

Project 001(B) Alternative Jet Fuel Supply Chain Analysis-Tropical Region Analysis

University of Hawaii

Project Lead Investigator

University of Hawaii Lead:

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University Participants

University of Hawaii

- P.I.(s): Scott Q. Turn, Researcher
- **FAA Award Number: 13-C-AJFE-UH, Amendment 005**
- Period of Performance: 10/1/15 to 9/30/16
- Task(s):
 1. Informing Regional Supply Chains
 2. Identification of Supply Chain Barriers in the Hawaiian Islands

University of Hawaii

- P.I.(s): Scott Q. Turn, Researcher
- **FAA Award Number: 13-C-AJFE-UH, Amendment 007**
- Period of Performance: 10/1/16 to 9/30/17
- Task(s):
 1. Informing Regional Supply Chains
 2. Support of Indonesian Alternative Jet Fuel Supply Initiatives

Project Funding Level

Under **FAA Award Number 13-C-AJFE-UH, Amendment 005**, the Alternative Jet Fuel Supply Chain Analysis-Tropical Region Analysis project received \$75,000 in funding from the FAA and cost share funding of \$75,000 from the State of Hawaii.

Under **FAA Award Number 13-C-AJFE-UH, Amendment 007**, the Alternative Jet Fuel Supply Chain Analysis-Tropical Region Analysis project received \$100,000 in funding from the FAA and cost share funding of \$75,000 from the State of Hawaii and \$25,000 of in-kind cost match in the form of salary support for Scott Turn from the University of Hawaii.

Investigation Team

Lead:

Scott Turn - University of Hawaii

Other Lead Personnel:

Tim Rials and Burt English (UT Co-PIs)
Manuel Garcia-Perez (WSU Co-PI)
Kristin Lewis (Volpe PI)



Michael Wolcott (WSU PI)

UH Investigation Team:

Under **FAA Award Number 13-C-AJFE-UH, Amendment 005**, Task 1 and Task 2 includes

Dr. Scott Turn, Researcher, Hawaii Natural Energy Institute, UH

Dr. Trevor Morgan, Assistant Researcher, Hawaii Natural Energy Institute, UH

Dr. Richard Ogoshi, Assistant Researcher, Department of Tropical Plant and Soil Sciences, UH

Dr. Adel H. Youkhana, Junior Researcher, Department of Tropical Plant and Soil Sciences, UH

Under **FAA Award Number 13-C-AJFE-UH, Amendment 007**, Task 1 and Task 2 includes:

Dr. Scott Turn, Researcher, Hawaii Natural Energy Institute, UH

Dr. Trevor Morgan, Assistant Researcher, Hawaii Natural Energy Institute, UH

Dr. Richard Ogoshi, Assistant Researcher, Department of Tropical Plant and Soil Sciences, UH

Project Overview

Under **FAA Award Number 13-C-AJFE-UH, Amendment 005**, the research effort has two objectives. The first objective is to develop information on regional supply chains for use in creating scenarios of future alternative jet fuel production in tropical regions. Outputs from this project may be used as inputs to regional supply chain analyses being developed by the FAA and Volpe Center. The second objective is to identify the key barriers in regional supply chains that must be overcome to produce significant quantities of alternative jet fuel in the Hawaiian Islands and similar tropical regions.

The **FAA Award Number 13-C-AJFE-UH, Amendment 005** project goals are to:

- Review and summarize:
 - the available literature on biomass feedstocks for the tropics,
 - the available literature on pretreatment and conversion technologies for tropical biomass feedstocks,
 - the available literature on geographic information systems data sets available for assessment of alternative jet fuel production systems in the tropics.
- Identify alternative jet fuel supply chain barriers in the Hawaiian islands

Under **FAA Award Number 13-C-AJFE-UH, Amendment 007**, the research effort has two objectives. The first objective is to develop information on regional supply chains for use in creating scenarios of future alternative jet fuel production in tropical regions. Outputs from this project may be used as inputs to regional supply chain analyses being developed by the FAA and Volpe Center. Included in this objective is the development of fundamental property data for tropical biomass resources to support supply chain analysis. The second objective is to support the Memorandum of Understanding between the Federal Aviation Administration (FAA) and Indonesian Directorate General of Civil Aviation (DGCA) to promote developing and using sustainable, alternative aviation fuels.

The **FAA Award Number 13-C-AJFE-UH, Amendment 007** project goals are to:

- Support the Volpe Center and Commercial Aviation Alternative Fuels Initiative (CAAFI) Farm to Fly 2.0 supply chain analysis.
- Use GIS-based estimates of fiber crop production potential to develop preliminary technical production estimates of jet fuel in Hawaii.
- Develop fundamental property data for tropical biomass resources.
- Transmit data and analysis results to other ASCENT Project 1 researchers to support improvement of existing tools and best practices.
- Support Indonesian alternative jet fuel supply initiatives

13-C-AJFE-UH, Amendment 005 Task 1: Informing Regional Supply Chains

University of Hawaii





Objective(s)

Task 1, Activity 1. Review the archival literature and assemble relevant citations for the tropical crops/feedstocks for alternative jet fuel production.

