

We Can Meet Growing Demand for Power in Texas with Renewable Energy

Texas has more renewable energy potential than any other state in the country. Our state can produce 21 times its annual fossil fuel consumption with clean green power. As Texas oil production declines, renewable energy can replace fossil fuels as a source of income and employment.



Texas is known as the King of the oil industry in the United States. But it is the King of an ever-shrinking hill, as state oil production has fallen 73% since its peak in 1972. Between 1955 and 2005, Texas produced 42 billion barrels of oil. *But all this oil does not amount to the renewable energy that Texas can capture in a single year.* Texas has 21 times the annual renewable energy potential of its current conventional energy use.

Some of this potential, such as wind power and biomass electric generation, is already competitive with conventional energy prices. Other technologies will be competitive if the pace of their development is assisted by Texas state policy. Some of this renewable energy might be exported to other areas of the country the way oil is now, either directly via power lines, or indirectly through clean energy equipment that is manufactured here.

The fifteen new coal plants proposed for Texas will cost \$16 billion plus interest! Operating them over their 30-year life will cost at least an additional \$40 billion—almost \$7,000 for every household in Texas. This locks up investment capital that Texas needs to create in-state jobs with clean energy technologies.

It is time to begin planning the sequel to the Texas oil industry, and start the transition to a sustainable economy. This fact sheet will discuss promising renewable energy technologies that can displace proposed coal plants in Texas while building a foundation for a new source of employment and wealth.

Wind Power



Courtesy: Cielo Wind Power

In general, wind power is currently seen as the most cost-effective form of renewable energy. In windy areas, it can deliver power at a price competitive with new natural gas power plants and coal plants. Thanks to required purchases of renewable energy set forth by the state legislature, Texas now surpasses all other states in the U.S. in wind energy production. But this is a tiny sliver of its potential.

The state of Texas has enough potential wind power to supply four times its current needs for electricity. The state has enough potential wind power to supplant Saudi Arabia's

current oil imports to the United States. Put another way, there is at least twice as much potential annual wind energy in Texas as its current oil production.

A recent economic evaluation by the Perryman Group in Waco, Texas, found that 10,000 Megawatts of wind power would create: \$7.4 billion in increased Gross State Product; almost 100,000 job years of employment from manufacturing, installation, and operation; and approximately \$1.4 billion in additional state and local tax revenue.

Texas manufacturing employment from wind power is on the increase.

- Molded Fiber Glass in Gainesville employs 200 people making blades and other fiberglass components.
- Trinity Structural Towers in the Dallas metroplex has created 310 jobs; it is the leading U.S. manufacturer of wind towers.
- TECO-Westinghouse in Round Rock, north of Austin, recently created 150 jobs when it was selected to manufacture wind turbine components for a national company.
- Farmers and ranchers owning land where wind turbines are sited are now receiving \$4,000 in royalties per year for every Megawatt produced. There is little to no resulting loss of the use of agricultural land.

Wind Power Storage

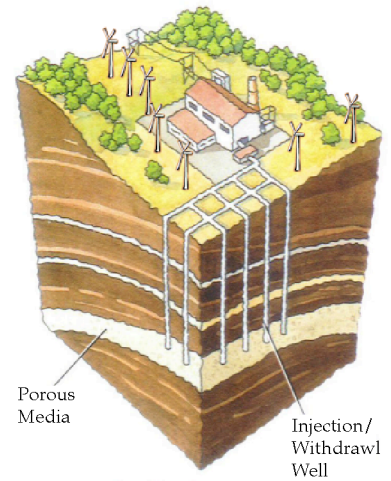
Wind power is currently economical in Texas primarily as a fuel saver. Its intermittent nature does not allow it to displace electric generation plants because wind energy cannot be “dispatched” when needed.

It seems paradoxical to “capture” the wind, but it is technically and economically feasible. Compressed Air Energy Storage (CAES) uses an air compressor located next to a geologic formation such as a salt dome, aquifer, or abandoned mine or oil well. (Storing gas is quite common in the natural gas industry.) Electricity from wind power, cheap night-time generation, or another source drives compressed air into the geological formation at 100 times atmospheric pressure.

