

# Alternative Energies

- ❖ Can Texans create the companies and workers for the unique industries of biomass, hydrogen, algae and wave energy production?

## Introduction

Carlos Guzmán is about to hire another 20 workers at his biofuel refinery on the west side of El Paso. Guzmán is president of three-year-old Global Alternative Fuels, a 25-worker company that converts waste grease from restaurants into about 15 million gallons of biodiesel fuel a year. Nearby Western Refining buys the biofuel and mixes it with diesel fuel, and the mixture then powers trucks and trains. Guzmán thinks his young company can continue to hire as demand rises for cleaner fuel made from by-products.

Companies in the alternative energy sector make energy from biofuels, hydrogen, waves and even algae. In 2005, federal mandates required the commercial transportation industry to use some biofuels to reduce air pollution, a move which sparked growth in the biofuels industry. In 2007, Texas boasted about 20 biodiesel plants, but within a few years some of these plants had placed their production on hiatus after the state declined additional tax credits for the production of alternative fuel. “We’re growing,” Guzmán said. “But we could grow more with some help from the state.”

Though the industry is still small in Texas — contributing only a trace amount of fuel or electricity to consumers currently — a growing number of Texas entrepreneurs like Guzmán are moving into the alternative energy industry. These young companies are making energy by incorporating biofuels, hydrogen, wave energy and even algae. These alternative energy companies have grown thanks to federal investment incentives and federal pollution laws. The proposed federal legislation to cap carbon pollution and allow for the trading of pollution credits (also known as cap and trade proposals) could further push these alternative energy companies forward. “Cap and trade will make this industry explode,” Guzmán predicted.

Even without the federal legislation, Guzmán and his fellow alternative energy entrepreneurs in Texas say that the rising costs of traditional energy sources will help create a business case for their products. For example, if the price of oil rises above \$90 a barrel, biofuels would become a more economically viable alternative, Guzmán noted, leading to the success of the biofuel industry.



## | What's Happening

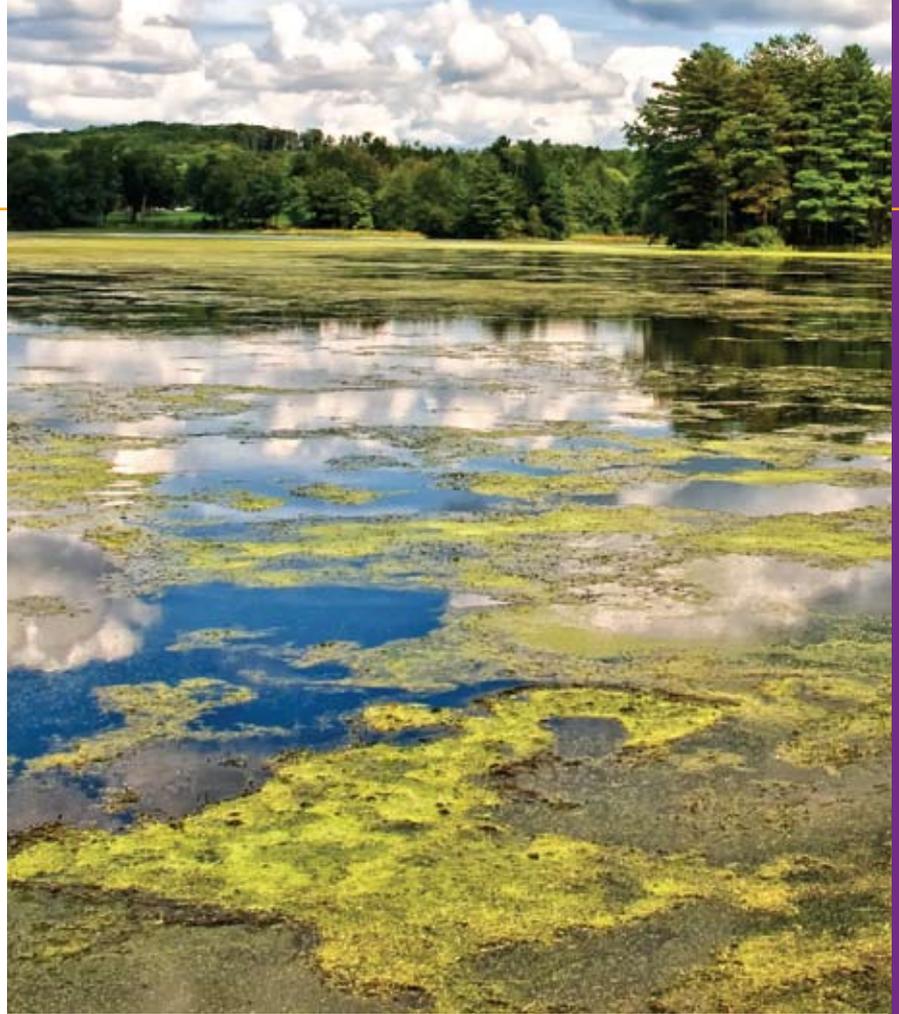
Competition for alternative energy companies is coming, specifically from other countries, who want to grab a piece of the alternative energy pie.

