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Congress of the United States

U.S. House of Representatives

Committee on Small Business

2361 Rayburn House Office Building
Washington, DC 20515-6315

Memorandum

To: Members, Subcommittee on Agriculture, Energy & Trade
From: Committee Staff
Date: April 23, 2012
Re: Hearing: "Small Business Innovators: On the Cutting Edge of Energy Solutions"

Introduction

At 10:00 AM on April 26, 2012, the Subcommittee on Agriculture, Energy and Trade will meet to receive testimony on the role of small business innovation in the renewable fuels industry. The purpose of the hearing is to examine innovative ways small businesses contribute to energy production. Specifically, the Subcommittee will focus on advanced biofuels, such as cellulosic ethanol, and new innovative technologies small companies have developed to produce energy from previously unused materials. The Subcommittee will also look at the role of research and development in spurring innovative technology within the advanced biofuels field.

Background

Energy is crucial to the operation of a modern industrial and services economy. Recently, there have been growing concerns about the availability and cost of traditional energy sources. Those concerns have rekindled interest in the development and commercialization of renewable fuel technologies.

Since the late 1970s, United States policymakers at both the federal and state levels have enacted a variety of incentives, regulations, and programs to encourage the production and use of agriculture-based biofuels. Initially, federal biofuels policies were developed to help ignite the biofuels industry during its early development, when neither productive capacity nor a market for the finished product was widely available. Federal policy has played a key role in helping to close the price gap between biofuels and less expensive petroleum fuels. Now, as the industry has evolved, other policy goals, such as national energy security and support for rural economies, are cited by proponents as justification for continuing support for federal biofuels policy.

The United States biofuels sector has responded to these government incentives by expanding output every year since 1980 (with the exception of 1996),[1] with important implications for the domestic and international food and fuel sectors. The production of ethanol (the primary

[1] UNITED STATES DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION HISTORICAL DATA, *available at* http://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb1001.

biofuel produced in the United States) has risen from about 175 million gallons in 1980 to nearly 14 billion gallons in 2011.[2] United States biodiesel production, albeit much smaller, has also shown strong growth, rising from 0.5 million gallons in 1999 to 1.06 million gallons in 2011.[3]

It is widely believed that the ultimate success of the United States biofuels sector will depend on its ability to shift away from traditional row crops (such as corn or soybeans for processing feedstock), to other, cheaper forms of biomass that do not compete with traditional food crops. However, the speed of transition remains a major uncertainty, since new technologies must first emerge and be implemented on a commercial scale. The uncertainty surrounding the development of such new technologies and their commercial adaptation has been a major impediment to the flow of much-needed private sector investment funds into these non-traditional biofuels.

Cellulosic Biofuels

Ethanol produced from cellulose in non-food sources is called "cellulosic ethanol." Other types of biofuels that can be made from cellulose include renewable gasoline, diesel, and jet fuel. Cellulosic biofuels are liquid, solid, or gaseous fuels made from cellulose material. Cellulose—a complex carbohydrate—is the organic matter found in plant walls that, along with hemicellulose and lignin, helps to give a plant its rigid structure. Cellulose feedstock includes agricultural residues (e.g., corn stover), forestry residues (e.g., wood chips), energy crops (e.g., switchgrass), tree crops (e.g., hybrid poplar), and urban sources of waste (e.g., municipal solid waste).[4]

Cellulosic ethanol differs from the corn ethanol currently blended into transportation fuel; it is made from feedstock with no food value, potentially results in fewer greenhouse gas emissions, and has a higher energy balance.[5] Converting cellulosic feedstock to ethanol, however, is more expensive and difficult than converting corn to ethanol.

Some analysis suggests that increased use of cellulosic biofuels for transportation could potentially help to reduce the United States' dependence on foreign oil, stabilize energy prices, strengthen rural infrastructure, and improve the environment.[6] In addition, cellulosic feedstocks may fare better in the food-energy debate, since crop residue, and not the crop itself, is used for cellulosic biofuel production.

Various federal incentives—grants, loans, tax credits, and direct government research—attempt to push cellulosic biofuels technology to the marketplace. Demand-pull mechanisms such

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[2] *Hearing before the Subcommittee on Environment and the Economy of the House Energy and Commerce Committee:* H.R. 4345, the Domestic Fuels Protection Act of 2012 (testimony of Bob Dineen, President and CEO of the Renewable Fuels Association) (April 19, 2012).

[3] UNITED STATES ENVIRONMENTAL PROTECTION AGENCY HISTORICAL DATA, *available at* http://www.epa.gov/otaq/fuels/rfsdata/2011emts.htm.