When this power is needed later, the compressed air is heated (the typical fuel being natural gas) and run through a turbine to create electricity. Since the CAES unit is only used to level power output when the wind is not blowing, a Wind/CAES plant would only use about 7% fossil fuel in its overall operation. It is feasible to make the plant totally renewable by using *renewable biofuels* to run the turbines.

CAES equipment is most commonly used in oil drilling. There is currently a CAES plant in McIntosh, AL, storing off-peak power for on-peak use. Another is planned in Iowa that will use off-peak wind power to store compressed air in an aquifer 2,900 feet below ground. It is expected to be on line by 2011. The Iowa project may use biodiesel to make its Wind/CAES plant more sustainable.

Conceptual view of Compressed Air Energy Storage plant, which stores energy in the form of air in geologic formations such as salt domes, old oil wells and mine caverns, and aquifers. Combustion turbines using compressed air operate much more efficiently than when using air at atmospheric pressure.



Aerial view of Compressed Air Energy Storage plant in McIntosh, Alabama. It banks cheap night-time, off-peak energy and sells it during daytime hours.

Biomass as a Resource

Up until the mid-19th Century, the U.S. received the majority of its power from wood. While wood, crop waste, and other biomass resources could not alone support America's economy today, unused biomass resources can serve as a reliable supplement to defer construction of new power plants. These resources can provide about 24% of Texas' current total energy use through a variety of large and small systems.

Forest and crop waste can be used in power plant applications. Timber mills in East Texas already use this to provide electricity and process heat. But there is enough waste wood in Texas to provide another 600 Megawatts (enough for 300,000 homes). This fuel can also be co-fired in existing coal plants to replace some percentage of its fuel.

A 100-Megawatt wood-burning power plant is planned near Nacogdoches in East Texas. It will provide 200 construction jobs as well as 35 permanent jobs operating the plant.

Landfill gas from decaying organic matter in refuse can also be used to generate small amounts of power. To date, these small generators yield a cumulative total of 40 Megawatts statewide. Untapped resources can add another 200 MW. One of the most interesting examples of this is the Biodiesel Industries manufacturing plant in Denton, TX. It is powered by landfill gas coming from the City of Denton, which in return receives low-cost biodiesel fuel for its City vehicles.



The City of Denton provides methane gathered from its landfill (above) to power a nearby biodiesel manufacturing plant (top right). In return, the City gets low-cost biodiesel to run its solid waste trucks



Manure waste from dairy farms and animal feed lots can also reclaim usable energy. The Huckabay Ridge dairy farm near Stephenville, TX, recently contracted with a company making equipment to derive methane, which will be sold to gas-fueled power plants. Construction and operation of this facility created 10 jobs. The plant also creates saleable fertilizer out of a waste product.

Pyrolysis, gasifying wood or crop waste and using the gas for heat or electric generation, is also feasible. The Vermont company Chiptec has onsite gasifiers that provide heating to at least 13 schools in the state, and also provided equipment to a hospital that creates both electricity and heat with the energy.

