

Alternative Energy



cost of wind energy in relation to conventional power technologies is becoming competitive. In fact, it's dropping at a faster rate than conventional. Financial incentives are also available to help offset the initial cost.

Not only is it becoming more affordable, wind energy is completely renewable and has minimal environmental impact.

Since no combustion takes place, no air or water emissions are released. This means no air toxins, greenhouse gases, or smog-producing pollutants. Because wind is so variable, if wind energy is combined with other renewable sources such as fuel cells, an even better alternative results.



SOLAR

The sun provides more energy in only one day than the entire world would use in 27 years. Solar energy is used in two ways: photovoltaic (PV) cells convert sunlight into electricity, while solar thermal is used for direct heating and indirect electricity production.

Energy from the sun is completely renewable, inexhaustible, clean and entirely domestic. Since no fuel is burned, no air pollution is generated.

PV cells, or solar cells, require very little maintenance with a life span of up to 30 years. A system can be enlarged, downsized and easily moved to meet the changing energy needs. They can power residences, businesses, water wells, and streetlights, among other things. Solar products can be integrated into building design, such as solar roof shingles. Solar thermal energy is being used to heat air and water for buildings.

Large-scale solar energy is not yet cost effective. But as the price of solar power decreases and the costs of conventional fuel increases, solar energy collection will become more accessible.

GEOTHERMAL

High temperature steam or hot water from the earth is used as energy in many parts of the world. In Oklahoma it is limited to low temperature heat from shallow rock and soil, also called earth energy. The Oklahoma climate is well suited for geothermal heat pumps. These use the ground temperature to heat and cool houses. In the winter, heat is extracted from the ground and in the summer, heat is discharged into the ground. This system is exceptionally efficient for home cooling and heating.

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ADDITIONAL INFORMATION

More information can be obtained from the following resources. Much information is available from these agencies and organizations over the Internet. Since Internet addresses change frequently, keyword searches can provide these sources as well.

General Information

- Environmental Protection Agency, <http://www.epa.gov>
- Alternative Fuel Data Center, <http://www.afdc.nrel.gov>
- National Renewable Energy Laboratory, <http://www.nrel.gov>
- Center for Renewable Energy and Sustainable Technology, <http://solstice.crest.org>
- Renewable Fuels Association, 202-289-3835
- National Alternative Fuels Hotline, 800-423-1DOE,
- Alternative Energy Institute, Inc., <http://www.altenergy.org>
- Association of Central Oklahoma Governments, <http://www.okccities.org>
- Indian Nations Council of Governments, <http://www.tulsacleancities.com>

Incentives

- Department of Energy, <http://www.energy.gov>
- Oklahoma Department of Commerce, <http://www.odoc.state.ok.us>
- Oklahoma Department of Central Services, <http://www.dcs.state.ok.us>

Natural Gas

- Oklahoma Natural Gas Co., <http://www.oklahomanaturalgas.com>
- Natural Gas Vehicle Coalition, 703-527-3022
- American Gas Association, 202-824-7000

Electric

- OG&E Electric Services, <http://www.oge.com>
- The Electric Vehicle Association of the Americas, <http://www.evaa.org>

Propane

- Oklahoma Propane Gas Association, 405-424-1775
- Oklahoma LP Gas Administration, 405-521-2458
- National Propane Gas Association, <http://www.npga.org>

Ethanol

- National Ethanol Vehicle Coalition, <http://www.e85fuel.com>
- American Coalition for Ethanol, 605-334-3381
- Governors' Ethanol Coalition, <http://www.ethanol-gec.org>

Methanol

- American Methanol Institute, <http://www.methanol.org>

Biodiesel

- National Biodiesel Board, <http://www.nbb.org>

Fuel Cells

- National Fuel Cell Research Center, <http://www.nfrcr.uci.edu>
- U.S. Fuel Cell Council, 202-293-5500

Wind

- American Wind Energy Association, 202-383-2500
- Oklahoma Wind Power Initiative, <http://www.seic.okstate.edu/owpai>

Solar

- American Solar Energy Society, <http://www.ases.org>
- Solar Electric Power Association, <http://www.solarelectricpower.org>

Alternative Energy for

OKLAHOMA



Fossil fuels provide 85% of the energy used in the United States.

Today in the world of high technology, fossil fuels are still relied on as the primary source of power. Technology has made huge leaps in the last 150 years; yet, the majority of activities continue to be fueled in the same manner as they were a century ago—the combustion of fossil fuels.

Fossil fuels are used more efficiently today—cars travel further on a gallon of gas, electricity is generated more efficiently, and appliances use less electricity. This increase in efficiency is being offset by the increase in population and demand. Fossil fuels are limited in supply and will not be reliable for the long-term. As energy needs rise, the use of alternatives becomes even more important.

