



Project 001(C) Alternative Jet Fuel Supply Chain Analysis

Purdue University

Project Lead Investigator

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University Participants

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- P.I.: Farzad Taheripour, Research Professor
- FAA Award Number: 13-C-AJFE-PU, Amendments 25, 29, 34, 36, 41, 46, 48, 51, 55
- Period of Performance: October 1, 2024, to September 30, 2025
- Tasks:
 1. Provide analyses on induced land use change (ILUC) and direct land use change (DLUC) emissions and other analyses related to land use changes (LUC) at global, regional, and country levels for national and international biofuel programs that tend to promote supplies of clean fuels. This task provides the required support to calculate a portion of the carbon intensity (CI) of sustainable aviation fuel (SAF) pathways and other biofuels that are related to LUCs.
 2. Collect data, conduct data analyses, and develop economic models to support the United States (U.S.) government agencies and the International Civil Aviation Organization (ICAO)/Committee on Aviation Environmental Protection (CAEP)/Working Group 5 (WG5) – Aviation Fuels, to develop techno-economic analysis (TEA) in determining profitability and feasibility of SAF pathways under alternative economic conditions and policy environments.
 3. Improve agro-ecological zone-emission factor (AEZ-EF) model and its emission factors to follow the 2019 International Panel of Climate Change (IPCC) guidelines in assessing land use emission factors and better measure the vegetation and soil organic carbon (SOC) contents of land cover items at a global scale. [This task has been moved to the ASCENT Project 104B (award number 13-C-AJFE-PU-058)].

Project Funding Level

This project received funding from the Federal Aviation Administration (FAA) as follows:

- Award received prior to this period of performance
 - Amendment 3: \$250,000
 - Amendment 6: \$110,000
 - Amendment 10: \$230,000
 - Amendment 15: \$373,750
 - Amendment 19: \$400,000
 - Amendment 29: \$400,000
 - Amendment 36, 41: \$523,000
 - Amendment 46, \$350,000
 - Amendment 48, \$350,000
 - Amendment 51, \$394,844
- Award received for the current period of performance
 - Amendment 55, \$399,865



Current cost sharing for this project year was provided by Neste US, Inc.

Investigation Team

Prof. Farzad Taheripour (P.I.), All Tasks
Prof. Dominique van der Mensbrugge (co-P.I.), Task 3
Prof. Qianlai Zhuang (co-P.I.), Task 3
Maksym Chepeliev, (co-P.I.; research economist), Task 1
Erwin Corong (co-P.I.; research economist), Task 1
Angel Aguiar (research economist), Task 1
EhsanReza Sajedinia (PhD student), All Tasks
Shuo Chen (PhD student), Task 3
Xiangyu Liu (PhD student), Task 3
Ye Yuan (PhD student), Task 3
Lauren Benavidez (PhD student), All Tasks

Project Overview

The research team of ASCENT Project 001C has worked on the three main tasks listed above and made major progress on each task in this performance time period. The first task is focused on providing analyses on ILUC and DLUC assessments for the national and international policies that tend to promote production and consumption of SAF and non-SAF biofuels including corn ethanol, sugarcane ethanol, and biodiesel produced from several types of vegetable oils. This task also considers advancing methodologies for ILUC and DLUC calculations.

The second task aims at supporting the U.S. government agencies and ICAO/CAEP/WG5 subgroups, including the Core Life Cycle Assessment (LCA), Technology, Production, and Policy (TPP), and Sustainability subgroups, to accomplish their tasks and achieve their goals. This task considers developing TEA for determining the profitability and feasibility of SAF pathways under alternative economic conditions and policy environments.

The third task focused on various activities including updating the AEZ-EF model to adopt the 2019 IPCC guidelines in assessing lands use emission factors, assessing the existing data and approaches that provide land use emission factors used in the AEZ-EF model; and studying and proposing a methodology to measure, check, and verify changes in the soil carbon content of cropland including SOC at the farm level due to production of SAF or other biofuels.

