

Biofuels' Bright Future

By Will Thurmond, Emerging Markets Online

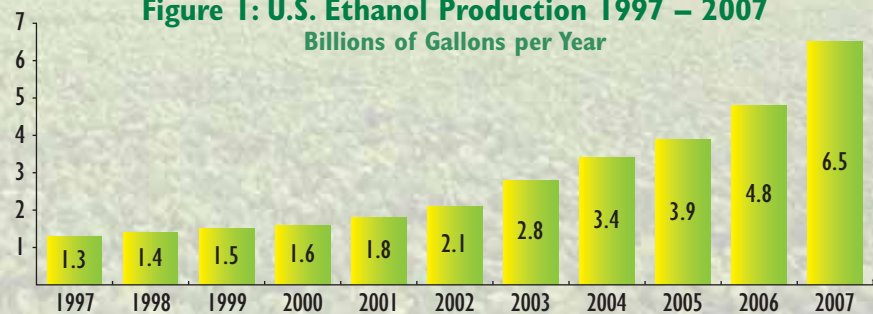
2001: The Biofuels Revolution

Seven years ago, a biofuels revolution was born in Europe from ambitious environmental, energy security and national security policies. Starting with the EU's Biofuels for Transport initiative in 2002, these revolutionary biofuels policies took root in the U.S. in 2005 with the birth of the Renewable Fuel Standard (RFS) under the Energy Policy Act. Not long thereafter, several countries, including India and China, followed suit and enacted policies aimed at reducing pollution and dependence

on foreign oil and producing renewable sources of transport fuels. Each of these emerging market nations has targets to replace from 5% to 20% of total transport consumption with ethanol or biodiesel.

Around the world, these biofuels initiatives have received government support in the form of mandates, subsidies, tax incentives and large R&D initiatives. In the U.S. these initiatives and tax benefits have helped to accelerate the growth of the biofuels industry, with over 150 new ethanol plants and more than 185 biodiesel enterprises through 2007 (see figure 1).

Figure 1: U.S. Ethanol Production 1997 – 2007
Billions of Gallons per Year



Source: Biodiesel 2020: A Global Market Survey, 2nd edition, RFA, EIA



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Since 2000, ethanol markets in the U.S. have seen impressive growth figures, from 2.1 billion gallons of production in 2002 to 6.5 billion gallons in 2007. Similarly, growth in the U.S. biodiesel markets has been impressive, starting with 25 million gallons of production in 2004, reaching 250 million gallons by 2006 and 500 million gallons of production by 2007 — a 20-fold increase. Clearly, market growth and the stimulus of the 2005 RFS have helped to accelerate the impressive growth of these markets (see figure 2).

Emerging Markets for Biofuels

In Brazil, India and China, major national biofuels programs are now under way. In 2006, India initiated a biodiesel development program to replace 20% of diesel fuels with Jatropha-based biodiesel fuel by 2012. In January 2008, Brazil officially delivered the first orders for its national biodiesel program to replace 2% of diesel fuels by 2008 and 5% by 2013, complementing its impressive ethanol program of 20-plus years.

The International Energy Agency notes that China will consume energy at an increased rate of 6% to 8% per year for the next ten years. To deal with these growing demands, China's Ministry of Science and Technology (MOST) has set aside an area the size of England (approximately 32 million acres) to grow Jatropha for biodiesel. In a few years, this project could produce up to 6 billion gallons of biodiesel. China is also fast at work testing next-generation technologies to turn municipal waste into biofuels. If implemented,

this project could tap 1.3 billion sources of renewable energy every day.

To handle China's fast energy growth, MIT notes the country is currently constructing the equivalent of two 500-megawatt, coal-fired power plants per week and adding capacity comparable to the entire U.K. power grid each year. According to biofuels consulting firm Emerging Markets Online, if China could sequester the carbon from these coal-fired power plants to produce algae for biodiesel and ethanol, it could deliver a quadruple-benefit of carbon reduction, clean fuels production, job creation and economic growth.

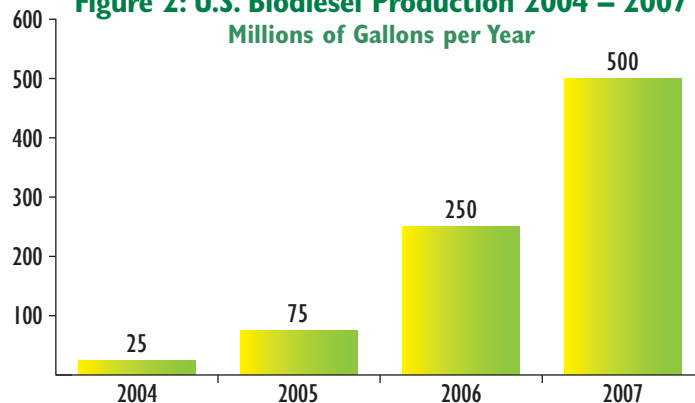
In Brazil, more than 50% of the transportation fuel consumed today comes from ethanol, compared with U.S. ethanol consumption at only 5% of total transport fuels, as cited in the landmark study *Biodiesel 2020: A Global Market Survey*.