[4] For a more detailed discussion on the types of cellulosic feedstocks, please see: http://advancedbiofuelsassociation.com/page.php?sid=2&id=19 or http://www.afdc.energy.gov/afdc/fuels/ethanol_feedstocks.html.

[5] THE OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY'S (EERE'S) BIOMASS PROGRAM, BIOMASS FAQ'S *available at* http://www1.eere.energy.gov/biomass/biomass_basics_faqs.html.

[6] NATIONAL RESOURCES DEF. COUNC., BRINGING BIOFUELS TO THE PUMP (July 2005) *available at* http://www.nrdc.org/air/energy/pump/pump.pdf.

as the renewable fuel standard (RFS)[7] mandate the use of biofuels, creating an incentive for the development of a new technology to enter the marketplace.

Some contend, however, that cellulosic biofuels require a substantial feedstock supply that has yet to be verified, may cause environmental degradation (e.g., by removing residues that furnish nutrients and stability to the soil),[8] and may hinder efforts to promote energy efficiency. Additionally, some critics of current biofuel production policies argue that these strategies only can be economically competitive with existing fossil fuels in the absence of subsidies if significant improvements are made to existing technologies or new technologies are developed. Until such technological breakthroughs are achieved, detractors contend that the subsidies distort energy markets and divert research funds from the development of other renewable energy sources not dependent on fossil fuels, wind, solar, or geothermal, which offer potentially cleaner, more bountiful alternatives.[9] Still others debate the rationale behind policies that promote biofuels for energy security, questioning whether the United States could ever produce and manage sufficient feedstocks of starches, sugars, vegetable oils, or cellulose to permit biofuel production to meaningfully offset petroleum imports.[10]

Selected Government Research and Development Programs Dedicated to Renewable Fuels

The Office of Energy Efficiency and Renewable Energy (EERE) Biomass Program[11]

The United States Department of Energy's EERE Biomass Program works with industry, academia, and national laboratory partners on a portfolio of research in biomass feedstocks and conversion technologies. Through research, development, and demonstration efforts geared toward the development of integrated biorefineries, the Biomass Program aims to help transform the nation's renewable and abundant biomass resources into commercially viable, high-performance biofuels, bioproducts, and biopower.

The Biomass Program primarily focuses on research and development (R&D) efforts to ensure that cellulosic ethanol is commercially viable by 2012 and that bio-based aviation fuel, diesel fuel, and gasoline are price competitive by 2017. The R&D activities sponsored by the Biomass

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[7] Congress first established a Renewable Fuel Standard (RFS)—a mandatory minimum volume of biofuels to be used in the national transportation fuel supply—in 2005 with the enactment of the Energy Policy Act of 2005 (Pub. L. No. 109-58). The initial RFS (sometimes referred to as RFS1) mandated that a minimum of 4 billion gallons of renewable fuel be used in the nation's gasoline supply in 2006, and that this minimum usage volume rise to 7.5 billion gallons by 2012. Two years later, the Energy Independence and Security Act of 2007 (Pub. L. No. 110-140) superseded and greatly expanded the biofuels blending mandate to 36 billion gallons by 2022. This expanded RFS is sometimes referred to as RFS2. In addition to gasoline, RFS2 applies to all transportation fuel used in the United States—including diesel fuel intended for use in highway motor vehicles, non-road, locomotive, and marine diesel.

[8] R. M. Cruse & C.G. Herndl, *Balancing Corn Stover Harvest for Biofuels with Soil and Water Conservation*, 64 J. OF SOIL AND WATER CONSERVATION 286-291, (July/Aug. 2009), *available at* http://www.jswconline.org/content/64/4/286.full.pdf+html.

[9] See R. Rapier, *Fixing a Broken Biofuels Incentive Program,* FORBES.COM (Sept. 4, 2011), *available at:* http://www.forbes.com/sites/energysource/2011/09/04/fixing-a-broken-biofuel-incentive-program.

[10] M. BAKER, D. HAYES & B. BABCOCK, CROP-BASED BIOFUEL PRODUCTION UNDER ACREAGE CONSTRAINTS AND UNCERTAINTY 21 (Working Paper 08-WP 460) (Feb. 2008), *available at* http://www.card.iastate.edu/publications/DBS/PDFFiles/08wp460.pdf.

[11] Federal Nonnuclear Energy and Development Act of 1974, Pub. L. No. 93-577 (codified as amended at 42 U.S.C. §§5901-16).

