Initial Steps to Laying the Groundwork for a Renewable Aviation Fuel Industry in Tennessee: Economic Feasibility and Economic Impact Analysis

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MOTIVATION

To increase the potential of developing a renewable aviation fuel industry in the Southeast requires information on the economic, environmental and social components of sustainability. Capital requirements, along with changes in farm income, employment, and gross regional product (GRP), are measures which track the impact that the formation of an industry has in a particular area.

The materials developed in this study will be delivered to regional stakeholders for their consideration as the industry begins. Efforts progress on various fronts including each of the supply stages. Technical Economic Analysis (TEA's) have been developed and economic analysis initiated. Refinements continue to occur. Two production regions have been selected. The first location is in middle/western Tennessee with a potential of supplying two major airports located at Nashville and Memphis. The second location is in northern/middle Alabama with Birmingham, Chattanooga, and Atlanta as potential consumers of the aviation fuel produced.

A renewable aviation fuel biorefinery will provide similar benefits to a local economy as any manufacturing plant of a similar size. The biorefinery provides jobs and a local tax base, increases economic activity within the region, increases demand for housing, and provides customers for regionally located businesses (Low and Isserman, 2008). To address the regional economic impact, an input-output (IO) analysis is conducted providing estimates of output, employment and income multipliers, which measure the response of the economy to a change in demand or production.

OBJECTIVES

Show the progress of the project with respect to Location 1 (Tennessee).

Indicate estimates in the job creation, economic activity, labor income, farmer revenue, and state/local taxes to the region both directly from growth in the aviation biofuel industry itself and through multiplier effects assuming that dedicated oilseed crops are grown as a cover crop with corn and soybeans.

METHODS

Process to achieve the objective requires several steps with each step building upon the previous.

1. Definition of the supply chain of fuel requirements
2. Estimation of the demand for renewable fuel at the airports
3. Identification of co-products
4. Development of Techno Economic Analysis (TEA) for the various supply chain steps
   A. Using ASCENT developed biorefinery
   B. Using a hybrid of the crushing facility TEA
5. Definition of potential candidate sites for preprocessing and biorefinery locations
6. Initiation of the first step in the analysis (Task 1)
7. Estimation of regional impacts (Task 2)
8. Completion of the final analysis (Task 1 through 3)

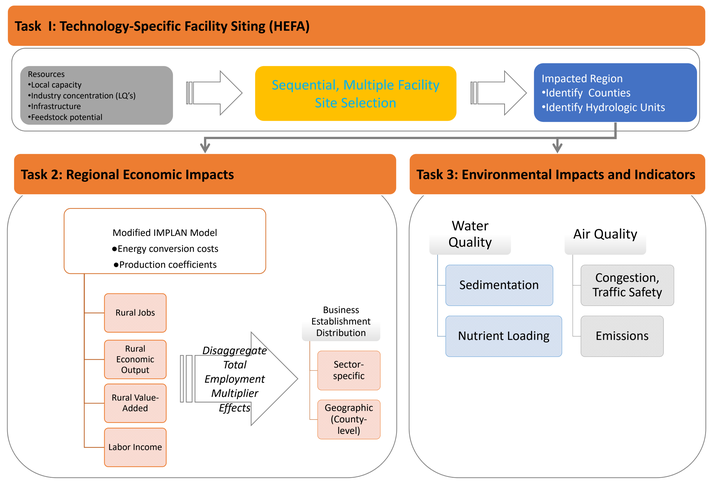


Figure 1. Schematic of the methods used to quantify the sustainability of a pre-specified supply chain for renewable aviation fuel

Pulling the Pieces Together

Task 1 and Task 2:

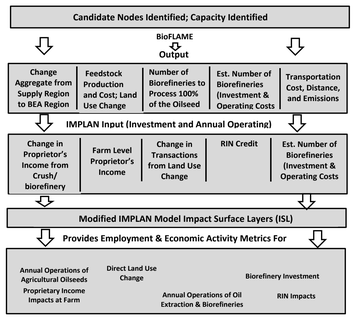


Figure 2. Analysis Flow of Information for Tasks 1 and 2

Table 1. Enterprise Budget for Camelina as a Cover Crop, Tennessee

2018 Field Camelina	Unit	Quantity	Price	Total
Revenue	Gross Revenue ($/Acre)			
Camelina	lbs	1050	$0.15	$157.50
Total Revenue				$157.50
Variable Expenses				
Seed	lbs	5	$2.00	$10.00
Fertilizer	Acre	1	$34.20	$34.20
Chemical	Acre	1	$27.50	$27.50
Repair & Maintenance	Acre	1	$11.76	$11.76
Fuel, Oil & Filter	Acre	1	$8.50	$8.50
Operator Labor	Acre	1	$5.95	$5.95
Machinery Cost for Broadcast Planting	Acre	1	$13.40	$13.40
Crop Insurance	Acre	1	$0.00	$0.00
Operating Interest	Acre	1	$0.90	$0.90
Other Variable Costs	Acre	1	$0.00	$0.00
Total Variable Expenses				$112.21
Return Above Variable Expenses				$45.29
Fixed Expenses				
Machinery				
Capital Recovery	Acre	1	$27.08	$27.08
Other Fixed Machinery Costs	Acre	1	$0.00	$0.00
Taxes, Housing & Insurance	Acre	1	$5.96	$5.96
Other Fixed Costs	Acre	1	$0.00	$0.00
Total Fixed Expenses				$33.04
Return Above All Specified Expenses				$12.25