In late 2009, the government of Kuwait announced a goal of enticing clean energy companies to set up operations in that country. In other countries, investors in clean energy have been making headway with governments to secure incentives and financial assistance for their projects. The trend also applies to the United States, where economic developers show a growing interest in attracting alternative energy companies to their communities.

## | The Data

Alternative energy consumption rose nationally by almost 17% from 2004 to 2008, according to data from the federal Energy Information Administration. In quadrillions of British thermal units (BTU), the United States consumed the following sources of energy:

- **Coal** — Decreased from 22.47 to 22.42
- **Natural gas** — Increased from 22.93 to 23.84
- **Petroleum** — Decreased from 40.29 to 37.14
- **Nuclear** — Increased from 8.22 to 8.46
- **Biofuels** — Increased from 0.51 to 1.41
- **Municipal waste** — Increased from 0.39 to 0.43
- **Wood** — Decreased from 2.12 to 2.04
- **Geothermal** — Increased from 0.34 to 0.36
- **Hydroelectric** — Decreased from 2.69 to 2.45
- **Solar** — Increased from 0.07 to 0.09
- **Wind** — Increased from 0.14 to 0.51



## | So What?

Interest in more diversified energy sources is growing in the United States and in Texas. While the markets for hydrogen, biomass, algae and wave energy are barely established, these secondary energy sources have the potential to grow and help communities diversify their energy bases while also reducing local pollution.

These low-cost, low-pollution alternative energy sources are also attractive to governments and investors. For example, Dyess Air Force Base in Abilene uses generators to burn municipal waste to create electricity, helping the base cut its electric bill in half and provide excess electricity to nearby cities. Sugar Land-based Wow Energy Inc. supplied the waste-to-energy technology used by the generators, which don't use water, a resource that is fast becoming limited in some areas.



## Chapter 20 | Suggested Strategies

### Think Globally, Plan Regionally

Alternative fuels like hydrogen, biomass, algae and wave energy have grown sporadically in Texas with a lot of starting and stopping to their technological advancement. Texas is the energy capital of the world while Texas utilities and even oil companies are trying to diversify their supply of fuel sources.

State and local officials would be wise to leverage the energy knowledge and alternative energy interest already in Texas to help entrepreneurs involved in hydrogen, biomass, algae and wave energy push their technology forward, thus creating new job opportunities and new revenues for their regions. The case studies in this chapter highlight some of the fledging alternative energy industries in Texas.

### Case Study | Biomass Energy

#### A sugar mill in South Texas has become an energy giant and may be part of the changing face of energy production in the Lone Star State.

For 36 years, the Rio Grande Valley Sugar Growers co-op sugar mill in Santa Rose near Harlingen has burned the leftover waste fiber from the milling of sugar cane stalks. The mill, which processes 1.6 million tons of sugar cane a year, is left with 450,000 tons of plant fiber waste. The co-op found that burning the waste created steam for the traditional boilers in the Santa Rosa mill, which uses about 8 megawatts of power. The boilers generated 5 megawatts of electricity, which helped lower the electricity costs for the mill. Recently, the Rio Grande Valley Sugar Growers decided to modernize and received approval from the Rio Grande River Authority to issue tax-free bonds to finance the construction of a \$30-million modern boiler, which went online in August 2009. Now, burning 450,000 tons of waste generates 16 megawatts of energy, instantly saving the mill \$1 million a year in electricity.

