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Economic Impact of a Second Generation Biofuels Facility

A Report of the Economic Impact Analysis Program

Authored by Brigid Tuck and William Lazarus

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A REPORT OF THE ECONOMIC IMPACT ANALYSIS PROGRAM

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EXECUTIVE SUMMARY

University of Minnesota Extension conducted an analysis of a proposed second generation biofuels plant. The proposed plant is expected to be co-located with an existing ethanol plant in southern Minnesota. The analysis revealed the following information.

Construction Impacts:

- Construction of the facility will create $59.5 million of economic activity in Minnesota, including 464 jobs and $35.6 million in labor income.
- Approximately half of the impact, $29.5 million will be directly generated by the construction companies. These companies will employ 230 individuals and pay $25.3 million to complete their construction duties.
- Construction impacts are temporary and will dissipate once construction is complete.
- These impacts are dependent on certain assumptions. Changing those assumptions would alter the calculated economic impact. The actual economic impact may vary from the calculated amounts if these assumptions turn out to be inaccurate.

Operation Impacts:

- Operations of the facility will create $34.6 million of economic activity in Minnesota, including 151 jobs and $8.4 million in labor income.
- The JetE plant will spend $11.8 million annually (other than feedstocks) in Minnesota to purchase inputs into its production process. The plant will employ 5 individuals and pay $516,000 in labor income.
- The plant itself is projected to have direct sales of $100.4 million annually. Federal incentives are expected to raise total revenue to $124.2 million.
- A major input to the production process is the feedstocks, which will be a mix of corn oil, soy oil, and non-food grade tallow. Because the feedstocks are by-products of other production processes (in the case of corn oil and tallow) and/or compete for limited cropland (in the case of soy oil), the utilization of the feedstocks by the plant is not expected to increase production of the main product (corn, soybeans, and meat). Therefore, the utilization of these feedstocks by the new plant is expected be offset by decreased utilization elsewhere for no net change in this aspect of the overall economic impact on Minnesota.
- Projected revenues and costs were provided to University of Minnesota Extension by the JetE company. Any changes in those projections will alter the economic impact analysis. Further, researchers did not review or verify any of the financial accounting of the proposed plant.

INTRODUCTION

Biofuels are fuels derived from biomass, which in turn, is biological material from living or recently living organisms. Biomass for use as a transportation fuel has been experimented with since the early invention of motorized transportation. However, due to its cost and relative efficiency, the use of petroleum oil derived from fossil fuels developed into the fuel of choice for transportation across the world.

The rising cost of fossil fuels, an interest in decreasing greenhouse gas emissions, and an interest in rural and agricultural development combined to increase interest in the development of biofuels for commercial use. The first generation of biofuel development focused on the use of starches, sugars, animal fats, and vegetable oil. While successful in terms of deriving fuel from these sources, first generation biofuels were limited in their ability to address certain key issues. First generation biofuels competed for food sources, were not always competitive with fossil fuels prices, and in some cases, did not reduce greenhouse gas emissions. Second generation biofuels have been developed to address these issues.

Second generation biofuels utilize residual components of feed crops such as corn, or dedicated energy crops such as switchgrass, miscanthus or hybrid poplar. Corn stover left over in the field following grain harvest is perhaps the most widely-discussed biofuel feedstock. One problem with corn stover is the possibility of increased soil erosion if too much is removed (see Brechbill et al. and Perrin et al. for reviews of the literature on environmental issues related to corn stover) (Brechbill, et al., 2011, Perrin, et al., 2012). Rather than corn stover, this study considers instead corn oil, soybean oil, and non-food grade tallow which are all by-products from other production processes. As technology and science advances, new potential sources for biofuel are being identified.

A new company, JetE, is working to develop a production process for turning spun corn oil, soybean oil, and non-food grade tallow into diesel and jet fuel. While these feedstocks have been identified as the primary inputs into the production of fuel, researchers continue to look at other possible sources, such as waste water algal oil, dairy waste, swine waste, and pyrolysis oils.

Researchers and designers with JetE have developed plans to integrate a second generation biofuels plant into an operational ethanol plant. The addition of the JetE production process into an ethanol plant allows for the co-utilization of key inputs. Ethanol plants have existing infrastructure and excess capacity that can be directed towards the production of biofuels.

