
The Renewable Fuel Standard

Timeline of a Successful Policy

Biotechnology Industry Organization (BIO)

2005

- Energy Policy Act of 2005 becomes law, enacting RFS1.
- Ethanol production is 3.9 billion gallons, biodiesel 112 million gallons.



2007

- EPA finalizes RFS1 rules and begins program, offering compliance through Renewable Identification Numbers (RINs).
- The Energy Independence and Security Act of 2007 becomes law, enacting RFS2.
- **Verenium (BP Biofuels)** breaks ground on 1.4 million gallon cellulosic biofuel demonstration.



2009

- EPA proposes rules for RFS2.
- More than **30 cellulosic and algae biofuel** pilot and demonstration biorefineries are operating or in planning stages, including Coskata and DuPont Cellulosic Biofuels.
- More than 12 companies in the United States and Canada have planned commercial biorefineries.



2010

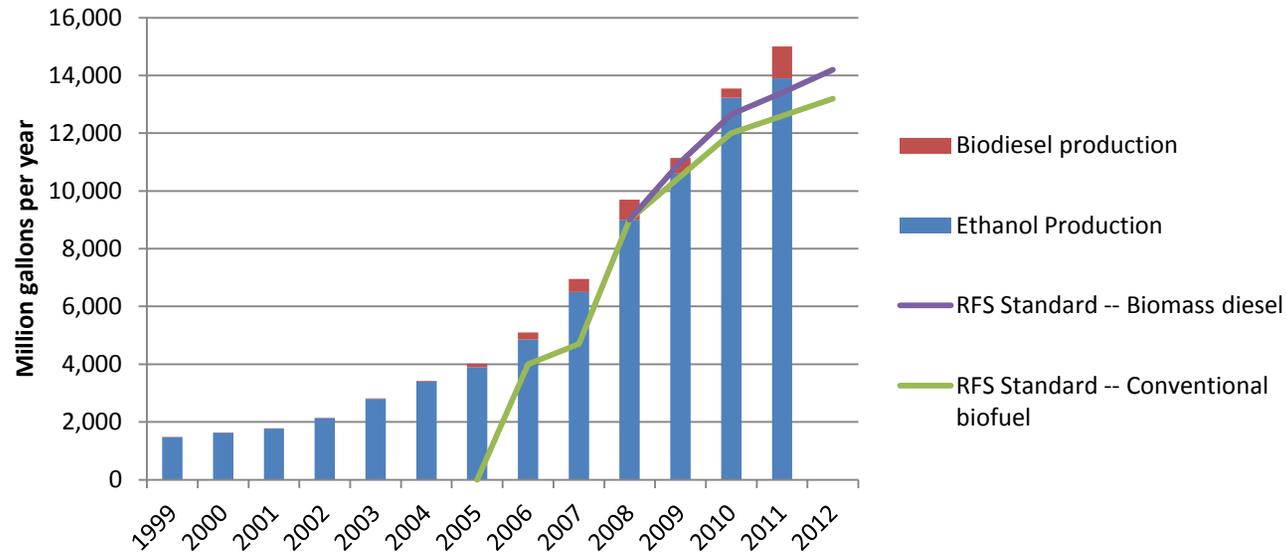
- EPA publishes final rules for RFS2, which takes effect in July.
- Additional demonstration facilities begin operations, including Fiberight



2011 - 2012

- Companies break ground on commercial-scale cellulosic biorefineries, including **INEOS Bio, Abengoa, KiOR and POET-DSM**. Projected completion and start up of biorefineries ranges from Q2 of 2012 to Q4 of 2014.

Biofuel Production Growth and RFS Requirements



Abengoa Bioenergy, Hugoton, Kans.

26.5 million gallons per year, cellulosic ethanol.

Start Date: 4Q 2013.



Figure 1: Abengoa Bioenergy biorefinery project stack yard.

Figure 2: Abengoa Bioenergy biorefinery construction progress, Feb. 2012.

BP Biofuels, Highlands County, Fla.

36 million gallon per year cellulosic biofuel biorefinery. 20,000 acre energy cane farm.

Start Date: 4Q 2014.



Figure 3: Energy cane from Henderson Liberty Farms in Highland County, Fla., April 2012.

BP Biofuels, Jennings, La.

1.4 million gallon per year cellulosic biofuel demonstration biorefinery.

Start Date: 1Q 2007.



Figure 4: BP Biofuels demonstration facility and feedstock processing, in operation since 2007.

Fibright, Blairstown, Iowa

6 million gallon per year cellulosic ethanol.

Start Date: 2Q 2013.



Figure 5: Fibright biorefinery undergoing renovation to cellulosic ethanol.

Gevo, Luverne, Minn.

22 million gallon per year biobutanol.

Start Date: 4Q 2012.



Figure 6: Gevo biorefinery undergoing renovation for biobutanol production.