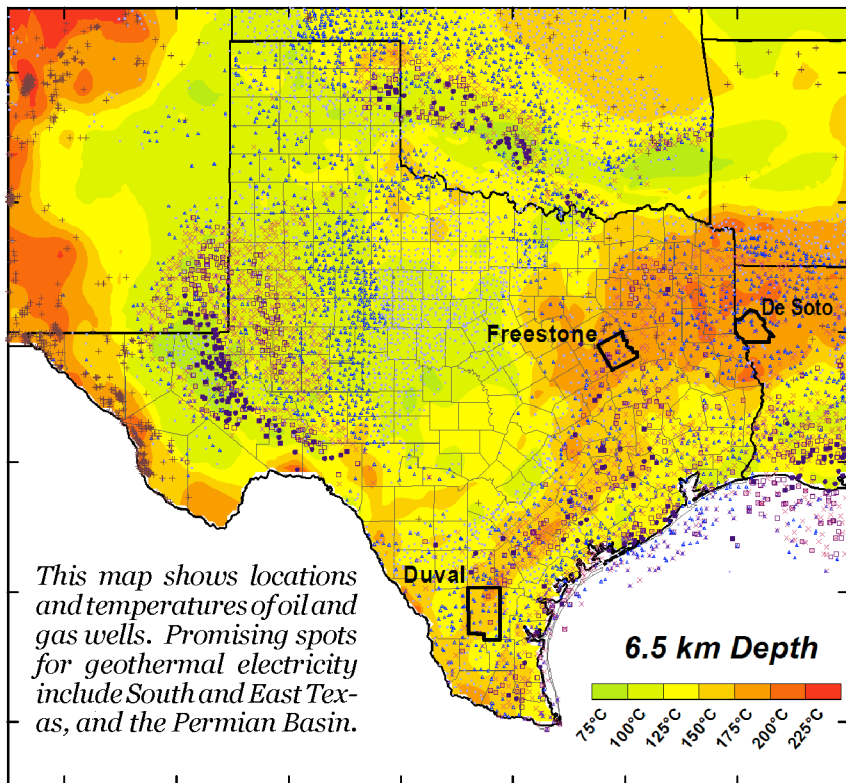
Geothermal Energy From Oil Wells

There are about 600,000 active and abandoned oil and gas wells in Texas. Many of them are deep enough that their temperatures are 100° C or hotter.

This low heat can be extracted with Organic Rankine Cycle (ORC) turbines. These are similar in concept to steam turbines, except that they use pressurized hydrocarbons instead of steam to turn the turbine. They then recycle these hydrocarbons in a closed loop system, the same way an air conditioner reuses refrigerant. Until recently, ORCs have required large volumes of heat to be cost effective. But new equipment is now available to economically extract heat in smaller volumes.

This, combined with the rising cost of energy, has created interest in extracting heat from hot brine water co-produced with oil (commonly called “produced water”) to create electricity. Since the largest cost, well drilling, is already accomplished, the major costs will be the generation equipment, minor maintenance, and the transmission lines. In abandoned wells, there will be costs associated with pumping hot water to the surface. But in existing wells, this is already part of the oil extraction process.

While this geothermal harvesting technique is not feasible everywhere, it can be used throughout much of the Gulf Coast and West Texas. One conservative estimate states



that about 2,200 Megawatts of potential power (enough for 1.1 million homes) can be produced from existing oil wells in the next 10 years.

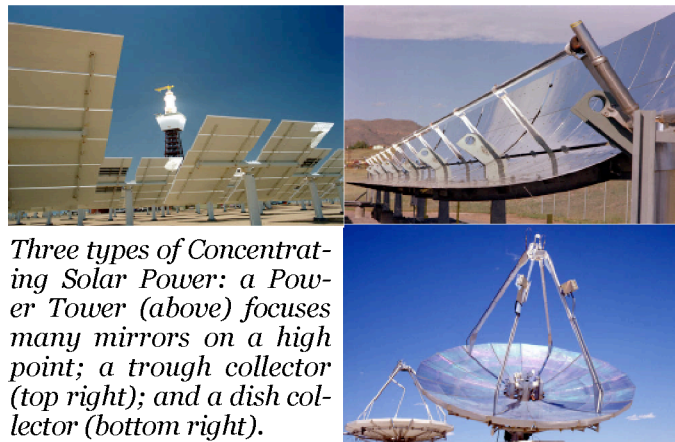
Concentrating Solar Power

Relatively few people realize just how advanced the technology for direct electrical generation from solar heat has become. Concentrating Solar Power (CSP) employs sophisticated mirrors to focus direct sunlight, creating heat to boil a working fluid for turbine-power generation. Some configurations have separate mirrors focusing sunlight on a single point, while others use parabolic troughs to focus sunlight on a heat pipe running a few feet above them at the focal point. Still others employ individual dishes (similar to satellite television receivers) to focus light and heat.