“Our goal is for this to become a profit center,” said Steve Bearden, mill president. Now the mill is selling power back to South Texas. During an especially hot three-week period in August 2009, the sugar mill powered the entire city of Santa Rosa.

Despite its success, the mill can’t be the only

power supplier for the region. The mill does not run continuously, so it cannot sign a full contract with regional utilities to supply power, and the boiler runs at full capacity only during the October to March grinding season. However, Bearden is negotiating with South Texas cities to take their yard waste as fuel for the mill’s boiler, which will allow the boiler to generate power for the region for 10 months each year. The plan will also need to be approved by the Texas Commission on Environmental Quality (TCEQ).

The new boiler also has environmental benefits. Because the TCEQ insisted that the mill install modern smoke scrubbers, which cost an extra \$2 million and suck up almost a megawatt of electricity, the new boiler produces lower emissions than the old boiler. The TCEQ’s restrictions could have killed the new boiler project, but the mill was able to obtain tax-free bonds, which allowed the project to make financial sense, Bearden said. As a result, South Texas now has additional power to support its growing population, as well as additional jobs — specifically, 20 new full-time jobs.

“It’s a unique situation for us in the sugar mill business that makes this possible,” Bearden said. “Support from the nearby communities has been very positive. And our utility can shift power to other growing local communities that need the power.”

Gasoline-powered forklifts can create dangerous exhaust in indoor warehouses, and traditional electric batteries require employees to stop work multiple times each day for recharging. So, in 2007, H-E-B grocery stores won a grant from the state to test-drive hydrogen-powered forklifts in the company's warehouses in San Antonio. The forklifts were retrofitted with hydrogen fuel cells that needed to be charged only once a day. And, rather than create air pollution, the hydrogen fuel cells produced only a few drops of water each day as a by-product.

Hydrogen is the most abundant resource in the universe. Manipulating the electrons in a hydrogen molecule to make electricity is an exciting prospect for many scientists and engineers, such as Brian Weeks, associate director of advanced energy systems for the Gas Technology Institute in Sugar Land. "Whether you believe that carbon emissions are hurting our planet or not, hydrogen is a good story for Texas," Weeks said. "The national energy portfolio will include hydrogen, and Texas can be part of that."

Weeks believes the most cost-effective way to generate electric power from hydrogen is to strip hydrogen from natural gas. For now, the cost of hydrogen-powered vehicles is still significantly higher than those powered by traditional fuels. For example, the University of Texas owns a hydrogen-powered passenger bus. The bus cost \$600,000 — about \$350,000 more than a traditional diesel bus. But Weeks and other supporters of hydrogen energy predict that the cost of hydrogen-powered vehicles will decrease as more hydrogen fueling stations come online. A stand-alone hydrogen fueling station, which is about the size of a mobile home, usually connects to traditional natural gas lines. The station then converts the gas to hydrogen.

"Hydrogen is in its infancy, but it has potential for big impact," said Jared Hightower, sales director at GreenField Compression Inc. in Richardson, which manufactures the modular hydrogen fueling stations. To date, the company has made 12 hydrogen fueling stations, which cost about \$1 million apiece, as well as about 2,000 natural gas fueling stations. GreenField executives hope that demand increases for both natural gas and hydrogen fueling stations as consumers and businesses start to explore alternative fuel options.

With natural gas prices especially low and fleet owners, such as AT&T, the city of San Antonio, Waste Management and others, shifting to natural gas vehicles, Hightower predicts that natural gas consumption will continue to grow in Texas. The young hydrogen industry is looking to replicate that growth as Honda, Toyota and General Motors release and promote hydrogen vehicles.

