

Coal and Nuclear Energy

❖ Can Texas create the next generation of workers for the new coal and nuclear energy industries?

Introduction

Coal is the most widely used source of electric energy, with growing consumption. Plentiful in the United States and Texas, coal is relatively cheap. Industry analysts forecast that liquefaction and gasification technology will produce enough cleaner burning coal in 2010 (at the equivalent of \$40 per barrel) to replace the 360,000 barrels of petroleum used to generate electricity daily. Combined, coal and nuclear energy contribute 50% of the power that generates Texas electricity.

Soon Texas will be home to America's newest coal-fueled electricity plant. In 2011, Omaha-based Tenaska Inc. is set to begin construction of its \$3 billion Trailblazer plant in the small West Texas city of Sweetwater. Approximately 1,500 construction workers will work about

three years to build the Trailblazer plant. Once completed, the plant will employ 100 workers. It also will boast lower emissions than standard coal plants, capture carbon dioxide (CO₂) gases and pump those gases into previously tapped oil fields in an effort to push out additional petroleum.

"This is huge for Texas," said Greg Wortham, mayor of Sweetwater. "This is a modern plant that can really impact the energy industry."

The Trailblazer plant is a major victory for the coal industry. Coal-fired electricity plants in the Lone Star State use the especially "dirty" lignite coal that comes from Texas surface mines. Just securing state and federal approval of a coal-fired plant is problematic in this era of public concern about breathable air and acid rain. Public outcry about air pollution blocked proposed coal-fired electricity plants in Dallas, Waco and Houston in the 2000s.

Still, the public and its elected leaders recognize that a growing population needs more energy. With U.S. coal reserves expected to last more than 50 years, once unpopular energy sources, such as coal and nuclear, are getting another look thanks to new technology that helps the once-scorned energy forms run cleaner.

"Wind and solar make sense in Texas, but we aren't going to rely on wind and solar for all of our power capacity," said Daniel Cohan, professor of environmental engineering at Rice University in Houston, who studies the energy industry. "We are starting to get our energy from a variety of sources — including established sources like coal and nuclear — and that trend of a portfolio of energy should continue."





Photo courtesy of South Texas Project Nuclear Plant near Bay City

What's Happening

Coal and nuclear power generation are not without detractors. Despite its enormous potential and generation of more than 50% of U.S. electricity, coal has a serious drawback: it is the leading source of carbon dioxide emissions, at 2.5 billion tons annually. Texas coal, in particular, has a relatively high sulfur content. Coal-burning power plants need smokestack scrubbers, carbon dioxide sequestration, coal liquefaction and gasification techniques to meet the higher quality air standards likely to be enforced in the near future. The more rigorous emission-control requirements raise the cost of building coal-fired plants, thus offsetting coal's lower cost.

Aspects of nuclear power also raise public concern. Interest in nuclear energy has been inching up, despite the negative images related to the Chernobyl disaster in Russia in 1986 and the radiation leaks at the Three Mile Island facility in Pennsylvania in 1979. Today, more than 100 nuclear power plants generate 20% of electricity in the United States.

However, a 2005 survey by the Nuclear Energy Institute found that two thirds of respondents do not want to live within 10 miles of a nuclear reactor, even though 70% favor nuclear energy. Most people surveyed favor adding new nuclear reactors to existing nuclear plant sites, instead of building new reactors.

Repeated in 2009, the survey still found 70% of the Americans questioned supported nuclear energy, especially job creation and the U.S. energy independence that nuclear energy could help create. And 90% of respondents think nuclear energy should be included with new, renewable energy sources for helping to curb greenhouse emissions.

These surveys encourage nuclear industry leaders in the United States.

Texas has two nuclear power facilities, Comanche Peak in Glen Rose and the South Texas Project near Bay City. These nuclear facilities, which each have two reactors, generate about 13% of the electricity consumed in Texas and employ about 2,400 workers. And each facility recently reapplied to the federal Nuclear Regulatory Commission to double their operations.

A new nuclear reactor in Texas would have a big impact. The United States hasn't authorized construction of a new nuclear plant since 1979. That year, 65 universities offered nuclear engineering degrees. Now only 29 universities have a nuclear engineering program due to lack of demand for new workers. The dearth of qualified American workers for the nuclear industry — if that industry were to grow again — is a critical issue. Also, most of the nuclear plants in the United States are on the East Coast, contributing to the lack of nuclear worker talent west of the Mississippi River.

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Sources of Electricity Generation in Texas

Power Source	ERCOT Electric Grid Sources	El Paso Electricity Sources
Natural gas	43%	28%
Coal	37%	7%
Nuclear	13%	43%
Wind	5%	< 1%
Other energy sources	2%	< 1%
Purchased power	-	22%

Table 18.1

The Data

In 2003, worldwide coal consumption was 24% of the world's energy production. By 2010, coal accounted for 27% of the world's energy production, and more global growth is expected. As a nation, the United States has significant coal reserves and does not need to import coal. Texas is the nation's fifth largest producer of coal, with ample reserves of "near surface" lignite. Thus, Texas has sufficient coal reserves to meet expected statewide demands of industrial users and electric power-generating plants (see **Table 18.1**).

For every 418 pounds of coal used to generate electricity, Texas utilities can displace one barrel of imported foreign crude oil in the Lone Star State's mix of energy feeder stocks.

Texas employment in the surface coal mine industry rose almost 20% from the first quarter of 2004 to the first quarter 2009, reaching 2,707 workers, and the average salary exceeded \$87,300 a year. At Texas nuclear reactors, employment has held steady for years at about 2,400 mining workers.

So What?