The goal of this report is to examine the potential economic impact of a second generation biofuels production facility co-located at an existing ethanol plant. Economic impact considerations include two phases: 1) the initial, and temporary, construction of the facility and 2) the on-going operations of the facility once construction and set-up is complete.

ECONOMIC IMPACT ANALYSIS METHODOLOGY

Economic impact studies are based on input-output theory. Input-output theory was first developed by Nobel Prize winning Professor Wassily Leontief. His analytical framework has since been adapted for use in economic impact analysis. One adaptation is the IMPLAN model and database produced by MIG. IMPLAN's database contains an accounting for the flow of all goods and services both between industries (inter-industry) and between industry and final demand sectors (households, government, and exports). These interrelationships can be leveraged to predict how a change in one sector the economy will impact or affect other sectors in the economy.

Production (measured as sales), in input-output modeling, is considered to be equal to expenditures. Expenditures are grouped into two main categories: inputs and value added. Inputs are the raw goods and services purchased from other industries and used in the production process. Value added are the additional components that are factored into the price of a good. Value added includes labor, profit, rents and royalties, and indirect business taxes. The ratio by which a product is manufactured or a service delivered is fixed within the IMPLAN model and defines the dollar amounts of the purchases of inputs and value added.

IMPLAN is sometimes described as a fixed-price model. What that means is that when a change is entered for in a given industry, such as an increase in size, as when you add a new plant or firm, or possibly a decrease in size as when one shuts down, IMPLAN then looks at the other industries that supply that one, and calculates the size increases or decreases in those industries and the ultimate impacts on the household sector. While it is doing all that, it assumes that the changes are small enough that prices don't change, just quantities.

To model the economic impact of the JetE plant, therefore, certain data are required. First, data on the construction phase is needed. This includes an accounting of the type of construction activities (non-residential, manufacturing structure), estimates of labor expenditures, and estimates of the equipment purchases to outfit the plant. Second, data on the production of the fuel is necessary. This includes estimates of the inputs into the production process, as well as estimates of labor requirements and payments for rents, royalties, indirect taxes and profits. The information used in this report is provided from the JetE project development team.

STUDY AREA, SCENARIOS, DATA NEEDS, AND SOURCES

The first step in completing an economic impact analysis is identifying and defining the study area. The study area matters because the analysis focuses on the interrelationships between one industry and another, and between industries and value added sectors, and these are based on the local economy. Purchases made outside the study area are leakages and do not contribute to the calculated economic impact.

There are several study areas that could have been considered in this study. First, the current proposed site for the JetE plant is a co-location with an ethanol plant in southern Minnesota. Establishing a study area comprised of the county in which the plant is located along with surrounding counties was one potential option. Second, the proposed JetE plant is expected to purchase feedstock from suppliers in a 200-mile radius of the plant. Establishing a study area comprised of the counties within this radius (which would include some counties in Iowa) was another potential option. Finally, a study area comprised of the state of Minnesota was an option. The proposed location for the JetE plant is in southern Minnesota, but its exact location has yet to be determined. Further, a goal of this research study is that the results be transferrable to other potential plants of this nature. For those two reasons, **the study area of this analysis will be the state of Minnesota**. The impacts discussed in this report are based on the purchases made in the state.

A second step in completing economic impact analysis is to quantify the direct impacts. Direct impacts are entered into the IMPLAN model. The model then estimates the secondary or ripple effects of the activity (for more on the IMPLAN definitions, see appendix 1). Direct impacts must be quantified by the researcher. In this case, the direct impacts are:

- Construction of the JetE plant.

Operations of the JetE plant once operational, including feedstocks, labor, and overhead.

The measurement of direct impacts for each of these components will be detailed throughout this report.

CONSTRUCTION OF THE SECOND GENERATION BIOFUELS MANUFACTURING FACILITY

Direct Effects of Construction

Construction of the JetE manufacturing facility will generate a short-term economic impact in the study area. During the construction phase, expenditures for inputs and for value-added, such as labor, will occur. Once construction is complete, these expenditures will cease and the economic impact will dissipate. Construction impacts on the study area are driven by expenditures within the study area. As discussed, spending that occurs outside the Minnesota study area is viewed as a leakage that does not contribute to economic impact. This is especially crucial when considering equipment purchases. Much of the equipment to be used in the biofuel production process is highly specialized and available only from a select number of manufacturers who do not produce them in Minnesota. Therefore, as a general rule, expenditures for this equipment are not local expenditures and do not factor into the direct impact.