INEOS New Planet Energy, Vero Beach, Fla.

8 million gallon per year cellulosic ethanol; 6 MW biomass electricity.

Start Date: 2Q 2012



Figure 7: INEOS Bio New Planet Energy groundbreaking February 2011.



Figure 8: USDA Sec. Tom Vilsack checks construction progress, August 2011.

Novozymes, Blair, Neb.

Commercial enzyme biorefinery.

Start Date: May 2012



Figure 9: Novozymes North America enzyme biorefinery at opening in May 2012.

POET-DSM Advanced Biofuels, Emmetsburg, Iowa

25 million gallons per year cellulosic ethanol.

Start Date: 3Q 2013.



Figure 10: POET-DSM groundbreaking March 2012.

Figure 11: POET-DSM corn stover stack yard November 2011.

Sapphire Energy, Columbus, N.M.

1 million gallon per year integrated algal biorefinery.

Start Date: 1Q 2014



Figure 12: Sapphire IABR construction progress November 2011.



Figure 13: Sapphire IABR ground preparation October 2011.

ZeaChem, Boardman, Ore.

250,000 gallon per year cellulosic ethanol and acetyl acid.

Start Date: 4Q 2011



Figure 14: ZeaChem demonstration biorefinery, aerial view.



Figure 15: ZeaChem demonstration facility under construction, September 2011.

Date	Event
July 29, 2005	<p>Congress passes the Energy Policy Act of 2005, with the first Renewable Fuel Standard (RFS1). President George W. Bush signs it into law (PL 109-58) on August 8, 2005. RFS1 sets annual standards for production and use renewable fuels, growing to 7.5 billion gallons by 2012, with 250,000 gallons to come from cellulosic sources beginning in 2012.</p> <p>Ethanol production reaches 3.9 billion gallons by year's end 2005. Biodiesel production is 112 million gallons.</p>
Sept. 7, 2006	<p>EPA proposes rules for RFS1 and asks Oak Ridge National Laboratories to estimate the energy security benefits of reducing foreign oil imports.</p> <p>Ethanol production reaches 4.9 billion gallons by year's end 2006. Biodiesel production reaches 250 million gallons.</p>
Feb. 16, 2007	<p>Verenium – a merger of Celunol Corp. and Diversa Corp. – breaks ground on a demonstration cellulosic ethanol biorefinery, with a capacity of 1.4 million gallons per year. The facility is commissioned in May 2009 and is later purchased by BP Biofuels.</p>
May 1, 2007	<p>EPA finalizes regulations for RFS1 for 2007 and beyond. EPA estimates the RFS1 will reduce emissions of benzene by as much as 4 percent and carbon dioxide equivalent greenhouse gas emissions between 8.0 and 13.1 million metric tons.</p>
Sept. 1, 2007	<p>RFS1 program begins. Obligated parties must demonstrate compliance on an annual basis through retirement of Renewable Identification Numbers (RINs) associated with each gallon of renewable fuel.</p>
Dec. 18, 2007	<p>Congress passes the Energy Independence and Security Act of 2007, containing an updated Renewable Fuel Standard (RFS2). President George W. Bush signs it into law (PL 110-140) on Dec. 19, 2007. RFS2 sets annual standards for production and use of both conventional and advanced renewable fuels, with conventional biofuel to reach 15 billion gallons by 2015 and advanced biofuel to reach 21 billion gallons by 2022, for a combined 36 billion gallons.</p> <p>Conventional biofuel production reaches 6.5 billion gallons by year's end 2007. Biodiesel production reaches 450 million gallons.</p>
May 26, 2009	<p>EPA proposes rules for RFS2 for 2010 and beyond, including four separate standards for biomass-based diesel,</p>