Task 1 – Provide Required Analyses on ILUC at Global, Regional, and Country Levels

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Objectives

The objectives of this task focus on calculating ILUC values and their updates for new SAF pathways, improving ILUC modeling approaches, collecting required data to more accurately estimate ILUC, updating the global trade analysis project for biofuel (GTAP-BIO) database to represent the global economy in recent years, and providing analyses that help to better elucidate LUCs across the world.

Research Approach

Our team collected the required data and developed required analyses for both TEA and LCA to determine the cost structure of each new SAF pathway to be included in the GTAP-BIO model to support ILUC calculations. We then used the modified model to assess the LUCs associated with new SAF pathways.

Milestones

- Calculated new ILUC values upon request by the ICAO/CAEP/WG5.
- Developed a new GTAP-BIO database, which represents the global economy in 2014.
- Added several SAF pathways to the new GTAP-BIO database. This new database has been used to develop the required analyses for the 40B provision of the Inflation Reduction Act of 2022.



Major Accomplishments

Accomplishments in Task 1 include providing various assessments for SAF that could be produced in Brazil using corn alcohol-to-jet (ATJ) technology and developing ILUC values for palm oil Hydroprocessed Esters and Fatty Acids (HEFA) that can be produced in South America and Sub-Saharan Africa. Several pathways were also examined for the 45Z provision of the Inflation Reduction Act of 2022. The pathways included for the 45Z provision of the Inflation Reduction Act of 2022 were two U.S. corn ethanol cases, U.S. soybean biodiesel, U.S. soybean renewable diesel, U.S./Canadian canola biodiesel, U.S./Canadian canola renewable diesel U.S. sorghum ethanol, two Brazilian sugarcane ethanol cases, and five cellulosic fuel pathways using miscanthus, switchgrass, poplar, willow, and energy sorghum.

Publications

Written Report

ANL. (2024). *Expansion of Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB) to Address Induced Land Use Changes and Other Indirect Effects of Clean Fuel Production for R&D GREET2024*. Argonne National Laboratory (ANL).

Taheripour, Sajedinia, Chepeliev, and Aguiar have contributed to developing this report and its Appendix A.

Presentations/Working Papers

- CAEP/14-WG5_1-WP05 – ILUC value estimation, May 12-16, 2025, Virtual.
- CAEP/14-WG5_1-WP06 – Model Improvement and modelling time, May 12-16, 2025, Virtual.
- CAEP/14-WG5_2_IP05 – Standard GTAP, GTAP-BIO, and CORSIA GTAP-BIO models and their databases, October 27-37, 2025, São Paulo, Brazil.
- CAEP/14-WG5_2-WP015 – Progress ILUC values determination, October 27-37, 2025, São Paulo, Brazil.

Outreach Efforts

- Participated (Dr. Taheripour) in ASCENT Advisory Group meetings in Fall 2024 and Spring 2025 and shared the findings of this research with the ASCENT community.
- Participated and presented (Dr. Taheripour) the results of this project at the following conferences, seminars, and meetings related to biofuels and their land use effects:
 - 2025 Sustainability Workshop, Clean fuel conference, April 7-9, 2025, Kansas City, Missouri.
 - 2025 American and Applied Economic Association (AAEA) Annual Meeting, July 27-29, 2025, Denver, Colorado.
- Reviewed (Dr. Taheripour) many academic papers for various journals that provide publications in research areas associated with Task 1.

Awards

None.

Student Involvement

- EhsanReza Sajedinia, current PhD student, Purdue University, for data collection and running simulations
- Lauren Benavidez, current PhD student, Purdue University, for data collection and working with land use emission data and models

Plans for Next Period

The new Cycle of ICAO CAEP began in 2025. Following the request by WG5, our team plans to use a new version of GTAP-BIO model that represents the world economy in 2017 and represents corn-soy double cropping system in Brazil to update the ILUC values for all Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) SAF pathways. In addition, we will develop required ILUC assessments to support the U.S. policies regarding biofuels production and use.