Program are focused on addressing technical barriers, providing engineering solutions, and developing the scientific and engineering underpinnings of a bioenergy industry. Near- to mid-term applied R&D is focused on moving current feedstock and conversion technologies from concept to bench to integrated pilot scale. The goal of longer-term R&D is to develop knowledge of biomass, biological systems, and biochemical and thermochemical processes. Program R&D is performed by national laboratories, industry, and universities.[12]

The National Renewable Energy Laboratory (NREL) is a national laboratory of the United States Department of Energy's Office Energy Efficiency and Renewable Energy which is operated by the Alliance for Sustainable Energy, LLC. It is the only national laboratory solely dedicated to advancing renewable energy and energy efficiency technologies from concept to commercial application. NREL's 327-acre main campus is located in Golden, Colorado which conducts research into new technologies on various forms of renewable energy such as wind, solar, geothermal, and biomass.

Renewable Energy Research and Development Program[13]

Also administered by EERE, this program provides financial assistance to conduct R&D efforts in several energy technologies, including biomass. Such assistance may be used to develop and transfer renewable energy technologies to the scientific and industrial communities, states, and local governments. State, local and tribal governments, colleges and universities, large and small businesses and nonprofit organizations are eligible to apply.

Small Business Innovation Research[14] *(SBIR) and Small Business Technology Transfer*[15] *(STTR) Programs*

SBIR and STTR are federal government programs in which federal agencies with large R&D budgets set aside a small fraction of their funding for competitions among small businesses only. Small businesses that win awards in these programs keep the rights to any technology developed and are encouraged to commercialize the technology. Various agencies participate in the SBIR and STTR programs, with the majority of renewable energy grants provided by the Departments of Energy and Agriculture and the Environmental Protection Agency.

Research and Development Funding

Energy-related R&D—on coal-based synthetic petroleum and on harnessing atomic energy —played an important role in the successful outcome of World War II. In the post-war era, the federal government conducted R&D on fossil fuel and nuclear energy sources to support peacetime economic growth. The energy crises of the 1970s spurred the government to broaden the focus to include renewable energy and energy efficiency. Over the 35-year period from the Department of Energy's inception at the beginning of fiscal year (FY) 1978 through FY2012, federal funding for renewable energy R&D amounted to about 17% of the energy R&D total, compared with 15% for

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[12] THE OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY'S (EERE'S) BIOMASS PROGRAM *available at* http://www1.eere.energy.gov/biomass/about.html.
[13] 42 U.S.C. § 16232.
[14] 15 U.S.C. § 638.
[15] *Id.* at § 638 (o).

energy efficiency, 25% for fossil, and 37% for nuclear. For the 65-year period from 1948 through 2012, nearly 12% went to renewables, compared with 10% for efficiency, 25% for fossil, and 49% for nuclear.

DOE Energy Technology Cumulative Funding Totals (billions of 2011 dollars)

	Period		
Technology	FY2003-FY2012 (10 years)	FY1978-FY2012 (35 years)	FY1948-FY2012 (65 years)
Renewable Energy	$ 6.83	$ 20.94	$ 22.55
Energy Efficiency	6.54	18.64	18.79
Fossil Energy	10.12	32.23	48.41
Nuclear Energy	10.32	46.87	95.69
Electric Systems	6.03	8.35	8.53
Total	$39.85	$127.03	$193.97

Sources: *DOE Budget Authority History Table by Appropriation*, May 2007; *DOE Congressional Budget Requests* (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

DOE Energy Technology Share of Funding

Technology	Period		
	FY2003-FY2012 (10 years)	FY1978-FY2012 (35 years)	FY1948-FY2012 (65 years)
Renewable Energy	17.1%	16.5%	11.6%
Energy Efficiency	16.4%	14.7%	9.7%
Fossil Energy	25.4%	25.4%	25.0%
Nuclear Energy	25.9%	36.9%	49.3%
Electric Systems	15.1%	6.6%	4.4%
Total	100.0%	100.0%	100.0%

Sources: *DOE Budget Authority History Table by Appropriation*, May 2007; *DOE Congressional Budget Requests* (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980; *DOE Conservation and Renewable Energy Base Table*. February 1990. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

Conclusion

This hearing represents an opportunity for members to learn more about how small businesses are exploring the limits of science to produce renewable energy to be incorporated into a comprehensive energy strategy for the United States. The hearing will not only address the benefits of producing more energy, but also the economic repercussions of a growing advanced biofuels industry as well. Finally, by examining the role of federal research and development efforts, the hearing will provide members with the opportunity to learn more about how the federal government conducts research into the growing field of advanced biofuels.