Construction of the plant is divided into two components. Construction activity related to the general preparation of the site for a manufacturing facility is known as "outside the battery limits" or OSBL. These construction costs are site-specific and would change if the plant is located elsewhere. Construction activity related to outfitting the building and its interior for the specific manufacturing process of JetE is known as "inside the battery limits" or ISBL. These costs are not site-specific and would not vary if the plant was located elsewhere. Estimates for the costs of construction were provided to University of Minnesota by JetE. These cost estimates are based on quotes provided to the company from industry experts using the design specifications of JetE.

Table 1 shows the projected expenditures for the construction ISBL. These purchases are primarily equipment for each of the proposed stages of fuel production. A cost estimate for purchasing equipment (column 3) was provided to JetE by the respective manufacturer. JetE then estimated a cost for installation based on industry standards. Researchers reviewed each piece of equipment and determined its likelihood of being manufactured in Minnesota. The conversion and separation process involve the purchase of pumps. Pumps of this kind are manufactured in Minnesota, though researchers cannot determine if the Minnesota-made pumps would be used in this installation. Expenditures for pumps were considered to be within the study area and included in the analysis. All other equipment was determined to be manufactured outside the study area and therefore not included in the direct impact calculations. The total cost for ISBL construction work is projected to be $41.8 million. Of this, an estimated $196,162 will be spent in Minnesota for equipment and an estimated $10.6 million in Minnesota for labor.

Table 1: JetE Construction Budget for Inside the Battery Limits Equipment

	Total Cost	Equipment Cost	Labor for Installation Cost	Equipment Purchase in Study Area	Labor Purchase in Study Area
Oil Pretreatment	$8,365,000	$2,390,000	$5,975,000	$0	$4,481,250
Conversion	$4,702,694	$2,970,097	$1,732,597	$140,997	$1,299,448
Separation	$1,229,015	$567,830	$661,185	$55,165	$495,889
Product Recovery and QA	$453,250	$161,875	$291,375	$0	$218,531
Gas Recycle and Conditioning	$7,793,000	$2,783,214	$5,009,786	$0	$3,757,339
Hydrogen Generation	$18,600,000	$18,600,000	$0	$0	$0
Tank Farm	$647,500	231,250	$416,250	$0	$312,188
Utilities and Flare	$0	$0	$0	$0	$0
Total (without contingency)	$41,790,459	$27,704,266	$14,086,193	$196,162	$10,564,645

Estimates provided by JetE

Labor comprises a significant share of the proposed costs for construction ISBL, as shown in column 4. A construction contractor has not yet been determined. Therefore, researchers assume that 75 percent of construction labor will be provided by locally-owned firms.

Table 2 shows the projected expenditures for construction OSBL. Since much of the OSBL work is site development and does not require equipment purchases, it is assumed that 75 percent of the total costs will be spent locally (primarily through the hiring of Minnesota-based construction companies). There are exceptions. Local expenditure totals for mechanical construction and electrical controls construction assume only the labor is local. Purchases for the specialty equipment to be installed are not considered a local purchase. Engineering services are anticipated to be 50 percent local and 50 percent provided by a firm from out-of-state. The total cost for OSBL construction is estimated at $32.3 million, $18.8 million which will be spent within Minnesota.

Table 2: JetE Construction Budget for Outside the Battery Limits		
	Total Expenditures	Local Expenditures
Site Work Utilities	$950,000	$712,500
Concrete and Masonry	$900,000	$675,000
Structural Steel	$0	$0
Exterior Enclosure	$500,000	$375,000
Interior Construction	$150,000	$112,500
Equipment	$0	$0
Specialty Contractors	$1,611,978	$1,208,984
Mechanical Construction	$8,465,822	$4,081,736
Electrical Controls Instrumentation Construction	$7,502,200	$3,617,132
General Conditions	$2,700,000	$2,025,000
Engineering Fees	$4,760,000	$2,380,000
General Contractors Fees	$4,760,000	$3,570,000
Total	$32,300,000	$18,757,852
		Estimates provided by JetE

TOTAL ECONOMIC EFFECTS OF CONSTRUCTION

The expenditures detailed in tables 1 and 2 are the direct effects of construction of the JetE facility. These are the expenditures made directly by the company to build the plant. As these expenditures are made, the businesses that supply the construction firms and their employees will increase their production in response. This action causes additional economic activity to occur. Adding the direct effects to the indirect and induced effects results in the calculation of total economic impact (see appendix 1 for definition of terms).