Task 2 – Collect Data, Conduct Analyses, and Develop Economic Models to Support Policy Decision at National and International Levels for SAF and Other Biofuels

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Objectives

The objective of this task is to (1) develop required analyses to support policy decision at national and international levels to promote supplies of cleaner fuels such as SAF and non-SAF pathways for aviation and road transportation, (2) coordinate with the WG5 subgroups to avoid conflicts between the ILUC subgroup activities and activities performed by other subgroups, and (3) collaborate with the U.S. government agencies to coordinate policy decision on SAF and non-SAF pathways.

Research Approach

This task considers various assignments and components. Our team uses standard methods to support WG5 subgroups, including the Core LCA, TPP, and Sustainability subgroups. We collected data and used economic models including GTAP-BIO and provided appropriate analyses to accomplish this task. Dr. Taheripour collaborates with the ILUC, Core LCA, TPP, and Sustainability subgroups of the ICAO/CAEP/WG5.

Milestones

- Developed analyses and models to support WG5 subgroups,
- Calculated LUCs for SAF pathways.
- Provided required economic analysis.

Major Accomplishments

Supporting International Activities

In addition to participating in meetings with WG5 subgroups and reviewing their working and information papers, Dr. Taheripour collaborated with the WG5 secretary and co-rapporteurs to develop reports for ICAO Steering Group meetings. One major accomplishment was developing the required analyses for the 45Z provision of the Inflation Recovery Act of 2022. Dr. Taheripour participated in the CAEP14/WG5-1 and CAEP14/WG5-2 meetings and many sub-group meetings and was involved in several tasks and document preparation activities for these meetings. He also responded to other subgroup requests for help and collaboration. He has led efforts in ILUC modeling and ILUC-related tasks associated with other subgroups. He also joined various meeting with the U.S. government agencies and provided various presentations to discuss and explain ILUC modeling.

Supporting Domestic U.S. Policy Decision

Dr. Taheripour also collaborated with U.S. government agencies such as the FAA, U.S. Department of Agriculture (USDA), U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), and Argonne Research Library to develop modeling practices for the use in the U.S. domestic policy analysis regarding the provision of 40B and 45Z of the Inflation Reduction Act of 2022.

Publications

The ILUC related reports are noted under Task 1.

Outreach Efforts

- See outreach efforts under Task 1.
- Reviewed (Dr. Taheripour) many academic papers for various journals that provide publications in research areas associated with Task 2.
- Attended (Dr. Taheripour, Dr. Chepeliev, Dr. Aguiar, Sajedinia, Chen, and Yuan) the ASCENT Advisory Group meetings in Fall 2024 and Spring 2025 and discussed the findings of this task with members of this community.

Awards

None.



Student Involvement

- EhsanReza Sajedinia, current PhD student, Purdue University, for data collection and running simulations
- Shuo Chen, current PhD student, Purdue University, for data collection and running simulations
- Xiangyu Liu, current PhD student, Purdue University, for data collection and running simulations
- Ye Yuan, current PhD student, Purdue University, for data collection and running simulations
- Lauren Benavidez, current PhD student, Purdue University, for data collection and running simulations

Plans for Next Period

- Collaborate with the Core LCA subgroup to refine the methodology of assessing changes in soil carbon content at the farm level.
- Continue to support WG5 subgroups, including the Core LCA, TPP, and Sustainability subgroups, in accomplishing the required LCAs for new SAF pathways.
- Continue to develop the required TEAs to include the cost structure of new SAF pathways in the GTAP-BIO database.
- Continue to collaborate with the U.S. government agencies to establish the U.S. domestic policy towards the SAF and non-SAF biofuel pathways.

Task 3 – Improvements in AEZ-EF Model

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This task has been moved to ASCENT Project 104B (Award Number: 13-C-AJFE-PU-058).