	cellulosic biofuel, advanced biofuel and conventional biofuel. EPA formulates a new lifecycle assessment (LCA) model and publishes preliminary estimates of greenhouse gas emissions from various feedstocks, production processes, discount rates and projection timelines. EPA commissions peer reviews of model.
Oct. 15, 2009	<p>Coskata commissions its Lighthouse demonstration cellulosic ethanol biorefinery in Madison, Pa., with a capacity of 40,000 gallons per year. The demonstration runs for two years.</p> <p>Conventional biofuel production reaches 10.6 billion gallons by year's end 2009. Biodiesel production declines from 700 million gallons in 2008 to 545 million gallons in 2009, as industry awaits final rules for RFS and reauthorization of tax policies.</p>
Jan. 29, 2010	DuPont Danisco Cellulosic Ethanol officially opens its demonstration cellulosic ethanol biorefinery in Vonore, Tenn., with a capacity of 250,000 gallons per year. The facility employs 40 people. Genera Energy – wholly owned by the University of Tennessee – supplies corn stover and switchgrass feedstocks to the facility, contracting with area farmers.
March 26, 2010	<p>EPA publishes final regulations for the RFS2 for 2010 and beyond, setting the cellulosic standard at 6.5 million gallons for 2010 and combining the 2009 and 2010 standards for biomass-based diesel, keeping the two other standards at statutory levels.</p> <p>EPA determines that biofuels made from a short list of approved cellulosic feedstocks comply with RFS greenhouse gas targets. The list includes:</p> <ol style="list-style-type: none"> 1. Crop residues such as corn stover, wheat straw, rice straw, citrus residue; 2. Forest material including eligible forest thinnings and solid residue remaining from forest product production; 3. Secondary annual crops planted on existing crop land such as winter cover crops; 4. Separated food and yard waste including biogenic waste from food processing; 5. Perennial grasses including switchgrass and miscanthus.
May 6, 2010	Fiberight LLC commences production of cellulosic ethanol from municipal solid waste at a converted corn ethanol biorefinery in Blairstown, Iowa. When the second phase of construction is complete, the facility will produce 6 million gallons of cellulosic biofuel annually.
July 1, 2010	RFS2 regulations take effect. Obligated parties must now demonstrate compliance with all standards on an annual basis, with RFS1 RINs remaining valid.
Dec. 9, 2010	EPA finalizes the RFS2 standards for 2011, setting the cellulosic biofuel standard at 6.6 million gallons and

	keeping all other standards at statutory levels.
Dec. 21, 2010	<p>EPA finalizes rules for Moderated Transaction System (EMTS) to track trading and retirement of RINs.</p> <p>Conventional biofuel production reaches 13.2 billion gallons by year's end 2010. Biodiesel production declines again to 315 million gallons.</p>
Feb. 9, 2011	INEOS Bio New Planet Energy breaks ground in Vero Beach, Fla., on the Indian River BioEnergy Center, a commercial biorefinery that will produce eight million gallons of cellulosic ethanol and six megawatts of power when fully operational. The project creates 175 construction jobs and the operational biorefinery will employ 50 permanent workers. INEOS Bio has operated a pilot facility in Fayetteville, Ark., since 2003.
May 12, 2011	KiOR breaks ground on a commercial biorefinery in Columbus, Miss., to produce 11 million gallons of renewable crude from wood chips. KiOR began production at a demonstration facility in Pasadena, Texas, the first quarter of 2010.
Sept. 16, 2011	BP Biofuels begins planting 300 acres of energy cane seeds in Highlands County, Fla., in preparation for an eventual 20,000 acre farming operation and a 36 million gallon per year commercial cellulosic biofuel biorefinery.
Sept. 21, 2011	Abengoa Bioenergy finalizes permits and begins construction of a commercial cellulosic biorefinery in Hugoton, Kansas, which will produce 23 million gallons of cellulosic biofuel plus renewable electricity for the facility. The biorefinery will employ 65 people and create 250 construction jobs over two years. Abengoa contracts with local biomass producers and farmers to secure up to 315,000 lbs. of crop residue each year.
Jan. 5, 2012	<p>EPA issues direct final rule determining that additional feedstocks and production methods meet the requirements for advanced and cellulosic biofuels:</p> <ul style="list-style-type: none"> • Biodiesel, renewable diesel, naphtha and liquified petroleum gas from camelina qualify as advanced biofuel; • Ethanol, renewable diesel, and naphtha from energy cane, giant reed and napier grass qualify as cellulosic biofuel; • Renewable gasoline and blendstock from crop residue and cellulosic components of municipal solid waste in a facility that uses natural gas or biomass for heat and power qualify as cellulosic biofuel; • Esterified biodiesel qualifies as biomass based diesel and advanced biofuel. <p>ZeaChem completes construction and begins operation of a demonstration cellulosic biorefinery in</p>

Boardman, Ore., producing intermediate chemicals acetic acid and ethyl acetate. By April, the company begins construction of a second phase to produce up to 250,000 gallons of cellulosic ethanol from acetic acid, expected to be completed in 2012. The demonstration biorefinery will employ 100 full-time workers and create 338 construction jobs. ZeaChem also contracts with Greenwood Resources and area farmers to supply coppiced willow trees from 7,000 acres surrounding the biorefinery.

Jan. 9, 2012

EPA finalizes 2012 RFS2 standards, setting the cellulosic standard at 8.65 million gallons.

March 5, 2012

EPA withdraws direct final rule issues on Jan. 9, due to adverse comments, and moves forward with proposed rule and additional comment period.

March 13, 2012

POET-DSM Advanced Biofuels breaks ground on a commercial biorefinery in Emmetsburg, Iowa, to produce 25 million gallons per year of cellulosic ethanol. The biorefinery will employ 40 full time workers and create 200 construction jobs. POET had previously completed the feedstock stackyard and worked with farmers for two years to begin harvesting and delivering corn stover to the facility. POET had also operated a pilot scale biorefinery in Scotland, S.D., since 2009.