Table 3 details the total economic impact of the construction of the JetE facility in Minnesota. As shown in tables 1 and 2, the direct spending by JetE in Minnesota for construction will be $29.5 million. The model estimates that 230 people will be employed to construct the facility and will be paid $25.3 million in labor income. As a result of this spending, a total of $59.5 million in economic activity will be created in Minnesota, employing 464 people, and paying $35.6 million in labor income. Labor income is a component of output and should never be added to output.

Table 3: Economic Impact of Construction of Second Generation Biofuels Plant in Minnesota

	Output	Employment	Labor Income
Direct	$ 29,518,658	230	$ 25,294,641
Indirect	$ 2,528,197	17	$ 928,959
Induced	$ 27,492,281	217	$ 9,362,189
Total	$ 59,539,135	464	$ 35,585,789

Estimates by University of Minnesota Extension

Construction Impact Sensitivity Analysis

In the analysis of construction impacts created by the JetE manufacturing plant, researchers made several assumptions. One assumption is that 75% of labor involved in the project is provided by Minnesota-based firms. A second assumption is that the project meets its budget and does not need budgeted contingency dollars. Sensitivity analysis allows for those assumptions to be relaxed and to see how this changes the results of the analysis.

Table 4 details the first sensitivity analysis. This analysis assumes 75 percent of the labor used in the construction project is local, but that the project costs exceed estimates and contingency funds are spent. When contingency funds are used, the total economic impact increases to $69.1 million. This includes 538 employees who are paid $40.6 million in compensation.

Table 4: Economic Impact of Construction of Second Generation Biofuels Plant in Minnesota, Sensitivity Analysis 1: 75 Percent Local Labor, Contingency Funds Used

TOTAL	Output	Employment	Labor Income
Direct	$ 34,256,910	267	$ 28,680,885
Indirect	$ 3,455,854	23	$ 1,274,163
Induced	$ 31,388,816	248	$ 10,689,341
Total	$ 69,101,580	538	$ 40,644,389

Estimates by University of Minnesota Extension

A second scenario is shown in table 5. This sensitivity analysis assumes that 50 percent of the labor is local and that no contingency funds are used in the construction of the plant. Under these assumptions, total economic impact of plant construction falls to $41.4 million, including 330 jobs and $24.5 million in labor income.

Table 5: Economic Impact of Construction of Second Generation Biofuels Plant in Minnesota, Sensitivity Analysis 2: 50 Percent Local Labor, No Contingency Funds Used

TOTAL	Output	Employment	Labor Income
Direct	$ 20,341,637	166	$ 17,324,543
Indirect	$ 2,110,815	14	$ 771,802
Induced	$ 18,936,342	150	$ 6,448,251
Total	$ 41,388,794	330	$ 24,544,596

Estimates by University of Minnesota Extension

OPERATIONS OF A SECOND GENERATION BIOFUELS MANUFACTURING FACILITY

Direct Effects of Operations

Once construction activities are complete, the facility will begin to produce fuel. Sales of the fuel, along with federal incentives, will generate revenue for the plant. Additionally, the production of fuel will require inputs, including goods and services to make the product, as well as labor. These expenditures will create economic activity in the state economy. Unlike construction impacts, which dissipate after construction is complete, the operations impacts will reoccur as long as the plant is operational. The next section of this report will quantify the economic impact of operations of the proposed plant.

JetE provided to University of Minnesota Extension their projected revenues and expenditures for the manufacturing facility. These estimates will be used here to determine the economic impact of the facility. The results are based on the JetE figures. If these figures change, the results will change as well.