2007: Welcome to The Biofuels Evolution

Brazil's successful efforts toward achieving energy independence have often been applauded by President Bush and the U.S. Congress. In December 2007, with the imminent arrival of \$100-per-barrel oil, the U.S. Congress swiftly acted to upgrade the 2005 biofuels initiative and RFS from its original target of 7 billion gallons by 2012 to a revised RFS target (passed in December 2007) of 36 billion gallons of biofuels production by 2022.

The 2007 RFS and Energy and Independence Security Act designates 22

Figure 2: U.S. Biodiesel Production 2004 – 2007
Millions of Gallons per Year



Source: *Biodiesel 2020: A Global Market Survey*, 2nd edition, RFA, EIA



billion gallons of the 36 billion gallons in the RFS mandate to come from advanced, non-food-based feedstocks such as algae, switch grass, sorghum, camelina, woody biomass, miscanthus and municipal waste. Most of these new non-food feedstocks offer greater production yields per acre compared to corn and soy, and do not compete with the food supply to provide biofuels.

BP, a global leader in the biofuels industry, has embarked on a continuum of biofuels development in keeping with this mandate, beginning with a growing investment in ethanol from Brazilian sugarcane, and moving to investments in more efficient fuel molecules like butanol and advanced biofuels like cellulosic ethanol, which is produced from non-food energy grasses and “for-purpose” feedstocks, such as miscanthus and energy cane.

According to the U.S. Department of Energy (DOE), the U.S. has invested \$7 trillion dollars in its petroleum refining, pipeline and distribution infrastructure. For these reasons, the DOE is sponsoring R&D projects at more than a dozen universities and research centers to develop biofuels and “renewable diesel” from wood waste, waste vegetable oil, municipal waste and algae. This will create a liquid biofuels feedstock called “biocrude” or “bio-oil” that can be directly integrated into the existing petroleum production infrastructure today to create clean fuels for tomorrow.

Next-Generation Biofuels Investments

In 2006 and 2007, most investments in next-generation biofuels went to technology and research. One of the first leaders in the group, BP, has committed approximately \$1 billion to biofuels business operations, and to a number of R&D efforts, in order to develop the technologies, feedstocks and processes required to produce advanced biofuels. They announced an investment of \$500 million at the University of California, Berkeley, and the University of Illinois, Urbana Champaign, to advance renewable energy R&D. BP also formed a partnership with DuPont on biobutanol,



a next-generation premium biofuel molecule.

Several other companies, too, have made groundbreaking contributions to the effort:

- Conoco-Philips partnered with Tyson® foods to create renewable diesel from chicken fat;
- Shell has partnered with HR Biopetroleum to produce biofuels from algae in Hawaii;
- and, Chevron invested in several biofuels R&D projects at universities and research labs, including an algae-to-biodiesel initiative at the U.S. National Renewable Energy Laboratory and a sorghum-based cellulosic ethanol initiative at Texas A&M University.

By 2008, investment in the biofuels industry had moved from Woodstock to Wall Street, demonstrating greater direct investment in private companies and increased confidence in the viability of next-generation projects.

For example, earlier this year, Chevron invested in Solazyme, a company that creates biocrude from algae that can be utilized in existing petroleum refineries. *Biofuels Digest* reported that Bill Gates and the Rockefeller family raised more than \$100 million for Sapphire Energy and its algae-based “green biocrude” technology.

Additionally, BP made two major announcements: Tropical — a joint venture in Brazilian sugar cane ethanol with plans to invest \$1 billion in two refineries; and plans to invest \$90 million in cellulosic-ethanol producer Verenium.

“BP’s strategy is to focus on better, more sustainable biofuels only,” says Susan Ellerbusch, president of BP Biofuels N.A., “as they can make significant contributions to reducing greenhouse gas emissions and can be produced in an environmentally and economically sustainable manner.”

By October 2008, more good news arrived, as the U.S. Congress and President Bush extended the biofuels production and blender’s tax credits for biodiesel and ethanol for another year — a hard-fought victory for the biofuels industry.

In support of these R&D efforts, several new private industry groups and associations have emerged to accelerate investment, innovation and commercialization of next-generation biofuels, including the U.S. National Algae Association, the American Biofuels Council, the National Sorghum Producers Association for cellulosic ethanol production and the Brazilian Jatropha Grower’s Association, to name a few. Each of these groups’ endeavors creates new markets and accelerates the commercialization of next-generation biodiesel, biocrude, aviation and ethanol biofuels.

Biofuels’ Bright Future

For thousands of years, biofuels were no different than the “hooch” Henry Ford used in his first alcohol-combustion engines, or the fuel Rudolf Diesel used to run an engine on peanut oil in the late 1800s. A hundred years later, the biofuels industry continues to accelerate, evolve and grow rapidly, creating new markets, renewable-energy jobs, entrepreneurial wealth, and a cleaner, more prosperous and brighter energy future. ●



About the Author

Will Thurmond is president of biofuels consulting firm Emerging Markets Online, author of *Biodiesel 2020: A Global*

Market Survey

