EXXONMOBIL GOES GREEN

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Abstract

In today's economy, the price of oil impacts many products from gasoline to groceries. The growing use of renewable energy sources, particularly ethanol based fuels, is a potential threat to the gasoline industry. ExxonMobil, the world leader in the oil industry is faced with the decision of expanding ethanol production, and how much to produce and which biomass to use. Public opinion on the skyrocketing price for gasoline and government regulations are the catalyst creating transformations within the industry.

BACKGROUND

ExxonMobil, a world leader in the oil industry, made record profits, 40 billion dollars, for the fiscal year 2007. [3] In today's economy, the price of oil impacts many products from gasoline to groceries. ExxonMobil prides itself on developing proprietary technology that increases the economies of scale and cuts costs of petroleum production. The volatile price of oil and gasoline in today's economy makes a competitive advantage more important to the future success of ExxonMobil. ExxonMobil must prepare to transform with the petroleum industry. The growing use of renewable energy sources is a potential threat to the gasoline industry as it stands currently. Public opinion and government regulations are the catalyst creating transformations within the industry.

The Energy Independence and Security Act of 2007, which sets requirements for 36 billion gallons of bio-fuels (21 billion gallons of non-cornstarch ethanol) to be mixed with gasoline sold by the year 2022, creates a substantial shortage of ethanol in the market. The bio-fuel market created by the Energy Act is an opportunity for ExxonMobil to extend its product line and create a competitive advantage over its competitors. ExxonMobil's research and development is currently focused on refinery efficiencies. ExxonMobil's focus on refinery efficiencies leads to stagnant product lines and limits the company's growth. Currently, ExxonMobil purchases corn-based ethanol for blending on the open market like its competitors. The use of cornstarch ethanol is impacting food prices. To reduce the increase of food prices, ExxonMobil can find innovative solutions to produce the required product, ethanol, from any carbon-based biomass. Producing non cornstarch ethanol will allow ExxonMobil to reduce its cost and it will decrease the impact cornstarch ethanol is having on the food supply. It should also prove to improve the company's image, while reducing its cost.

With proven oil and gas reserves, as well as efficient production and distribution practices in place, the question is not if ExxonMobil could produce ethanol, but how much to produce and which biomass to use.

BIOMASS TO ETHANOL

ExxonMobil has different options to choose from to solve the above problems. The United States' production of ethanol focuses mostly on the production from corn. However, the following table shows that the corn-based fabrication is not very efficient. Table 1: The Biomass Yield per Acre shows corn-based ethanol has a lower overall annual yield per acre than other biomass sources. Corn-based ethanol also has the least greenhouse gas savings compared to the other biomass sources. There are other sources of ethanol such as switchgrass and woodchips that are much more effective and efficient than corn. [8] In the United States, corn is the easiest and most abundant agricultural crop in use. Farmers, looking for a way to increase the value of their crops, focused on corn. With the increase of food prices, consumers are realizing that using a biomass that is also used for a food source is not such a good idea financially. Understanding the financial impact of corn prices to consumers, researchers have found other biomass that can be used to produce ethanol without impacting food prices.