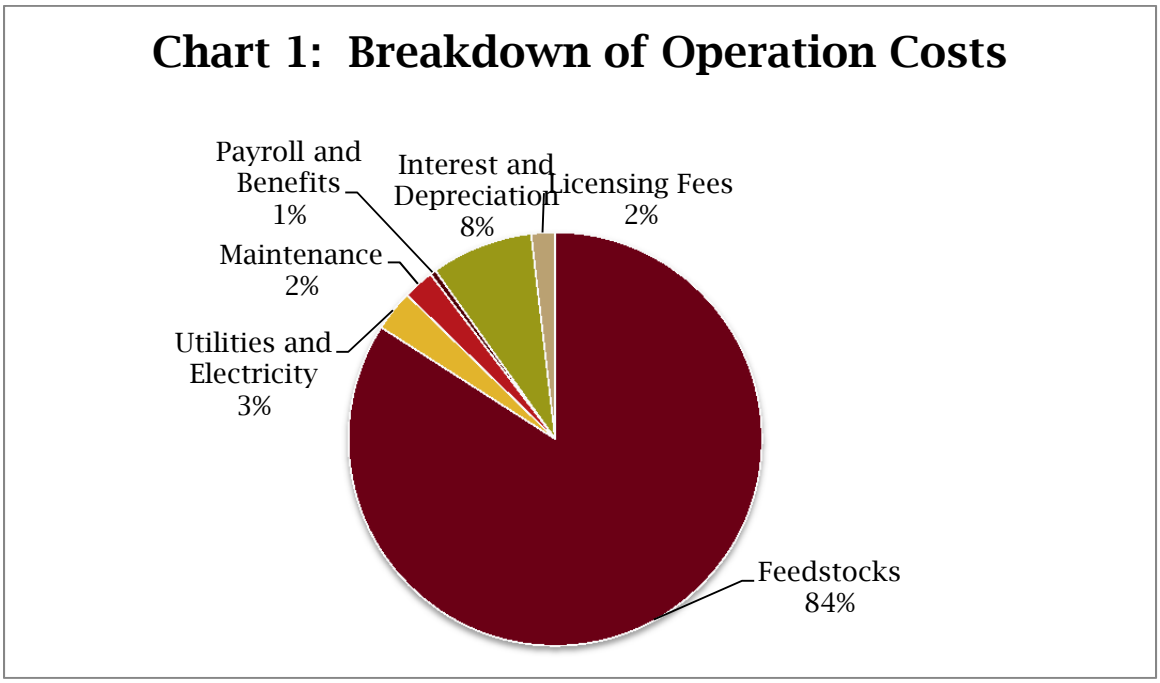
As shown in table 6, JetE company projections estimate the plant will generate $124.2 million in total revenues. Revenues will be derived from both direct sales of the final product and from federal tax incentives. Total sales of the fuel are estimated to be $100.4 million annually. The plant will employ 5 individuals and pay just over $500,000 in wages and benefits.

Table 6: Direct Effect of Second Generation Biofuels Plant Operations

Total Revenue	$124,164,081
Total Sales (Output)	$100,408,836
Employment	5
Labor Income	$516,131

Indirect Effects of Operations

The production of fuel in the proposed plant will require the following inputs: feedstocks, utilities and electricity, interest and depreciation, maintenance, licensing fees, and payroll with benefits. Chart 1 illustrates the breakdown of input costs. The purchases of each of these will contribute to the economic impact of the plant in different ways. The next section of the report will quantify the impact of each input. The impact of the purchase of each of these inputs contributes to the indirect effect of the plant.



In total, the proposed JetE plant is estimated to expend $112.4 million annually to operate the plant. The majority of anticipated expenses are for feedstocks. In total $94.1 million, or 84 percent of total expenditures, will be spent to purchase feedstocks. An additional $17.8 million will be spent for operating costs. See table 7.

Table 7: Total Estimated Operating Expenditures, Second Generation Biofuels Plant

Feedstocks (corn oil, soy oil, tallow)	$94,053,122
Utilities and Electricity	$3,582,704
Maintenance	$2,704,035
Interest and Depreciation	$8,935,045
Licensing Fees	$2,081,185
Payroll and Benefits	$516,131
Total	$112,372,223

Estimates provided by JetE

Feedstocks

Feedstocks are the largest single input into the JetE production process. There are several types of biomass which can be integrated into the JetE production process. Through a study of the availability of biomass within range of the plant, JetE has determined that initially corn oil, soy oil, and tallow will be the primary feedstock inputs for the proposed plant.