The depletion of fossil fuels is a significant reason to focus on alternative fuels, but it is just one of many reasons:

■ *The U.S. imports over 50% of the oil needed for our country. Political changes, embargoes, and trade issues can disrupt foreign imports. The U.S. economy is critically impacted by petroleum prices and shortages. The use of locally produced alternatives allows greater control of the economy and energy security.*

■ *Burning fossil fuels releases certain gases into the air. These gases prevent the sun's energy from leaving the Earth's atmosphere. This trapped heat results in an effect referred to as global warming and could influence the climate of the world.*

■ *Fossil fuels also emit pollutants into the air, water and soil. Air pollution from fossil fuels contributes to many health problems as well as property damage and visibility degradation. Asthma, allergies, chronic bronchitis, lung cancer and other respiratory diseases are caused or amplified by air pollution.*

Because of these issues, a future of energy options must be considered. Many sources are less harmful to health and the environment and some are even renewable. Research and

Experts estimate that by the year 2020 electricity needs in the U.S. will increase by 33%.

development are ongoing to improve existing fuels and explore options for new fuels. Some sources that have been used minimally in years past are becoming more readily available and economical.

With the various offered incentive plans and improved technologies, many alternative energy sources are viable options today. The stage is now set to educate consumers and to make these options more widespread.



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TRANSPORTATION

Two-thirds of the oil consumed by the U.S. is used for transportation, and nearly half of all air pollution comes from vehicles. These two facts alone make the transportation sector a focal point for alternative energy improvements.

The Clean Air Act Amendments (CAAA) of 1990 and the Energy Policy Act (EPACT) of 1992 are national laws that contain mandates and incentives for the use of alternative fuel vehicles (AFV). EPACT provides federal tax deductions and credits for the promotion of AFVs. Oklahoma provides additional incentives in the form of **tax credits and zero or low-interest loans to either purchase new AFVs, convert vehicles to alternative fuels, or install AFV fueling and charging infrastructure.** These state deductions and credits are available until 2009.

Fuel for vehicles has prompted perhaps the largest diversification of alternative energies. It is also "fueling" the frenzy of research and development of alternative energy sources. It is now possible to drive a vehicle powered by nearly a dozen different fuel or fuel combination options.



Natural Gas

Natural gas is the most common alternative vehicle fuel used in Oklahoma. Even though natural gas is a fossil fuel and not renewable, it does fulfill the major criteria of alternative fuels. It is produced domestically, even locally in Oklahoma. Its use ensures energy security in addition to a degree of economical security for Oklahoma.

Natural gas releases less pollutant emissions than gasoline and diesel. This cleaner burning fuel results in fewer air pollutants that contribute to ozone, smog, global warming, and health hazards.

When compared to conventional vehicles, natural gas vehicle engine life increases without sacrificing performance. Vehicles using natural gas are ideal for commuters and company fleets. Many manufacturers offer passenger vehicles and heavy-duty vehicles equipped to burn natural gas. Gasoline powered vehicles can be easily converted to run on natural gas.

Propane

Liquefied petroleum gas, propane, is a by-product from natural gas processing and crude oil refining. It is convenient and available across the vehicle spectrum, from farm trucks to city busses. Propane vehicles perform comparably to conventional vehicles yet have increased engine life and reduced maintenance.

Vehicles can be purchased as propane powered or they can be converted from gasoline to propane use. Refueling time and ease is comparable to gasoline and public fueling stations are available.

Propane is one of the cleanest burning fuels. It releases half the amount of air toxics and particulate emissions of gasoline and up to 90% less carbon monoxide.

Ethanol

Nationally, ethanol is the most widely used alternative fuel. It is a renewable energy source produced primarily from grains such as corn, barley and wheat. It can be blended with gasoline at any percentage level or even used in its pure form. All manufacturers selling cars in the U.S. ap-

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prove the use of certain ethanol/gasoline blends. (Check the owner's manual) In fact, **many models can now use either gasoline or ethanol or any combination of the two.**

Ethanol performance is comparable to conventional gasoline. Costs for ethanol vehicles are similar to gasoline vehicles, but run slightly higher for heavy-duty vehicles. Ethanol is produced domestically and is of tremendous importance for American farmers and the American economy.

It is by far the most efficient liquid trans-

When used as an octane enhancer in gasoline, toxic emissions are greatly reduced. Using ethanol as an alternative fuel decreases the amount of carbon monoxide and greenhouse gases emitted by vehicles.

portation fuel available today. Eighty percent more energy is used to produce gasoline than is needed to produce the same amount of ethanol. Ethanol is a good choice for an alternative fuel in many states. However, this fueling infrastructure is not yet available in Oklahoma.

Methanol

Like ethanol, methanol is an alcohol-based fuel. It can be made from renewable resources that contain carbon, but is currently produced mostly from natural gas. Performance, availability, and benefits are similar to those of ethanol. Future applications lie in the use of fuel cells. Methanol is the most economical means of supplying hydrogen to the fuel cell. In Oklahoma, the infrastructure for methanol-powered vehicles is not yet available.

