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Title: **Renewable Energy in Texas**

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Abstract:

Examination of the production potential and demand in Texas for renewable energy from three sources: solar photovoltaic cells, wind and bioenergy.

# Renewable Energy in Texas

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Imagine that it is the year 2097. People drive hydrogen-powered cars and live in homes powered by solar electric panels. Texas remains an energy "giant," but its resources are all renewable: solar, wind, and bioenergy. Not long ago, oil was king and much of the state's electricity was generated by power plants burning coal from Wyoming. The oil industry has been replaced by providers that supply their customers with electricity generated by solar photovoltaic cells and large wind plants located in West Texas or by bioenergy plants located in the eastern part of the state.

The above scenario, though imaginary, will become a reality if Texans and their leaders invest in solar, wind, and bioenergy resources. These "renewables" are the state's greatest energy resources and its best hope to maintain its position as an energy "giant" through the next century.

## Renewable Energy In Texas Today

According to recent data presented by the Sustainable Energy Development Council (SEDC), the amount of energy produced with renewable energy resources is less than 1 percent of the primary energy mix in Texas. Although small, this percentage is significant when compared to the actual wind and solar energy production in other states. An updated version of a survey of states by the National Renewable Energy Laboratory (NREL) ranks Texas second to California in the use of solar photovoltaic modules with 900 kilowatts of capacity and third in its wind power with about 44,000 kilowatts (the update includes 42 megawatts [MW] of wind generation capacity installed in 1995). However, in its use of bioenergy, Texas lists low (#33) among the states.

Research by Virtus Energy Research Associates (VERA) indicates that Texas ranks first among the states in its potential to produce energy with renewable resources. The study shows that the wind energy potential alone in Texas is 524,800 MW of capacity. This translates to a \$100 to \$200 billion industry.

## Solar Photovoltaic Cells

Solar photovoltaic (PV) cells and modules use semiconductor materials to convert sunlight directly into electricity. Commercially available photovoltaic modules convert at an efficiency of about 15 percent. When the first solar cells were produced in the 1950s, they were capable of 2 to 4 percent efficiencies, and a one-watt cell cost as much as \$1,000. Today modules of solar cells have cost less than \$6 per one-watt cell. Manufacturing and technology improvements and mass production will bring prices even lower, making it more cost-effective to install rooftop systems and build large-scale utility plants.

Many consumers and electric utilities already use PV modules in highly cost-effective applications. Planergy, Inc. and several rural and municipal utilities are implementing a program to use PV systems in lieu of extending expensive utility distribution lines. Typically, a distribution line of two miles to serve a residential cabin or to power a ranch watering pump or a security light could cost as much as \$50,000. In contrast, a stand-alone PV generator system costs from \$3,000 to \$20,000, resulting in immediate savings.

Other large PV manufacturers, utilities, and system designers in Texas are installing larger-scale PV systems for environmentally-conscious customers who prefer clean energy from resources such as the sun. PV systems can be designed to meet various load sizes, ranging from small residential scale 2- to 4-kilowatt systems to multimegawatt plants requiring several acres of solar panels.

## **Wind Energy**

Modern wind turbines use highly developed blades and power electronic devices to produce electricity compatible with the utility transmission and distribution network in Texas. Similar to photovoltaic systems, wind systems can be used for a wide variety of electric loads. They can be cost effective for both individual customers in remote locations and wind farms covering large areas of land. Resource assessments by SEDC indicate that West Texas possesses some of the best wind resources in the country. A resource map shows parts this area with class 5 and class 6 wind resources (6 is the highest), suggesting that a significant portion of the state's electricity could be generated at these sites.

Wind farms today can produce electricity at competitive costs, according to the American Wind Energy Association. California's Sacramento Municipal Utility District is currently building a 50-MW wind farm to deliver power for a forecasted 4.3 cents per kilowatt hour (kWh), and in Minnesota, Northern States Power estimates a cost of 4.7 cents/kWh for electricity from a recently installed 25-MW wind farm. In 1995 the Lower Colorado River Authority (LCRA) installed a 35-MW wind farm in the West Texas mountains of Culberson County and now sells electricity to the City of Austin for 4.99 cents/kWh with an additional 1 cent/kWh delivery charge. The wind farm produces enough electrical energy for about 12,000 homes in Central Texas.

## **Bioenergy**

Bioenergy systems use plant or animal matter (biomass) as fuel for heat or for engine generators producing electricity. As one of the nation's leading agricultural states and with a large forest industry, Texas is a major biomass producer. In addition, urban sources of biomass in landfill sites may represent some of the best opportunities for power generation.

Strong markets for bioenergy are being created in Texas. The Renewable Aviation Fuels Development Center at Baylor University has developed and received certification for a plane engine that runs on ethanol (alcohol derived from biomass) or a mixture of ethanol and an oil derivative. Other manufacturers are developing efficient means for burning biomass fuels cleanly for heat and electric generation. In December 1996, the City of Austin Electric Utility began purchasing electricity from a nominal 3-MW power plant using landfill gas as the fuel source. The plant uses perforated pipes to capture methane gas generated below ground at the site. The city will purchase the power for an average of less than 5 cents/kWh over a 25-year period and could save its customers a total \$800,000 over its lifetime.

## **Texas Consumers Speak Up**

Recent surveys indicate that consumers desire electricity generated from clean renewable resources. According to Central and South West Services, Inc., surveys conducted in Abilene, Shreveport, and Corpus Christi, customers would prefer that utilities invest in energy conservation and renewable energy options to meet future power needs. On average, customers also expressed a willingness to pay an extra \$4 to \$5 per month on their electric bills to receive electricity generated from renewables.

The survey results indicate a market for renewables and suggest that customers would support a major statewide effort toward renewable resources. If the statewide campaign succeeds and investments are made now, Texas could become a renewable energy "giant," with resources to carry the state through the next century and reap huge economic benefits.

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