Economic impact is created when a new activity occurs. The oils and tallows used in the production process will be non-food grade commodities that are byproducts of other production processes. For example, corn oil is a byproduct of ethanol production. The availability of excess corn oil from the production process is a primary reason for co-locating the JetE facility with an ethanol plant. The soybeans that would provide soy oil compete for limited cropland in the state so soybean acreage is unlikely to increase significantly due to the soy oil demand by the JetE plant. These considerations suggest that the economic impacts of their utilization by this plant are likely to be offset by decreased utilization elsewhere, for no net economic impact from this aspect of the plant's operation. Therefore, this analysis assumes that the economic impact of the plant's operation will result from the non-feedstock inputs and services it will purchase and utilize, rather than from the utilization of the feedstock. Tables 9-15 below show the economic impacts of each of the non-feedstock inputs and services analyzed for this report. There is no economic impact table for feedstocks because of our assumption of reduced utilization elsewhere.

Increased demand for oils may have implications for the oils' market. Since the JetE utilization of feedstocks would be significant relative to the total U.S. supply of corn oil, a price impact may occur in the feedstock markets of corn oil, soy oil, and inedible tallow (see table 8). Given that the proposed corn oil is non-food-grade, it may be that the impact would be on the distillers grain oil energy content and market value as affected by its oil content, rather than on the food-grade corn oil market. Earlier, this report described the fixed-price nature of the IMPLAN model, which does not allow us to quantify such price impacts.

Table 8: Corn and Soy Oil Production and Utilization Relative To JetE Requirements

	2010-2011 Supply (million pounds)	2010-2011 Disappearance (million pounds)	Estimated JetE Utilization (million pounds)	JetE Utilization as Percent of Production
Corn Oil	2,701	2,461	156	5.8%
Soy Oil	22,452	20,027	22	<1%

Sources: United States Economic Research Service and JetE

Utilities and Electricity

The JetE plant will require additional utilities to produce the biofuels. Specifically, the plant will purchase electricity, fuel gas, and water. The total cost of utilities for the plant is estimated by JetE to be $3.6 million or approximately 3 percent of total costs.

The proposed plant will require $3.6 million of electricity and other utilities. According to IMPLAN model estimates, utility providers in Minnesota will employ 13 individuals and pay $462,000 in labor income to produce the electricity, fuel gas, and water required by the plant, as shown in "direct" line in table 10. As a result of the production of these utilities, the economy of the state of Minnesota

will see an increase in total output of $5.6 million, including 26 jobs and $1.2 million in labor income.

Table 10: Economic Impact of Utilities at Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$3,582,705	13	$461,641
Indirect	$1,135,490	6	$408,673
Induced	$905,148	7	$308,915
Total	$5,623,342	26	$1,179,228

Estimates by University of Minnesota Extension

Maintenance

Daily operations of the plant will require maintenance duties be performed. For this facility, based on industry standards, JetE estimates that $2.7 million will spent annually on maintenance, the "direct" output effect in table 11. According to IMPLAN model estimates, maintenance providers for the plant will employ 24 individuals and pay $1.5 million in labor income to maintain the plant (the "direct" employment and labor income effects in table 11). As a result of the spending for maintenance, the economy of the state of Minnesota will see an increase in total output of $5.3 million, including 43 jobs and $2.4 million in labor income.

Table 11: Economic Impact of Maintenance at Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$2,704,035	24	$1,457,633
Indirect	$778,740	5	$284,101
Induced	$1,816,667	14	$619,963
Total	$5,299,442	43	$2,361,697

Estimates by University of Minnesota Extension

This is a good time to point out the importance of the definition of employment in the model. In this model, one job is one job, regardless if it is a full-time, part-time, or seasonal position. One cannot imagine that 24 people will be at the plant year-round performing maintenance. However, one can see that through a variety of different contractors hired to service various types of equipment, that over the period of a year, several different maintenance workers would rotate through the plant for a day or two at a time.

Licensing Fees

The technology to be used in this process has been developed by the JetE company. Therefore, the plant will pay a licensing fee to the corporation. Total licensing fees will be approximately $2

million a year, just under 2 percent of total costs. JetE is a Minnesota-based company, so the payments will be distributed in Minnesota. For purposes of this analysis, it is assumed that the licensing fees will be reinvested by the company into new projects, and therefore, create an impact similar to an engineering firm. If the company instead treats the licensing fees as profit, the economic impact would be different.

