

Potential Use of Renewable Diesel for Transportation in Texas and its Environmental Impacts under Uncertainties Caused by COVID-19

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Evaluation of the potential use of renewable diesel for transportation in Texas

Compared to biodiesel, renewable diesel is a relatively new biofuel that can also be used for diesel vehicles. Some advantages of renewable diesel over biodiesel are no special requirements for the vehicle, cold startup, and fuel storage. There is no renewable diesel plant in Texas, and no action is being considered on renewable diesel application for Texas’ transportation. The proposed project would address this critical gap and develop environmental life cycle and cost assessments to produce renewable diesel in Texas and its local applications in transportation. A novel and key component of this work would be the development of a decision-making tool that would help determine where the renewable diesel processing plant should be built. The COVID-19 pandemic has been an enormous disruption with immense economic impacts in the U.S., and it caused a sharp drop in fuel price when the economic activities plummeted during the lockdown. Our analysis will explore the long-term impacts of the COVID-19 pandemic on life cycle cost analysis (LCCA) of renewable diesel production in Texas. A new LCCA model will be designed with the consideration for such uncertainties of resources, transportation, and fuel production caused by the COVID-19 pandemic. The decision-making tool developed in this study would help the biofuel industry to make the decision on the development of renewable diesel in Texas. Faculty working on this research will integrate LCA as an important focus area for all senior and graduate-level civil and environmental engineering courses. These students will also be introduced to the techniques of well-to-wheel analysis and production cost evaluation for renewable fuels.

Problem Statement

Biomass, which consists of waste products of agriculture, forestry, and post-consumer waste, is an essential feedstock for a bio-refinery where these inputs are converted into either fuel for energy, fibers, and molecules for chemicals and materials and even food products. Texas provides many feedstocks for bio-refinery. For example, 35% of east Texas agricultural income depends on timber, and North West of Texas is producing a

huge amount of agricultural waste from different crops. Table 1 below shows the regional distribution of crops and biomass production in Texas. The abundant availability of crops and biomass in Texas provides a great potential to produce renewable diesel in Texas’ local towns. Bioethanol, biodiesel, and renewable diesel are biomass-based fuels. With respect to the fuel used for heavy-duty trucks, renewable diesel has some advantages over biodiesel as in the introduction section. There is no renewable diesel plant in Texas, although there are a few bioethanol and biodiesel plants in North West Texas and East Texas. Before building a renewable diesel plant, it is critical to carry out the studies of LCA and LCCA of the renewable diesel production in Texas.

Objectives

The overall goal of this study is to evaluate the environmental impacts of renewable diesel use in Texas’ transportation and the potential of renewable diesel production in Texas considering uncertainties Caused by COVID-19. Following are the major objectives that constitute in realizing the overall goal:

- (i) Quantify the life cycle environmental impacts resulting from the use of regular diesel in Texas’ transportation
- (ii) Develop the framework for methodological environmental LCA of renewable diesel use in Texas’ transportation
- (iii) Develop the framework for LCCA of renewable diesel production from inedible biomass in Texas, including uncertainty analyses with the consideration of the impacts caused by the long-term impacts of the COVID-19 pandemic
- (iv) Evaluate the net change in environmental impacts due to partial use of renewable diesel in Texas’ transportation
- (v) Conduct environmental/economic-benefit evaluation of renewable diesel production in Texas
- (vi) Recommend stakeholders, community leaders within Texas to the adoption of renewable diesel production in Texas and its use in Texas’ transportation



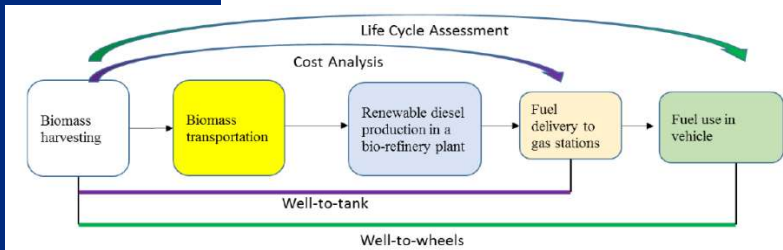


Figure 1. The system boundary and key stages of renewable diesel used in transportation

Intended Implementation of Research

The research team will work with PVAMU's research and outreach programs to coordinate educational offerings on renewable fuel applications in transportation for minority and underrepresented students in STEM disciplines. Through this current project, we anticipate to partially fill the requirement of improving the participation of underrepresented groups (African-Americans and women) in engineering, thereby increasing diversity in the civil engineering profession and encouraging future enrollment by increasing visibility and national recognition of PVAMU. The PIs will also leverage existing collaborations with the CEES network to establish seminars/workshops to disseminate research findings to community leaders and stakeholders in Texas, especially in Houston and Dallas. In order to assuage resistance to investments in renewable diesel production in Texas, we propose to organize information sessions that detail environmental cost-benefit analysis with regards to energy and environmental impacts of renewable diesel use in transportation and cost analysis of renewable diesel production in Texas.

Anticipated Impacts/Benefits of Implementation

This study would be a first attempt at conducting environmental LCA and cost analysis of renewable diesel use in Texas' transportation. Renewable diesel is a drop-in replacement to petroleum diesel, which means no engine modification is needed. This project would fill this critical gap and provide environmental life cycle and cost analysis for the production of renewable diesel in Texas and its applications in state transportation. The comparative assessment of regular diesel and renewable diesel would help to identify potential applications of renewable fuels in Texas by considering the impacts of the COVID-19

pandemic. A novel component of the proposed project would be the development of a decision-making tool that would determine where the renewable diesel processing plant should be built based on the function of distance to the bio-resource locations and its processing capacity. Results from this project would serve as a guidance framework in order to evaluate the decision to develop and use renewable diesel at a pilot/large scale in Texas. The exhaustive list of impact categories generated from considering renewable diesel would enable a comprehensive assessment of life cycle environmental impact, providing regulators and stakeholders' viable alternatives for improving the sustainability of transportation infrastructure. The results of this research would serve as a source of information and data for future renewable fuel studies in Region 6.

Web links

- Tran-SET's website <https://transet.lsu.edu/research-in-progress/>

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.