Task 1, Activity 2. Review the archival literature and assemble relevant citations for pretreatment and conversion technology options and experience with potential tropical feedstock materials.

Task 1, Activity 3. Review the archival literature and assemble relevant citations for GIS biofuel production system analyses elsewhere in the tropics

Research Approach

Task 1, Activity 1. The archival literature will be reviewed to construct an updated database of relevant citations for the tropical crops identified in section 8; new potential energy crops will be identified and added to the database. Available information on agronomic practices, crop rotations, and harvest techniques will be included. The database will be shared with and serve as a resource for the Project 1 team and Volpe Center analyses of regional supply chains.

Task 1, Activity 2. A database of relevant pretreatment and conversion technology options and experience with potential tropical feedstock materials will be assembled from the archival literature and from existing Project 1 team shared resources. Of particular interest are inventories of material and energy flows associated with the pretreatment and conversion unit operations, fundamental to the design of sustainable systems and the underlying analysis. Pairings of pretreatment and conversion technology options provide the starting point for evaluation of tropical biorefineries that can be integrated into ASCENT Project 1 team and Volpe Center activities.

Task 1, Activity 3. GIS tools that are currently available to support tropical supply chain analysis will be reviewed and revised as needed to conform to Project 1 team working standards. Literature review of published GIS biofuel production system analyses elsewhere in the tropics will be conducted and a database assembled. Repositories of GIS data layers typically needed in regional supply chain analysis maintained by institutions elsewhere in the tropics will be surveyed and compiled into a report. The existing GIS analyses and the database of GIS analyses for the tropics will serve as a resources for Project 1 Team and Volpe Center analyses of regional supply chains.

Milestone(s)

Include a description of any and all milestones reached in this research according to previously indicated timelines.

Task 1, Activity 1: Identify target list of databases to search for relevant literature.

Task 1, Activity 1: Interim report summarizing progress on literature search.

Task 1, Activity 2: Identify target list of databases to search for relevant literature.

Task 1, Activity 2: Interim report summarizing progress on literature search.

Task 1, Activity 3: Identify target list of databases to search for relevant literature.

Task 1, Activity 3: Interim report summarizing progress on literature search.

Major Accomplishments

None – Task in progress

Publications

None – Task in progress

Outreach Efforts

None – Task in progress



Awards

None - Task in progress

Student Involvement

None

Plans for Next Period

Reports for each of the three literature review activities have been drafted and will be finalized in the coming year. The reports will be merged into a publication on options for alternative jet fuel production in the tropics.

13-C-AJFE-UH, Amendment 005 Task 2. Identification of Supply Chain Barriers in the Hawaiian Islands

University of Hawaii

Objective(s)

Identify the key barriers in regional supply chains that must be overcome to produce significant quantities of alternative jet fuel in the Hawaiian Islands and similar tropical regions.

Research Approach

UH developed the Hawaii Bioenergy Master Plan for the State of Hawaii [1]. Completed in 2009, UH was tasked with determining whether Hawaii had the capability to produce 20% of land transportation fuels and 20% of electricity from biobased resources. Toward this end, the plan included assessments of (1) land and water resources that could support biomass feedstock production, (2) potential biomass resources and their availabilities, (3) technology requirements, (4) infrastructure requirements to support logistics, (5) economic impacts, (6) environmental impacts, (7) availability of human capital, (8) permitting requirements, and (9) limitations to developing complete value chains for biomass based energy systems. In keeping with the stakeholder driven development of the Hawaii Bioenergy Master Plan, barriers to development of regional supply chains for ASCENT will be identified by interacting with key stakeholder groups. Green Initiative for Fuels Transition Pacific (GIFTPAC) meetings are held quarterly and are attended by biofuel development interests in Hawaii including representatives of large landowners, producers of first generation biofuels, petroleum refiners, electric utilities, the State Energy Office, U.S. Pacific Command, biofuel entrepreneurs, county government officials, and the University of Hawaii. Additional stakeholders are invited as necessary to fill information and value chain gaps. These meetings are excellent opportunities to receive stakeholder input, identify barriers to supply chain development, and organize data collection efforts that span supply chain participants.

Milestone(s)

Task 2: Introduce activities at next regularly scheduled GIFTPAC meeting after contract executed.

Task 2: Interim report outlining two tropical supply chain scenarios developed in consultation with Project 1 team, and with input from GIFTPAC participants.

Major Accomplishments

None - Task in progress

Publications

None - Task in progress



Outreach Efforts

Task objectives were introduced to stakeholders at the Green Initiative Fuels Pacific meeting on April 8, 2016 and a facilitated stakeholder meeting was held on September 21, 2016, to aid in identifying alternative jet fuel production barriers.

Awards

None

Student Involvement

None

Plans for Next Period

A report on barriers to alternative jet fuel production based on stakeholder meetings has been drafted and will be finalized in the coming year.