Figure 3. Yield Estimates from EPIC

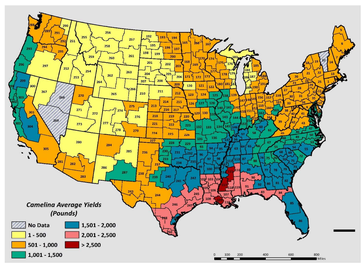


Figure 4. St. Dev. Of Yield Estimates from EPIC

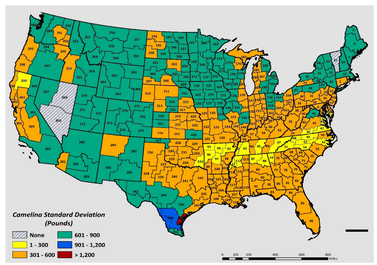
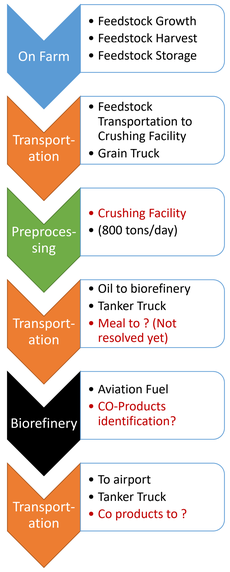
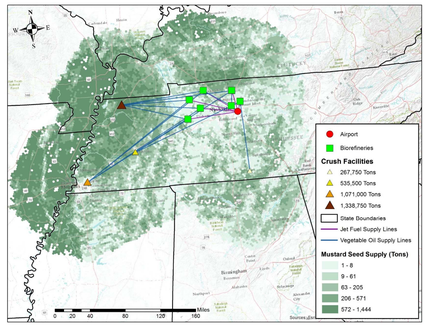


Figure 5. Supply Chain Identified



Areas in red (above)are not completed yet for the Tennessee region.

Figure 6. Example of BioFLAME output



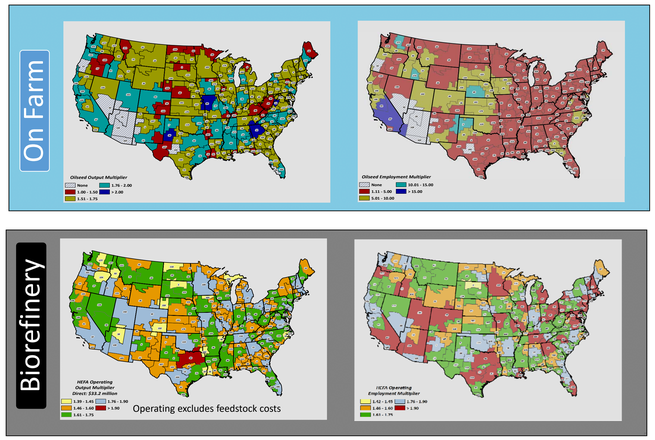
Demand for renewable aviation fuel set at 250 million gallons/year at the Nashville Airport (BNA). Crushing facility capacity is 850 tons/day operating 315 days/year or 267,000 tons/year of oil seed.

The biorefinery is the ASCENT HEFA modeled in 2018 by WSU (Tanzil, 2018). The biorefinery produces the following products:

Jet (36.9 million gal.), Naphtha (6.6 million gal.), Diesel (17.2 million gal.), and LPG (7.5 million gal.).

Seven biorefineries are needed to meet a jet fuel demand of 250 million gal.

Figure 7. IMPLAN Impact generated annual operating Surface Layers (ISL): HEFA Biorefinery



Impacts from input purchases to grow the feedstock

Impacts from input purchases to create the fuel from oilseed oil.

Impacts from resulting from labor and proprietor profit – farm, transportation, industry, and RINs.

DISCUSSION

Economic impact metrics currently contain changes in economic activity, employment, labor income, value added or regional (GDP), and tax implications. The first three metrics have been estimated by Bureau of Economic Analysis regions. These data contain for each BEA the magnitude of an impact if a facility were located in that BEA for **feedstock**, **preprocessing** (not completed yet), **biorefining**, and **transportation**. Jamey Menard has developed the ISL's for the three ASCENT technologies that have been distributed. He is also in the process of developing these for crushing and camelina. The data driving the maps have been estimated; however, we are working with WSU to develop an ASCENT crushing facility. Once these are developed, initial impact analysis for renewable fuel delivered to the Nashville airport will be completed and ready for a stakeholder meeting

Lead investigator: Tim Rials, University of Tennessee
Project manager: Nate Brown, FAA October 9, 2018

REFERENCES

Low, Sarah and A. M. Isserman, 2008. Ethanol and the Local Economy: Industry Trends, Location Factors, Economic Impacts, and Risks. Economic Development Quarterly, Vol. 23, 1, p[p 71-88, https://doi.org/10.1177/0891242408329485
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