitioning to a low-water clean energy economy, Texans could save billions on power-related water costs, and vast amounts of water could be allocated to Texas homes, businesses, industry, and agriculture, rather than to coal-powered plants.

Lower wholesale power costs

The lower price of natural gas, coupled with the impact of additional renewable energy on ERCOT's grid, are reducing the wholesale cost of power in Texas. Figure 4 shows the significant reduction in wholesale power costs over the past decade – today's prices are less than a third of 2008's peak prices, and are even lower than when retail electric competition began in 2002, even without accounting for the impact of inflation.⁵⁶ Today and for the foreseeable future, Texas produced natural gas, wind, and increasingly solar will keep energy costs low for Texans.

FIGURE 4
Load-weighted average energy prices in ERCOT



2016 prices are less than a third of 2008 prices.
Source: ERCOT

Recommendations

Market forces are leading Texas to a clean energy economy powered by Texas-produced natural gas, wind and solar. State leaders should take advantage of this momentum and create a Texas energy plan to capitalize on the economic, health, and water benefits of a cleaner electricity system.

Texas policymakers can begin developing the clean energy economy by taking the following steps:

State leaders should create a Texas energy plan to capitalize on the economic, health, and water benefits of a cleaner electricity system.

1. Direct the Public Utility Commission of Texas (PUCT) to engage economic experts, ideally from Texas' major universities, to complete an economic study determining the additional jobs and income resulting from ERCOT's projected 2030 generation mix, as well as from more ambitious clean energy deployment.
2. Direct the PUCT to follow the example established by the 2008 Itron study and provide an updated analysis of Texas' energy efficiency and demand response potential, including water impacts.
3. Direct the PUCT to increase or remove the current financial cap for energy efficiency expenditures, so distribution utilities can increase their investment in these money-saving programs. Additionally, direct the PUCT to increase the minimum energy efficiency goals to be achieved by Texas utilities, a commonsense measure that has recently been implemented in several other states.
4. Ensure the PUCT has sufficient authority to consider new approaches to electric utility ratemaking that minimize the reduced earnings utilities may experience due to the expansion of energy efficiency programs and the resulting reduced consumption of electricity. Additionally, ensure the PUCT has sufficient authority to consider new approaches to electric utility ratemaking to encourage a regulated utility to contract with third parties for services to improve grid reliability, rather than constructing higher-cost capital infrastructure.
5. Ensure ERCOT is planning for operational modifications necessary to integrate the new energy resources, including more renewable energy, that are displacing old coal-fired and other uneconomic generation.
6. Ensure Texas A&M University's Energy System Laboratory has the authority and funding to expand its existing work, which measures the priority pollutant reductions resulting from the increased use of clean energy, to include carbon.
7. Continue to support the Texas competitive market and reject proposals to bail out uneconomic generation facilities.
8. Direct the Texas Railroad Commission, in collaboration with the Texas Commission on Environmental Quality, to develop a set of comprehensive, statewide rules or programs with the goal of reducing methane emissions from the oil and gas sector in Texas by 45 percent by 2025.



Texas has a global competitive advantage because of its wind, solar, and natural gas resources and potential, as well as the opportunity to save money through energy efficiency. Moreover, wind and solar power generation now employs more than four times as many Texans than fossil-fuel electricity,⁵⁷ and 85 percent of Texas voters support increasing clean power.⁵⁸ State leaders need to leverage this advantage to provide Texans a cleaner and healthier, as well as less water-intensive and wasteful, electricity system. They can do so by developing and implementing a bold, comprehensive Texas energy plan to grow the state's economy, create jobs, attract investment, and save billions of dollars.

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