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Evolution of Renewable Energy Policy

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Historically, renewable energy policies were first adopted to establish domestic fuel reserves during emergencies, such as wartime, when imported and regional fuel supplies could be interrupted (Yergin, 1991). As U.S. dependence on foreign oil increased, energy policies began to focus on encouraging new domestic energy production, including renewable energy. For example, in response to the energy crisis of the 1970s the U.S. Congress funded the Alaskan pipeline and created the strategic petroleum reserve. Policymakers began to look to agriculture as a source of energy supply, and Federal and State legislation was passed to encourage renewable fuel production and fund research on developing ethanol, biodiesel, solar, and wind power. More recently, President George W. Bush's National Energy Policy Group advocated the use of Federal programs to promote alternative fuels, including ethanol and biodiesel, to help reduce U.S. reliance on petroleum-based fuels.

The energy crisis also motivated the Government and private sectors to adopt a number of polices aimed at conserving energy. American households became more conservation-minded and industries increased their energy efficiency. U.S. farmers also decreased their energy use significantly. Between 1978 and 1993, energy (excluding electricity) used by agriculture declined 25% (USDA, 1997; USDA, 1980-94). The U.S. Congress set fuel efficiency standards for the automobile industry. The U.S. government adopted building energy-efficiency standards and required government motor fleets to purchase alternative fueled vehicles. Supply and demand adjustments helped reverse the trend of rising oil prices of the 1970s and 1980s.

However, by the end of the 1990s, increasing world energy demand began to exert upward pressure on oil prices and supply disruptions in the natural gas industry caused major price shocks in the U.S. energy sector. Uncertain energy supplies and homeland security concerns triggered by the terrorist attacks on September 11, 2001 have caused policymakers to intensify their efforts to secure our long-term energy sources. The purpose of this paper is to review U.S. renewable energy policy and describe its effectiveness in advancing the use of renewable fuels.

The Role of Energy Policy

There have been several approaches used to adopt renewable energy policies, including Federal energy legislation adopted to increase the use of renewable energy through mandates and tax incentives. Federal environmental polices, which indirectly affect renewable energy use, have been passed by Congress in recent years with a major effect on renewable energy development. In addition, State legislation has been used as an effective tool to stimulate renewable energy demand. Finally, agricultural legislation has recently been used to create renewable energy policies and programs.

Federal Energy Legislation

One of the earliest energy policies aimed at increasing the domestic energy supply and addressing energy security concerns was the National Energy Act of 1978 (NEA). The NEA established the Public Utility Regulatory Policies Act of 1978 (PURPA), a regulatory mandate that encouraged facilities to generate electricity from renewable energy sources (Gielecki, Mayes, & Prete, 2001). A major goal of PURPA was to foster the development of biopower by requiring utilities to buy electricity generated from small power plants using renewable energy sources (Energy Information Administration, 1996).

Much of the success of corn ethanol can be attributed to government incentive programs starting in the 1970s. The motor fuel excise tax exemption was originally passed by the Energy Tax Act of 1978, giving ethanol blends of at least 10% by volume a $0.40/gallon exemption on the

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Federal motor fuels tax. Enacted in 1980, the Energy Security Act offered insured loans to small ethanol plants, producing less than one million gallons per year. Also in 1980, the Crude Oil Windfall Tax Act extended the ethanol motor fuel excise tax exemption and provided blenders the option of receiving the same tax benefit by using an income tax credit instead of the fuel tax exemption. Since 1980, various tax laws have been adopted changing the level of the tax credit that currently stands at $0.51/gallon through 2010.

The Energy Policy Act of 1992 (EPACT) extended the fuel tax exemption and the blender's income tax credit to two additional blend rates containing less than 10% ethanol. The two additional blend rates were for gasoline with at least 7.7% ethanol and for gasoline with 5.7% ethanol. The EPACT also established a number of alternative-fueled vehicle (AFV) requirements for government and state motor fleets that have encouraged biofuel use. The Energy Conservation Reauthorization Act of 1998 amended EPACT to include biodiesel fuel use credits. Under this law, fleet operators are allowed one alternative-fueled vehicle credit for using 450 gallons of biodiesel.