According to the model, the $2 million in licensing fees will support 17 jobs at the JetE company and pay $1.2 million in labor income, as shown in table 12. As a result of the JetE licensing fees being paid, the economy of the state of Minnesota will experience an increase in economic activity of $4.5 million, including 36 jobs and $2.0 million in labor income.

Table 12: Economic Impact of Licensing Fees for a Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$2,081,185	17	$1,193,353
Indirect	$806,723	6	$310,970
Induced	$1,566,934	12	$534,754
Total	$4,454,843	36	$2,039,077

Estimates by University of Minnesota Extension

Interest and Depreciation

As with all new facilities, the JetE production plant will have interest and depreciation costs. In total, these costs account for about 8 percent of total plant operation costs. Depreciation is an accounting measure by which the capital costs of equipment and building are distributed over time. In economic impact analysis, the impacts of the purchase of equipment and buildings are calculated when the purchases occur. This analysis has already fully accounted for the economic impact of the equipment and buildings in the construction impacts section of this report. To measure the economic impact of depreciation would be double counting. Interest payments, however, are assumed to be made to Minnesota-based banks and to generate economic impacts during operation that are included in table 13 below.

According to the model, in order to provide services for the interest payments by JetE, banks/investment institutions would need to hire 8 people and pay $461,000 in labor income. As a result of this investment income, the economy of the state of Minnesota will experience a $6.2 million increase in economic activity, including 32 jobs and $1.6 million in labor payments.

Table 13: Economic Impact of Interest Paid During Operation of a Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$2,926,078	8	$461,378
Indirect	$2,083,081	14	$719,216
Induced	$1,226,590	10	$418,627
Total	$6,235,749	32	$1,599,222

Estimates by University of Minnesota Extension

Total Indirect Effect

The purchase of each of the inputs into the JetE production process generates economic activity, as described above. Added together, these impacts constitute the indirect impact of the plant. Due to purchases by the plant for inputs, $21.6 million in economic activity will be generated, including 137 jobs and $7.2 million in labor income, see table 14.

Table 14: Economic Impact of Interest During Operation of a Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$11,294,003	62	$3,574,005
Indirect	$4,804,034	32	$1,722,960
Induced	$5,515,339	43	$1,882,259
Total	$21,613,376	137	$7,179,224

Estimates by University of Minnesota Extension

Induced Effects of Operations

Induced effects are generated through the spending of employee wages in the study area economy. In this analysis, induced effects are created by the spending of the proposed JetE facility for the 5 employees it plans to hire.

Payroll and Labor

JetE estimates it will employ 4 to 5 people, working in shifts, to operate the plant. Payroll and benefits are expected to be less than 1 percent of total operation costs. Spending by employees will also generate economic activity in the economy. Since the change in the economy is a change in labor income, there is not a direct output effect. Note that the 5 employees will be responsible for creating $95.2 million in biofuel sales. There will be 5 jobs at the plant paying $516,000 in labor

income. This spending will generate 10 jobs and nearly $700,000 of labor income, as well as drive $590,000 of additional output. See table 15.

Table 15: Economic Impact of Payroll at Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Direct	$0	5	$516,131
Indirect	$0	0	$0
Induced	$594,327	5	$201,975
Total	$594,327	10	$718,106

Estimates by University of Minnesota Extension

Total Economic Impact of Operations

The purchase of each of the inputs described above creates economic activity in Minnesota, as described. Together, they create the total economic impact of the operations of a second generation biofuels plant.

The proposed plant is anticipated to have total sales of $124.2 million annually. Directly, the proposed JetE plant will make $11.8 million of new expenditures in Minnesota to operate the plant on an annual basis, as shown in table 16. The plant will employ 5 people and pay $516,000 in labor income. As the direct expenditures of the JetE plant extend throughout the Minnesota economy, the plant will contribute $34.1 million to the economy, including 151 jobs and $8.4 million in labor income.

Table 16: Total Economic Impact of Operations of a Second Generation Biofuels Plant

TOTAL	Output	Employment	Labor Income
Total Direct	$112,372,223	5	$516,131
Direct in Minnesota	$11,810,134	5	$516,131
Indirect	$21,613,376	137	$7,179,224
Induced	$698,978	9	$698,978
Total in Minnesota	$34,122,488	151	$8,394,333

Estimates by University of Minnesota Extension

Notes on the Analysis

Projected revenues and costs for the proposed second generation biofuels facility were provided to University of Minnesota Extension by JetE. Extension researchers quantified the economic impact

based on these estimates. Any changes in the estimates will affect the outcome of the analysis. In addition, Extension did not conduct a review of the financial data.