Table 1: Biomass Yield per Acre

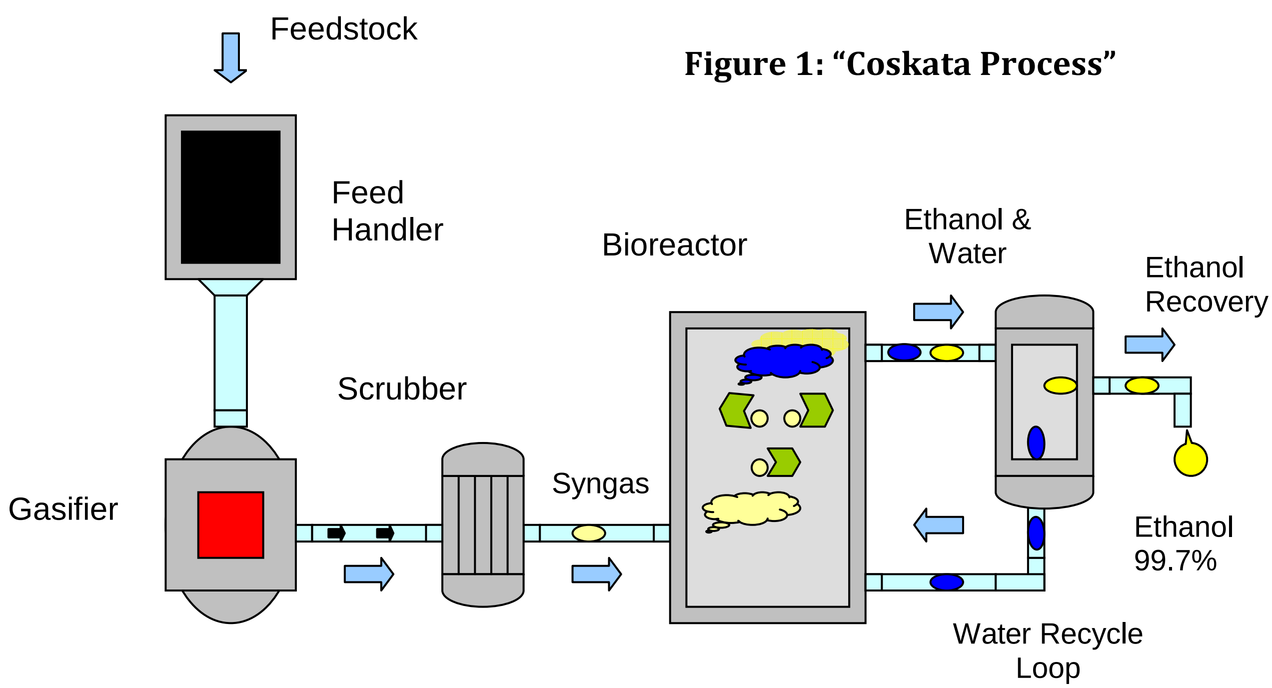
Crop	Annual yield (US gal/acre)	Greenhouse-gas savings (% vs. petrol)
Miscanthus	780	37–73
Switchgrass	330–810	37–73
Poplar	400–640	51–100
Sugar cane	570–700	87–96
Sweet sorghum	270–750	No data
Corn	330–420	10–20

Source (except sorghum): *Nature* 444 (December 7, 2006): 670-654.

To extract ethanol from different cellulose input, ExxonMobil will need to implement specific processes. Our research shows different ways to generate ethanol to include enzymatic conversion and acid hydrolysis. However, after further research, we found an innovative process presented by Coskata, Inc., a biology-based renewable energy company. Coskata's process uses not only switchgrass or corn, but also woodchips, landfill waste, and even old tires. The process starts with inputting renewable feedstocks and other carbon-based feedstock into a feed handler. From there, the feedstocks go into a gasifier where the process of gasification occurs. The gasifier breaks the chemical bonds in the input and converts it into a gas called synthesis gas, or "syngas." The syngas passes through the scrubber, which separates potential ethanol and energy. This energy is used to cool the syngas, which goes to the next step of the process, biofermentation. This phase occurs in the bioreactor where microorganisms consume hydrogen (H_2) and carbon monoxide (CO). As a result, the output of the process is ethanol (C_2H_5OH) and water (H_2O). Ethanol recovery, separating ethanol and water, occurs in membranes, reducing the inefficiency of distillation by 50%. The outcome of the process is 99.7% pure ethanol. Up to 85% of that ethanol can be mixed with gasoline. The water is reused in the process to avoid additional costs and waste. The following page presents Figure 1, the process based on the data from Coskata's Web site. [2]

ExxonMobil maintains economies of scale in oil refining and has the potential to achieve the same economies of scale in ethanol production. Economists estimate bio-fuels can be produced for sale at prices equal to or lower than average gas and diesel prices by 2015. [7] Low marginal cost of production of ethanol and greater marginal revenues are two reasons for ExxonMobil to consider moving into non-corn ethanol production. The automobile market is repositioning engines marketed for flex-fuel vehicles. Toyota, Ford, and Chevrolet are introducing flex-fuel vehicles in the form of cars, trucks, and sport utility vehicles. [4] [5] [9] These industry changes and the mandates by the government have created a large market for ExxonMobil to create an additional competitive advantage through investing.