The use of AFVs is also increasing in the private sector, primarily due to the Alternative Motor Fuels Act that was passed in 1988 to encourage auto manufacturers to produce cars that are fueled by alternative fuels, including an ethanol/gasoline blend containing 85% ethanol called E85. The law provides credits to automakers towards meeting their corporate average fuel efficiency (CAFE) standards. Automakers can lower their average fuel economy requirements by receiving credits for producing alternative-fueled vehicles that meet government requirements. Several auto manufacturers offer various models that run on both E85 and gasoline. About 3.5 million of these vehicles, called flexible fuel vehicles (FFVs), were on the road in 2004 (National Ethanol Vehicle Coalition, 2004). This program, however, has been criticized because most FFV owners usually use gasoline instead of ethanol, because E85 fueling stations are few in number.

Biodiesel received a fuel tax credit, similar to that of ethanol, with the American Jobs Creation Act of 2004, called the Jobs Bill. Starting in 2005, biodiesel blenders can receive a credit of $1.00 per gallon of biodiesel made from oil crops and animal fats and a $0.50 per gallon credit for biodiesel made from recycled fats and oils. The tax credit was initially set to expire on December 31, 2006; however, it was extended through 2008 by the Energy Policy Act of 2005. In addition, the jobs act extended the ethanol tax credit to 2010.

The the biodiesel tax credit has already had a major impact on the emerging biodiesel industry. Largely due to this tax credit, biodiesel production increased from about 25 million gallons in 2004 to over 90 million gallons in 2005. According to the National Biodiesel Board, there are currently 53 plants producing biodiesel in the United States, with another 40 plants expected to come online soon.

Production tax credits have also been used to encourage electricity generated by qualified energy resources, including biomass, and some animal wastes (Gielecki, Mayes, & Prete, 2001). The EPACT established a 10-year $0.018 per kilowatt-hour (kWh) production tax credit for biomass plants, wind energy, and other renewable energy production. This program has been especially important to growth in the wind industry that depends on the tax credit to encourage investment. When the tax credit expired in 2003, financing of new wind power installations came to a halt. Fortunately for wind-energy advocates, the production tax credit was extended to the end of 2005 by the Jobs Bill, and the Energy Policy Act of 2005 extended it through 2007.

Environmental Policies Stimulate Renewable Energy Demand

Policymakers have recognized that there is a significant opportunity to reduce pollutants and greenhouse gas (GHG) emissions by replacing fossil energy with renewable energy and bioproducts derived from agriculture. Ethanol and biodiesel are prime examples. Ethanol, which is 35% oxygen, improves combustion, and reduces carbon monoxide emissions, particulate matter, and other harmful air pollutants (Environmental Protection Agency, 2002). Likewise, biodiesel has many desirable environmental properties. It is nontoxic, biodegradable, and biodiesel exhaust emits less toxic air emissions, carbon monoxide, and particulate matter than petroleum diesel (Graboski & McCormick, 1998). Biodiesel also contains no sulfur.

GHG emissions can be reduced using ethanol and biodiesel compared with gasoline and diesel. Biofuels have the advantage that the plants grown each year to produce the fuel sequester carbon, which offsets the carbon released during fuel combustion (National Renewable Energy Laboratory, 1998; Wang, Saricks, & Santini, 1999; Levelton Engineering Ltd., (S&T)^2 Consulting Inc., & J.E. & Associates, 1999). Another potentially large source of renewable energy is livestock waste that can be turned into electricity through anaer-

obic digestion, which also reduces methane emissions from manure.

The first environmental policy to have a major effect on renewable energy was the Clean Air Act Amendments of 1990 (CAA). Provisions of the CAA established the Oxygenated Fuels Program and the Reformulated Gasoline (RFG) Program to control carbon monoxide and ozone problems. Both program fuels required 2% oxygen, and blending ethanol became a popular method for gasoline producers to meet the new oxygen requirements mandated by the CAA. The CAA also has provisions for controlling stationary sources of air pollution, such as the Acid Rain Program, that set tighter restrictions on sulfur dioxide and nitrogen oxides. Under this program, utilities may apply for bonus emission allowances as a reward for undertaking energy efficiency or renewable energy measures. Qualified renewable energy sources include wind, solar, geothermal, and biomass energy (U.S. Environmental Protection Agency, 2004); however, these energy sources are not widely used in the program.

Recent EPA diesel fuel regulations could have a major effect on the demand for biodiesel as a lubricity additive. EPA's low sulfur highway diesel fuel regulations begin July 2006 and the nonroad diesel fuel regulations begin June 2010. Lowering the sulfur in diesel fuel also lowers the fuel's lubricity. As a result, the demand for diesel fuel lubricity additives is expected to increase significantly. Research suggests that biodiesel is an excellent fuel lubricity agent (Schumacher, 2004). Only a small amount of biodiesel (1% to 2%) is needed to restore the lubricity level of ultra-low-sulfur diesel fuel. The lubricity additive market could provide a much larger market than the niche markets that currently exist for biodiesel.