Biodiesel

Made from renewable sources such as vegetable oils and animal fats, biodiesel is an alternative to diesel. Use of biodiesel blended with conventional diesel at 20%/80% does not require any engine modifications and provides the same performance and range as diesel. Higher blends, even at 100% biodiesel, can be used in many engines with little or no modification.

Biodiesel is only available through bulk suppliers. Fuel cost varies depending on the feedstock. Soy biodiesel is more expensive



than that produced from fats and greases. Biodiesel is a viable alternative for diesel fuel. It is gaining interest as an alternative in situations where workers are exposed to diesel exhaust.

Biodiesel is cleaner burning than conventional diesel. Although more nitrogen oxides are released, these emissions are easily managed with other technologies. The release of hydrocarbons that contribute to ground level ozone is decreased by 68%. Overall, it releases far less air toxics and smog-producing emissions.

Electric

Electric Vehicles (EVs) have the same performance abilities as conventional vehicles. They travel just as fast, but not quite as far on a single charge as is possible on a tank of gas. Rechargeable batteries store the energy in the vehicle. The weight, size and capacity of these batteries have made EVs less optimal in the past. But new battery technology is providing faster recharges, smaller batteries, and allowing vehicles to travel farther distances.

The vehicle is simply plugged into a 110 or 220-volt electric outlet. Most homes and businesses already have the electrical capacity and can easily be equipped for recharging. Many variables affect recharge time, but it can take less than 10 hours. EVs are being manufactured in a variety of styles and for many uses. They are well suited for commuters and in-city use such as fleets and transit.

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Electric vehicles (EVs) produce no emissions from the tail pipe. The only emissions come from the electric generation plant during vehicle recharge.

Hybrid Electric

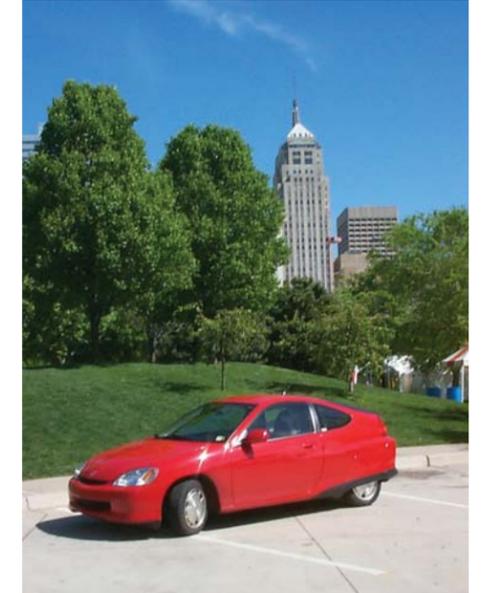
Hybrid Electric Vehicles (HEVs) are among the leaders in transportation research and development. HEVs combine the conventional combustion engine with the battery and electric motor of an EV. This combination results in better fuel economy than a standard gasoline vehicle plus many of the energy and environmental benefits of an EV. Using an alternative fuel in place of standard gasoline can further increase the benefits.

Current technologies include reclaiming the energy used during braking and storing it in a battery for later use. In some designs the primary engine is used for main driving and the electric motor provides additional power as needed. In others, the primary engine is used to produce the electricity to power the wheels.

HYDROGEN

The most promising renewable energy future lies in the use of fuel cells. A fuel cell converts hydrogen into electricity. It functions like a battery, but never runs down. It provides electricity as long as hydrogen fuel is supplied. With the aid of a catalyst, hydrogen atoms are split into electrons and protons. The electrons run through a circuit to create electricity and are later reunited with the protons and oxygen to produce water. Fuel cell vehicles are 80% energy efficient when powered with pure hydrogen, whereas gasoline vehicles are only 20% efficient.

Hydrogen can be supplied to the fuel cell from any hydrogen-rich material such as gasoline, methanol, hydrogen gas, and even water. Today, for economic and availability reasons, hydrogen is mostly supplied through methanol made from natural gas. Many other sources of hydrogen production are being explored. The goal is to find totally renewable and economical sources of hydrogen supply and transport. Promising options include sunlight and water, wind, biomass, bio-



logical organisms, methanol, and ethanol.

Fuel cells are being used in vehicles and businesses already. Future widespread use of hydrogen is targeted for vehicles, aircraft, portable electronics, and heat and electricity for homes and buildings. Hydrogen shows potential for being a future energy carrier, much like electricity is today.

WIND

Possibly, one of the oldest sources of energy used is wind. Today's windmill is far superior to that of centuries ago. Electricity produced from wind turbines is becoming a reliable alternative across the nation. This is particularly so in Oklahoma with the state being ranked 8th for its

wind energy potential. It is estimated that wind could produce three times more electricity than the total amount now produced in the U.S.

Wind turbines vary in size and function. Residential turbines are available in sizes for recharging batteries, pumping water and even for supplying all electrical needs to a home. On the other extreme, a commercial turbine can be large enough to provide power to hundreds of homes.

Utility wind farms are being constructed to supply electricity on a large scale. The