Figure 1: "Coskata Process"



Current investment allocations are less than 2% of ExxonMobil's cash flow in research and development and only 4% in exploration. [6] ExxonMobil's management has a reputation for being conservative in their investment decisions. To align with management's cost-efficient goals, the bio-fuel production method chosen for our projections allows for ethanol production facilities to be built close to supply terminals where wholesale gasoline is stored. The close proximity of the ethanol plant to the terminals will keep transportation costs for the ethanol at a minimum. Ethanol cannot be transported in the existing gasoline pipelines because of corrosion concerns.

MARKET ENTRY PROJECTIONS

The Projected Investment and Return Schedule (Appendix) is a conservative approach to entering the cellulosic ethanol market. The schedule also includes projected costs and financial profits expected to result from the investment in the cellulosic ethanol production. As mentioned, The Energy Independence and Security Act of 2007 mandates the use of 36 billion gallons of ethanol annually by 2022. The expectations are that 15 billion gallons of cornstarch ethanol can be provided from corn crops in the U.S., the difference must be supplied from non-cornstarch ethanol. The projected entrance schedule allows for ExxonMobil to enter the ethanol market by providing 75% of the 21 billion gallons of non-cornstarch ethanol. The entrance schedule plans for investment and research over the next 14 years, in time to meet the 2022 deadline. Investments in building of ethanol plants, research, and development of the efficiency of ethanol production are included in the schedule. Production will not start until 2010, allowing time for the first plants to be built. The projection schedule plans for ExxonMobil to build four ethanol plants in the first two years, requiring a 1 billion dollar investment. The projection for the third year expects the same financial investments, but due to the learning curve, the schedule allows for six plants to be built during year three. Years four through eight require the investment to increase to 1.5 billion dollars. During this time, ExxonMobil can use the .5 billion dollar increase in invested money to concentrate on improving the efficiency of the production process. The projections allow for 59 plants to be built during the first eight years. Annual output is expected to increase from 100 million gallons to 250 million gallons per plant by 2022. The "Coskata process" currently allows cellulosic ethanol to be produced at a cost of one dollar per gallon. ExxonMobil should be able to reduce these production cost to 79 cents by 2022.

The changing economy presents some unknowns to projecting a production schedule; to adjust for these unknowns we made some assumptions. A fixed 38 cents per gallon production cost for gasoline was used to allow for changes in oil prices. A wholesale price of $2.40 per gallon was used for E85 (15% ethanol and 85% gasoline) in the entrance schedule. A conservative 12% cost of capital is used for the calculations. Tax savings and depreciation on the plants are not included in the calculations. Total investment would be 6.7 billion dollars, and the present value of the future cash flows is 495.3 billion dollars, leaving a net present value of 488.6 billion dollars for the investment.

The potential financial gains from investing in this bio-fuel process are not the only benefits ExxonMobil could experience. ExxonMobil has suffered a long-standing negative reputation in relation to its environmental record, and leadership has had an uphill battle following the March 24, 1989, 10.8 million-gallon oil spill into the Prince William Sound off the coast of Alaska. [1] Entering the bio-fuel market could be advantageous to its public image in two important ways. The first impact would come from utilizing the Coskata process. It does not pollute the environment, and it actually helps to clean it up by using trash, such as old tires, in the production process. The second impact is reducing the financial pressure on the food industry. The ability to supply 75 % of the cellulosic ethanol required by 2022 from non-corn based biomass would have a direct effect on slowing the escalating price for food. ExxonMobil has made some humanitarian efforts in terms of biodiversity conservation in recent years to buffer the public image of the company. These efforts have not been enough in scale to the 40 billion dollar profit earned in 2007 as evidenced by negative feedback from government officials and consumer rights groups. [3]

Entrance into bio-mass production of ethanol can help ExxonMobil reposition public perception and increase its efforts toward social responsibility while continuing to meet large profit goals. ExxonMobil has to answer to a variety of stakeholders, and the proposed entrance into the bio-fuel production market should satisfy stakeholders while allowing the company to sponsor more humanitarian programs. The bio-fuel production process recommended is the optimal solution to meet both profit demands of stakeholders and conservation demands of the public. ExxonMobil's entrance into bio-fuel production will help decrease the shortage created by government regulations and by the growth of commercial demand for non-corn based ethanol.