State Renewable Energy Programs

There are also many U.S. state programs designed to encourage the growth in renewable energy use. States encourage renewable energy use through tax credits, production incentives, and renewable energy mandates. For example, over 20 states have "Renewable Energy Portfolio Standards" that require utilities to generate a certain percentage of their power from renewable energy sources (North Carolina Solar Center, 2005). The most aggressive state in promoting renewable fuels is Minnesota, which has consumption mandates for ethanol and biodiesel.

Farm Policy Directed at Energy

Farm policies have only recently been directed at energy, becoming an explicit policy goal in farm programs in the late 1990s, with a provision in the USDA's FY 2000 Appropriations Act. This provision authorized the establishment of pilot projects for harvesting biomass on lands set aside from crop production under the Conservation Reserve Program (CRP).

In 2000, USDA initiated the Commodity Credit Corporation (CCC) Bioenergy Program to stimulate demand and alleviate crop surpluses, which were contributing to low crop prices and farm income, and to encourage new production of biofuels. Since ethanol dominates the renewable fuels market in the United States, most of the funds went to ethanol plants. However, the few biodiesel plants that were in operation in 2000 took advantage of the CCC payments and the Program spurred new investment in biodiesel facilities.

Major agricultural disaster and crop insurance legislation, the Agricultural Risk Protection Act of 2000 (ARPA), was signed into law in June 2000. Title III of ARPA, the Biomass Research and Development Act of 2000, directed the agriculture and energy secretaries to cooperate and coordinate polices to promote research and development leading to the production of bioproducts. In particular, Title III established a biomass research and development initiative that authorized financial assistance for public and private sector entities to carry out research on bioproducts. The objectives of the initiative include enhancing the productivity and sustainability of biomass production and decreasing its cost. While the Department of Energy (DOE) initially undertook research activities under the statute, USDA did not receive funding for the initiative until enactment of the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill).

The 2002 Farm Bill contained the first energy title in Farm Bill history. The energy title, Title IX, created a range of programs through 2007 to promote bioenergy and bioproduct production and consumption. Key provisions include Section 9002, which mandates the Federal Biobased Product Procurement Preference Program (FB4P). Modeled on the existing program for purchase of recycled materials, the FB4P requires all Federal agencies to prefer bioproducts in their procurements.

Another program, the Biodiesel Fuel Education Program created by Section 9004, awards competitive grants to educate governmental and private entities with vehicle fleets and the public about the benefits of biodiesel fuel use. Section 9006 created the Renewable Energy Systems and Energy Efficiency Improvements Program, a loan, loan guarantee, and grant program to assist eligi-

ble farmers, ranchers, and rural small businesses in purchasing renewable energy systems and making energy efficiency improvements. Another program aimed at encouraging renewable energy investment in rural areas is the Value Added Grant Program (VAGP). The VAGP makes funds available to farm families and rural businesses to help them develop new value-added products, such as ethanol and biodiesel. The VAGP was created by the Agricultural Risk Protection Act of 2000 and amended by Section 6401 of the 2002 Farm Bill.

The energy title of the 2002 Farm Bill also amended the Biomass Research and Development Act of 2000 by extending its termination date to September 30, 2006, and by providing funding to USDA for the research initiative. A wide range of projects have been funded, from addressing biomass production issues to improvements in biorefinery production processes.

Section 9010 of the bill codified the CCC Bioenergy Program and broadened it to allow biodiesel made from animal byproducts and fat, oils, and greases (including recycled fats, oils, and greases). Initially, only biodiesel made from oil crops received payments. This program expires in 2006.

The 2002 Farm Bill was also notable for greatly expanding natural resource conservation and environmental programs, such as the Environmental Quality Incentives Program (EQIP), which was created by the Federal Agriculture Improvement and Reform Act of 1996 (1996 Farm Bill), and reauthorized in the 2002 Farm Bill. EQIP offers incentive and cost-share payments to implement conservation practices, including the use of electric generators that run off of methane gas produced from animal waste. The CRP was continued and a new program, the Conservation Security Program (CSP) was authorized. The CSP was conceived as a way to reward producers who have been good stewards in the past and those who can improve their conservation performance in the future. The program provides financial and technical assistance to producers for conservation and improvement of soil, water, air, energy, plant, and animal life on cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation.