13-C-AJFE-UH, Amendment 007 Task 1: Informing Regional Supply Chains

University of Hawaii

Objective(s)

Task 1, Activity 1. Support Volpe Center and Commercial Aviation Alternative Fuels Initiative (CAAFI) Farm to Fly 2.0 supply chain analysis.

Task 1, Activity 2. Use GIS-based estimates of fiber crop production potential to develop preliminary technical production estimates of jet fuel in Hawaii.

Task 1, Activity 3. Develop fundamental property data for tropical biomass resources.

Task 1, Activity 4. Transmit data and analysis results to support improvement of existing tools (e.g. POLISYS).

Research Approach

Task 1 Activities 1 and 4 will be coordinated with the respective cooperating organizations through discussions to identify support points and data gaps. These are anticipated to align with work carried forward from Amendment 005 activities related to supply chain analyses in Hawaii and elsewhere in the tropics but is also open to respond to immediate needs as they are identified.

Task 1, Activity 2 will rely on GIS layers for fiber crop production potential that are based on soil type, rainfall patterns, irrigation availability, slope, elevation, land use zoning, and land owner classification. Using this as a basis, fiber yield projections based on available crop models will be implemented and alternative jet fuel (AJF) production will be estimated. This activity will also provide guidance for locating AJF production sites and a basis for estimating supporting logistic requirements.

Task 1, Activity 3 will focus on identifying and filling data gaps related to AJF feedstock materials and conversion processes. Examples of potential activities undertaken as part of this subtask include (i) identifying higher value compounds present in tropical oil seeds that could provide co-product price support for AJF production, (ii) determining physical and chemical property data for tropical candidate feedstocks, and (iii) logistics data related to feedstock handling, port/harbor capacity, or harvesting time and motion studies.

Milestone(s)

Task 1, Activity 1: Identify target opportunities to augment POLYSYS, AFTOT, and conversion modules

Task 1, Activity 2: Review previously developed GIS information layers for tropical fiber crops and identify updating requirements

Task 1, Activities 1 & 4: Status report on provision of data to other ASCENT 1 researchers (e.g. POLYSYS and AFTOT)

Task 1, Activity 2: Preliminary estimates of AJF technical potential in Hawaii based on previously developed GIS information layers

Task 1, Activity 3: Status report on biomass resources in Hawaii

Major Accomplishments

None - Task in progress

Publications

None - Task in progress

Outreach Efforts

None - Task in progress

Awards

None

Student Involvement

None

Plans for Next Period

Next steps for this task will include activities to accomplish the following:

Task 1, Activity 1. Support Volpe Center and Commercial Aviation Alternative Fuels Initiative (CAAFI) Farm to Fly 2.0 supply chain analysis.

Task 1, Activity 2. Use GIS-based estimates of fiber crop production potential to develop preliminary technical production estimates of jet fuel in Hawaii.

Task 1, Activity 3. Develop fundamental property data for tropical biomass resources.

Task 1, Activity 4. Transmit data and analysis results to support improvement of existing tools (e.g. POLYSYS).

13-C-AJFE-UH, Amendment 007 Task 2: Support of Indonesian Alternative Jet Fuel Supply Initiatives

University of Hawaii

Objective(s)

The objective of Task 2 is to support the Memorandum of Understanding between the Federal Aviation Administration (FAA) and Indonesian Directorate General of Civil Aviation (DGCA) to promote developing and using sustainable, alternative aviation fuels.

Research Approach



This task will support the Memorandum of Understanding between the Federal Aviation Administration (FAA) and Indonesian Directorate General of Civil Aviation (DGCA) to promote development and use of sustainable, alternative aviation fuels. This will begin with working with the FAA to establish points of contact to coordinate efforts with Indonesian counterparts. The Indonesian Aviation Biofuels and Renewable Energy Task Force (ABRETF) membership includes Universitas Indonesia, Institut Teknologi Bandung, and Universitas Padjadjaran. A prioritized list of tasks will be developed in consultation with Indonesian counterparts and data required to inform sustainability and supply analyses and potential sources of information will be identified. This could include data collection on Indonesian jet fuel use and resources for alternative jet fuel production, airport locations and annual and monthly jet fuel consumption patterns. Characterization of sustainable biomass resources with potential for use in producing alternative jet fuel supplies could include developing preliminary GIS mapping information of their locations and distributions and preliminary estimates of their technical potentials.

Milestone(s)

Preliminary report on Indonesian project element 1 (e.g. airport and jet fuel consumption patterns)

Status report on project element 2 (e.g. targeted biomass resources in Indonesia)

Status report on project element 3 (e.g. data required to inform sustainability analyses and potential sources of information for Indonesian alternative jet fuel production options)

Major Accomplishments

None - Task in progress

Publications

None - Task in progress

Outreach Efforts

None - Task in progress

Awards

None

Student Involvement

None

Plans for Next Period

Plans for the next period include working with the FAA to establish points of contact to coordinate efforts with Indonesian counterparts to meet project objectives.