APPENDIX: Projected Investment and Return Schedule

Year		*# of Plants Built That Year*	*Total # of Plants*	*Year Production Per Plant (MilGal)*	*Production Each Year (MilGal)*	*Investment Each Year ($bln)*	*Cost Per Gallon ($)*	*Total cost ($bln)*	*Gas Cost Per Gallon ($)*	*E85 Cost Per Gallon ($)*	*Cost of Ethanol ($bln)*
2010	after 2	4	4	100	400	1	1	400.00	0.38	0.473	400.00
2011	3	6	10	100	1,000	1	1	1,000.00	0.38	0.473	1,000.00
2012	4	9	19	100	1,900	1.5	1	1,900.00	0.38	0.473	1,900.00
2013	5	10	29	140	4,060	1.5	0.95	3,857.00	0.38	0.4655	3,857.00
2014	6	10	39	160	6,240	1.5	0.92	5,740.80	0.38	0.461	5,740.80
2015	7	10	49	170	8,330	1.5	0.88	7,330.40	0.38	0.455	7,330.40
2016	8	10	59	175	10,325	1.5	0.855	8,827.88	0.38	0.45125	8,827.88
2017	9		59	200	11,800	0.8	0.84	9,912.00	0.38	0.449	9,912.00
2018	10		59	220	12,980	0.8	0.825	10,708.50	0.38	0.44675	10,708.50
2019	11		59	235	13,865	0.8	0.8	11,092.00	0.38	0.443	11,092.00
2020	12		59	243	14,337	0.8	0.785	11,254.55	0.38	0.44075	11,254.55
2021	13		59	247	14,573	0.8	0.775	11,294.08	0.38	0.43925	11,294.08
2022	14		59	250	14,750	0.8	0.769	11,342.75	0.38	0.43835	11,342.75

cost of capital 12%

Gallons of Gas	**Cost of Gas ($bln)**	**Total Cost ($bln)**	**Revenue ($bln) at $2.40/gallon**	**Profit Margin ($bln)**	**Year**	**Investment ($)**	**PV of Investment**	**Profit Margin ($)**	**PV of Profit Margin**
2,266.67	861.33	1,261.33	6,400	5,138.67	2	1,000,000,000	797,193,878	5,138,666,667	4,096,513,605
5,666.67	2,153.33	3,153.33	16,000	12,846.67	3	1,000,000,000	711,780,248	12,846,666,667	9,144,003,584
10,766.67	4,091.33	5,991.33	30,400	24,408.67	4	1,500,000,000	953,277,118	24,408,666,667	15,512,148,936
23,006.67	8,742.53	12,599.53	64,960	52,360.47	5	1,500,000,000	851,140,284	52,360,466,667	29,710,734,965
35,360.00	13,436.80	19,177.60	99,840	80,662.40	6	1,500,000,000	759,946,682	80,662,400,000	40,866,082,149
47,203.33	17,937.27	25,267.67	133,280	108,012.33	7	1,500,000,000	678,523,823	108,012,333,333	48,859,294,230
58,508.33	22,233.17	31,061.04	165,200	134,138.96	8	1,500,000,000	605,824,842	134,138,958,333	54,176,475,489
66,866.67	25,409.33	35,321.33	188,800	153,478.67	9	800,000,000	288,488,020	153,478,666,667	55,345,945,821
73,553.33	27,950.27	38,658.77	207,680	169,021.23	10	800,000,000	257,578,589	169,021,233,333	54,420,313,549
78,568.33	29,855.97	40,947.97	221,840	180,892.03	11	800,000,000	229,980,883	180,892,033,333	52,002,137,005
81,243.00	30,872.34	42,126.89	229,392	187,265.12	12	800,000,000	205,340,074	187,265,115,000	48,066,290,798
82,580.33	31,380.53	42,674.60	233,168	190,493.40	13	800,000,000	183,339,352	190,493,398,333	43,656,170,288
83,583.33	31,761.67	43,104.42	236,000	192,895.58	14	800,000,000	163,695,850	192,895,583,333	39,470,258,116

$6,686,109,642 Total Investment

$495,326,368,536 Total PV

NPV $488,640,258,893

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