Nine CSP plants totaling 354 Megawatts have been operating in the California Mojave Desert for about two decades. Built between 1985 and 1989, they have an impressive record: maintenance costs have decreased while generation output has increased. The plants generate 90% of their power from solar energy while employing natural gas as backup. CSP does not *require* conventional backup, however, as it is possible to generate well into the night with onsite heat storage.

To operate economically, CSP needs large amounts of direct sunlight typical of the climate in the Western desert areas of the U.S. This includes West Texas, where there are 1,200 square miles of preferred potential site area, enough to provide about 70% of the state’s current electric use.

Currently, the generating cost in increments of 200 Megawatts or more is about 10-13¢/kwh, which is not a bad price for peak summer power. To reach economies of scale to



Three types of Concentrating Solar Power: a Power Tower (above) focuses many mirrors on a high point; a trough collector (top right); and a dish collector (bottom right).

lower the cost to that of a conventional gas or coal power plant, a development program should be created that can guarantee economies of scale. The level of commitment has been predicted to be a cumulative total of 2-4,000 Megawatts. This is an insubstantial figure spread over six states in the Western U.S. over a ten-year period.

A 64-Megawatt plant went online in Nevada in 2007, and a 280-Megawatt facility is now proposed for Arizona. There were 5,500 Megawatts of CSP proposed worldwide by 2007.

As with other forms of renewable energy, economic development opportunities are great. The University of New Mexico studied the impact to the state of building a single 50-Megawatt CSP plant. The study found the state’s economy would gain almost half a billion dollars, 1,000 temporary construction jobs, and 74 permanent jobs.

Decentralized Solar Energy in Texas

Renewable energy can also be generated onsite in buildings where we live and work. By 2025, there will be an estimated 254 square miles of roofs on residential and commercial buildings in Texas appropriate for solar hot water heating and electric production.

Solar hot water heating commonly uses a dark metal plate framed in glass to trap heat. Pipes with flowing water run near the plate to conduct and convey the heat to a storage tank to heat water for domestic use. It is cost-effective now when deferring electric water heating, and can provide 70-80% of annual water heating energy in a Texas climate.

Photovoltaics (PVs), or solar cells, are semiconductors that produce electricity when exposed to light. They were first invented in 1883 and were used on space satellites in the 1950s. Since then, they have fallen to about 1/1000th of their original cost. While onsite PV power is still about four times the cost of retail power in Texas, the cost is expected to come down substantially with mass production.

Employment from PV installation is pronounced. When the City of Austin's municipal utility created a rebate program to promote the technology, nine local companies were either created or expanded. At least one of these is going national.

If all suitable roofs in Texas were covered with PVs by 2025, the electricity generated would amount to 40% of the state's current consumption.



Grid-connected photovoltaic array



Domestic solar hot water heater

What Can You Do to Support Renewable Energy?

If You Are an Individual

1. Buy Green Power – Some Texas deregulated Retail Electric Providers sell electricity partially or totally generated by renewable energy. Several Texas municipal utilities also sell green power. Find more information at www.powertochoose.com.

2. Buy Your Own Renewable Energy System – If you own a home or business and can afford to do so, purchase a solar water heater or photovoltaic system. These can be a great demonstration project for your neighbors.

3. Invest in Green Power – More than 50% of Americans have invested in the stock market. *Why not invest in companies that manufacture or research clean energy?*

If You Are a Public Official

1. Buy Green Power – Cities and government agencies can buy green power for their buildings and operations. Dallas, Houston, and Austin all buy some amount of green power. Austin's City Hall has solar cells near the building entrance.

2. Support Renewable Energy Companies with Employee Pension Funds – Some of these companies can be found at www.defgllc.com.

3. Start a Local Renewable Energy Program – City and regional governments can develop their own alternative energy policy and programs by mandating funding through utility franchises and rate cases.



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