The issue ultimately comes down to cost and convenience for the consumer, according to Hightower. "People will go to a little more trouble to get your fuel if yours is a little less expensive than traditional fuels," Hightower noted. "But they won't if your fuel is more expensive than traditional gasoline."

Hydrogen currently costs about four times as much as gasoline, according to the U.S. Department of Energy. Still, several public and corporate organizations are working to drive down those costs and have been experimenting with hydrogen-powered vehicles in Texas:

- **Texas State Technical Institute in Waco**
- **Lamar University in Beaumont**
- **Southwest Research Institute in San Antonio**
- **J. J. Pickle Research Campus, University of Texas at Austin**
- **Dow Chemical and General Motors Test Center in Freepport**

## Case Study | Wave or Hydrokinetic Water Energy

Houston-based Hydro Green Energy LLC installed two hydrokinetic water turbines on the Mississippi River near Minneapolis in 2008. These turbines work much like an old-fashioned water wheel: they use the flow of water in a river to create electricity. Hydro Green's portable turbines rest under barges.

Meanwhile, Minnesota-based Independent Natural Resources Inc. recently brought hydrokinetic energy to the Gulf Coast of Texas, where it set up pumps about a mile off the coast of Freeport. Passing waves power the pumps, which turn seawater into fresh water.

While these projects are attracting some attention, wave (or hydrokinetic water) energy is still more of a concept than a reality in terms of

being a viable alternative energy source. Wave energy projects are constrained by wave size as well as financing challenges. Many wave energy projects in Europe have been suspended due to international financial struggles. And U.S. wave energy projects have attracted venture capital funding primarily in Northern California and New England, where bigger waves mean bigger energy production, which nearby investors hope will eventually lead to bigger returns.

In spite of these difficulties, Texas boasts a limited water-generated energy industry. For example, the East Texas Electric Cooperative is poised to expand the Lake Livingston Dam in Southeast Texas. The co-op secured \$10 million in clean renewable energy bonds and plans to borrow another \$64 million from the U.S. Department of Agriculture's Rural Utilities Service. The dam will provide electricity to 10 neighboring co-ops.

## Case Study | Algae Biofuel Energy

"We're in Texas for the sunlight, the salt water and the land," said Brad Bartilson, president of Photon 8 Inc. in Brownsville. His company, which is developing a five-acre algae farm, mixes nitrogen, phosphorous and carbon wastes from nearby industrial plants with seawater and sunlight to make biodiesel fuel. Rapidly growing algae, which needs only a day to become of useful size to create oils, bloom year-round.

Bartilson moved his company from New Jersey to Texas and got it off the ground thanks to South Texas angel investors and state and local economic development grants. As his company scales up, it will need chemical and biochemical engineers along with technicians. And land. Lots of land. Land is the key constraint for companies trying to convert algae into biofuels. To achieve its goals, a company needs 10,000-acre pools — that's a pool the size of the city of San Marcos or a third the size of the city of Galveston.

This emerging industry that is using "pond scum" for fuel is linking the agriculture and energy industries. Sunrise Ridge Algae won a \$250,000 investment from the Texas Emerging Technology

Fund to push forward its algae development of "bioleum for petroleum refinery feedstock" in Katy.

"We're in Texas because we need to be near oil guys and guys who make fuel. You also need to have close ties to the agriculture and the best place to have all of those connections is Texas," said Norm Whitton, CEO of Sunrise Ridge, who notes that the Big Oil giants of Exxon, Shell and BP are developing biofuel programs outside of Texas. "Texas is sending a message that it is unfriendly to biofuel. This is something that should create employment but needs some policy change in Texas."

Big companies are also taking an interest in biofuels. Here in Texas, ExxonMobil is in the middle of a \$1.5 billion investment in alternative energy, with a concentration on experiments in algae production, wind energy production and even advanced battery production.

Carlos Guzmán at Global Alternative Fuels in El Paso points out that algae, which already provides biofuels for British consumers and airlines, could become a feedstock for his biofuel business. "It's going to take time for the algae business to scale up. We use 50,000 gallons a day of waste oil. We can use algae, but they have to get a lot bigger," Guzmán said. "Alternative energy is a growth business."