Energy Policy Act of 2005 – H.R. 6

With recent record oil and natural gas prices and increasing energy supply uncertainty, there has been much interest in passing new energy legislation. In early 2001, President Bush's National Energy Policy Development Group laid out a proposal for a long-term, comprehensive strategy to lessen the impact of energy price volatility and supply uncertainty (NEPDG, 2001). The U.S. Congress responded to the energy situation and President Bush's energy strategy by enacting the Energy Policy Act of 2005. The 2005 Act reflects President Bush's general approach by creating programs and policy aimed at increasing and diversifying domestic energy production. It includes key provisions to help diversify domestic energy production through the development of renewable fuels. The 2005 Act mandates a renewable fuel phase-in called the renewable fuels standard (RFS), requiring U.S. fuel production to include a minimum amount of renewable fuel each year, starting at 4 billion gallons in 2006 and reaching 7.5 billion gallons in 2012. After 2012, renewable fuel production must grow at least the same rate as gasoline production. The RFS provision also eliminates the requirement for reformulated gasoline to contain 2% oxygen and establishes a credit trading system. This gives gasoline suppliers the flexibility to use less renewable fuel than required by the RFS and still meet the standard by purchasing credits from suppliers who choose to use more renewable fuel than required. The RFS is expected to be satisfied by ethanol and biodiesel, but ethanol will likely provide the bulk of the mandated fuel.

The 2005 Act creates a Cellulosic Biomass Program to encourage the production of cellulosic ethanol. Under this provision, every one gallon of ethanol made from biomass, such as switchgrass, crop residues, and tree crops, counts as 2.5 gallons towards satisfying the RFS. Beginning in 2013, the applicable volume of renewable fuel required by the RFS must include a minimum of 250 million gallons of fuel derived from cellulosic biomass. However, the technology for converting biomass into "cellulosic" ethanol has not been fully developed, so a number of other provisions were adopted to stimulate research and development on biomass conversion technologies that could take advantage of less expensive energy crops and significantly expand the resource base for ethanol production. The Cellulosic Biomass Program also has the authority to provide loan guarantees for up to $250 million per production facility. A $650 million grant program was authorized to fund research on cellulosic ethanol production, and $550 million is authorized for the DOE to create an Advanced Biofuels Technologies Program.

The biodiesel fuel excise tax credit was extended to 2008. In addi-

tion, a small biodiesel producer credit was created that grants biodiesel producers a $0.10 per gallon income tax credit. Only biodiesel plants that have an annual capacity of 60 million gallons or less are eligible for the producer tax credit. This provision also modified the small producer tax credit received by ethanol producers. Under previous legislation, small ethanol producers were already eligible for a $0.10 per gallon production income tax credit if their capacity was 30 million gallons or less. The 2005 Energy Bill increased the small producer capacity limit for ethanol plants to 60 million gallons per year or less. The tax credit can only be taken on the first 15 million gallons of production for both ethanol and biodiesel producers and it is capped at $1.5 million gallons per year. The bill also provides a 30% tax credit for the cost of installing fueling facilities for alternative-fueled vehicles that run on 85% ethanol, natural gas, liquid natural gas, propane, hydrogen, and any blend of diesel fuel and biodiesel containing at least 20% biodiesel.

The 2005 Energy Act updates the Biomass Research and Development Act of 2000 (as modified under section 9008 of the 2002 Farm Bill). Originally a competitive grant program aimed at achieving scientific break-through leading to the development of biofuels, biopower, and bioproducts, the 2005 Act refines the program's objectives and redirects research emphasis.

The Sugarcane Ethanol Program was established to create a program to study the conversion of sugarcane, bagasse, and other sugarcane byproducts to ethanol in Hawaii, Florida, Louisiana, and Texas. The Sugar Ethanol Loan Guarantee Program was authorized to help finance commercial demonstration projects for ethanol derived from sugarcane, bagasse, or other sugarcane byproducts.

A USDA grants program was established by the 2005 Act to assist small biobased businesses, encourage bio-economy development in rural areas, and support energy feedstock production demonstration projects by farmer-owned enterprises. In addition, USDA was authorized to establish an education and outreach program to provide training and technical assistance to feedstock producers and encourage investment in processing facilities. Funds were also authorized for public education and outreach to familiarize consumers with biofuels and bioproducts.

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