Regions with growing populations need more electricity-generating capacity. In addition, they need to keep energy input

costs low, so other sectors of their regional economies can be price-competitive in the global marketplace. Coal prices nearly tripled in 2008 from the previous year. That price spike encouraged utility companies to look to cheap natural gas as an energy source to fire electricity plants, but the spike didn't help the image of coal in the eyes of the American public, which was already dealing with price hikes for oil and gasoline.

The economic cost of a cleaner environment rose in late 2009, when a panel of federal appeals court judges ruled that states and communities can sue utility companies in other states for emitting carbon dioxide that drifts over state borders and pollutes air and water. This legal wrinkle comes after the U.S. Supreme Court ruled in 2007 that the Environmental Protection Agency (EPA) has the authority and power to regulate pollutants under the Clean Air Act.

Those court actions are only part of the changing regulatory environment. The U.S. House of Representatives passed legislation in 2009 to cap greenhouse gas emissions and create a financial market for trading pollution credits — so-called cap and trade legislation. The cap and trade bills essentially provide energy and industrial companies with a limited number of pollution credits. These credits, which are designed to encourage energy and manufacturing companies to shift to lower-polluting forms of production, can be traded or sold to companies that cannot yet afford to lower their polluting

emissions. These carbon pollution limits laws are disconcerting for the traditional energy companies in the oil, natural gas and nuclear sectors, but especially for coal.

Coal emissions contribute approximately two thirds of the air pollution in Texas, which has the EPA ordering coal-fired plants to install scrubbers and other expensive emissions-control equipment.


“About 55% of our energy comes from coal. You can’t just turn that off,” Dennis Welch, executive vice president of environment, safety and facilities for utility company American Electric Power, told the Public Utilities Commission of Texas. Welch hopes that federal emissions regulations allow time for the development of more low-emission, new energy sources, such as wind and solar, to develop and eventually complement the traditional energy sources of coal, natural gas and nuclear energy. “The future needs to be a fuller portfolio of energy generation.”

“There is a slow shift going on,” said Cohan, engineering professor at Rice. He points out that, for more than a decade, the energy industry has been expecting to shift from fossil fuels to more renewable energy

due to shrinking fossil fuel reserves and public pressure against pollution.

Cohan points out that Texas energy producers have already started making adjustments to prepare for two federal regulations that affect them the most. The first is the renewed federal mandates for automakers to improve the average fuel efficiency of their fleets from 25 miles per gallon to 35.5 miles per gallon by 2016, which could reduce U.S. gasoline consumption by about 20%. Energy producers also may need to prepare for the proposed cap and trade limits on emissions, which may be phased in over 40 years.

Cohan also points out that, due to public outcry, state and federal regulators for years have blocked construction of coal-burning electric plants, while allowing the more polluting, older, coal-fired plants to continue running. He said the development of new carbon-capture, coal-fired plants in Texas and Illinois should help expand the coal industry and help the oil drilling industry use the carbon gases to push out hard-to-reach oil from underground, all while remaining palatable to environmentally minded consumers.



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Chapter 18 | Suggested Strategies



Think Globally, Plan Regionally

Between 2005 and 2007, Texas sought to capture a huge federal grant (FutureGEN) to build a pilot clean-coal facility but lost out to Illinois in that bid. However, the U.S. Department of Energy pulled the FutureGEN project when data projections raised serious doubts about the emission reduction capabilities of state-of-the-art coal technologies. The federal FutureGEN project has begun accepting bids once again to provide initiative for states to conduct additional research and development before proceeding with a large-scale demonstration project. Federal funds will be available to explore both precombustion (e.g., liquefaction and gasification) and postcombustion technologies (e.g., carbon capture at the “smokestack”).

Texas may have lost the FutureGEN coal plant project to Illinois, but the state received the next best thing: the Tenaska Trailblazer Energy Center in Sweetwater.

Even with proposed federal carbon emissions regulations, the existing oil, natural gas and coal industries will have decades to develop the lower emissions processes. And as the United States tries to lower its dependence on foreign energy sources for political and security reasons, the existing traditional energy sources in America are not going away.

Texas is, once again, in a good position to partner with coal companies to pursue clean coal options. Texas’s coal supply is abundant but is of a quality that will require clean technology to meet stiffer emissions standards likely to be imposed in the near future. Prominent Texas researchers have the engineering expertise to tackle the problem. And, more important, coal companies in Texas have partnered with oil and gas exploration companies to determine what to

do with the carbon once they’ve captured it. Namely, they are successfully demonstrating that they can capture carbon, inject it into existing below-peak oil wells to increase subsurface pressure and subsequently move oil reserves to the wellhead.

“The energy business is an old business. It moves slowly. Change takes many years or decades,” said John Sibley Butler, director of the technology commercialization organization IC² Institute in Austin.

Still, energy regulation and consumer energy demands are moving forward. Texas has the fastest growing population in the country, adding to what is already the state with the biggest energy demands. Texas energy providers and energy policymakers need to move faster to create more low-polluting energy in the Lone Star State, even within the established, “old” energy sectors, such as coal and nuclear.

Building new power plants and oil refineries is expensive — price tags start at \$3 billion — and take 2 to 10 years to construct. Alternative energy forms, such as wind and solar, can scale up faster and cheaper — but only if Texas continues its investments in transmission lines, which will modernize and link the electric grids statewide. And Texas needs more innovation research to produce more energy — and less pollution — from the existing resources of oil, natural gas, coal and nuclear energy.

It remains to be seen if the coal or nuclear industry can grow in the United States. Still, if Texas universities can revitalize their engineering programs in those fields, they could supply workers who will likely be stepping into a growth field. If not in the United States, those trained Texas workers can likely find opportunities outside the nation, in Europe and Asia.