Replicability

This analysis is based on cost estimations for a plant located in a specific site. Therefore, the economic impact would differ depending on the final location. In general, the results would not be significantly different if the plant is located in Minnesota. The most significant economic impact changes would occur as a result of changes in the construction costs for the activities "outside the battery limits". These construction costs are site specific. Aside from those costs changing, the other costs should remain constant for any site in Minnesota. Thus, the economic impact generated by those other aspects of construction and operations should not vary.

If the plant is located outside of Minnesota, then the assumptions about local purchases change. Further, the underlying assumptions in the model, based on Minnesota data, would also change. Therefore, these results cannot be transferred or applied outside of the state.

SUMMARY AND CONCLUSIONS

The rising cost of fossil fuels, an interest in decreasing greenhouse gas emissions, and an interest in rural and agricultural development have combined to increase interest in the development of biofuels for commercial use. Second generation biofuels, derived from the residual components of feed crops, are emerging as a new potential source of biofuels to replace traditional sources of transportation fuels.

Once researchers develop viable processes for producing transportation fuels from biofuels, the next step is to begin producing these fuels. To this end, JetE has designed a plant which will use corn oil, soy oil, and non-food grade tallow to produce a green diesel fuel. This report has analyzed the economic impact of a proposed second generation biofuels production plant to be co-located with an ethanol plant in southern Minnesota. The input-output model, IMPLAN, was used to complete the analysis.

In total, the proposed JetE plant is expected to produce 29 million gallons of green diesel annually. This production is expected to result in $100.4 million in direct sales. Additional tax federal incentives are anticipated. The major input into production will be the feedstocks. The plant is expected to require $94.1 million in feedstocks annually. Additionally, the proposed facility will spend $17.8 million on operating expenditures, including utilities, maintenance, interest and depreciation, payroll, and licensing fees.

Economic impact of the proposed plant occurs when expenditures by the plant increase the demand and production of inputs (goods or services). A major input to the production process is the feedstocks, which will be a mix of corn oil, soy oil, and non-food grade tallow. Because the feedstocks are by-products of other production processes (in the case of corn oil and tallow) and/or compete for limited cropland (in the case of soy oil), the utilization of the feedstocks by the plant is not expected to increase production of the main product (corn, soybeans, and meat). Therefore, the utilization of these feedstocks by the new plant is expected be offset by decreased utilization elsewhere for no net change in this aspect of the overall economic impact on Minnesota.

In total, the JetE plant will demand $11.8 million of new inputs annually from Minnesota-based firms. To produce biofuels at the plan, JetE will directly hire 5 individuals, and pay $516,000 in labor income.

The total estimated economic impact of the proposed JetE plant's annual operations is $34.1 million. The plant will support 151 jobs in the Minnesota economy. These jobs will pay $8.4 million in labor income to the workers who perform them.

APPENDIX 1: IMPLAN DEFINITIONS

A few definitions are essential in order to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant "double counting." Think of corn, for example. The value of the corn is counted when it is sold to the mill, again when it is sold to the dairy farmer, again as part of the price of fluid milk, and yet again when it is sold as cheese. The value of the corn is built into the price of each of these items and then the sales of each of these items are added up to get total sales (or output).

Employment

Employment includes full- and part-time workers and is measured in annual average jobs, not full-time equivalents (FTE's). IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the corn example when the corn is sold to the mill, a certain percentage of the sale goes to the farmer for his/her labor. Then when the mill sells the corn as feed to dairy farmers, it includes some markup for its labor costs in the price. When dairy farmers sell the milk to the cheese manufacturer, they include a value for their labor. These individual value increments for labor can be measured, which amounts to labor income. Labor income does not include double counting.

Direct Impact

Direct impact is equivalent to the initial activity in the economy.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to spending for inputs (goods and services) by the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel, and equipment. As the plant increases purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to spending by labor. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to spend to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. Induced impacts also include spending by labor generated by indirect impacts.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

APPENDIX 2: BIBLIOGRAPHY

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