Toward Commercially Viable, Environmentally Friendly Alternative Jet Fuels

An Update on FAA Activities

Presented to: UTIAS-MITACS 2nd International Workshop on Aviation and Climate Change

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Office of Environment and Energy

Date: May 28, 2010

Federal Aviation Administration

The Interest in Alternative Jet Fuels

"Drop in" alternative jet fuels to enhance:

- Environmental sustainability

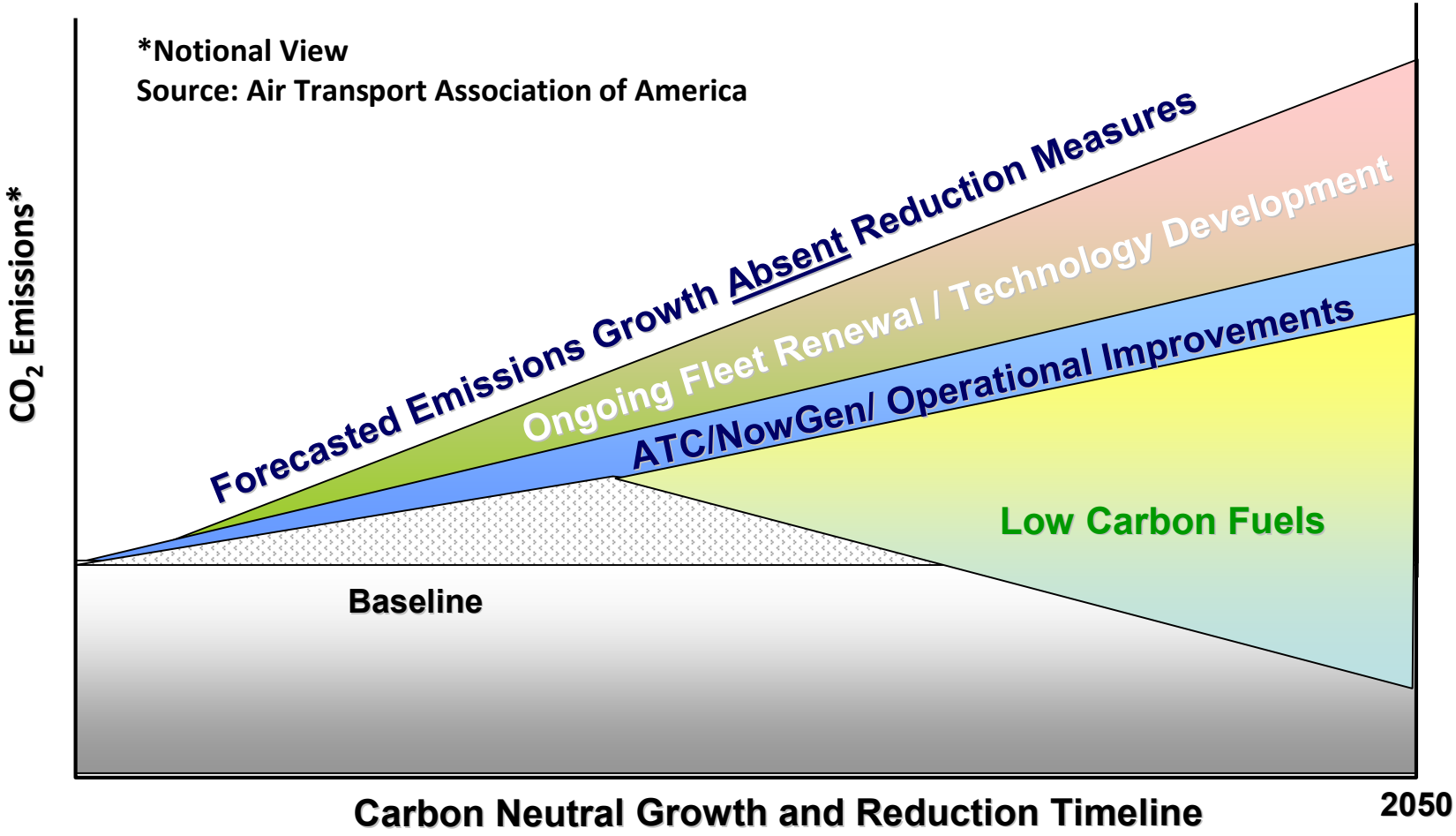
  GHG emissions reduction

  Air quality improvement (not just CO2)

- Fuel supply security
- Fuel price stability
- Job creation/ Rural development

… without compromising safety or performance.

Alternative Jet Fuels Key Technology for Carbon Neutral Growth



Aviation Unique Strengths as Alt. Fuel User

- Liquid Fuel dependent – assured market for producers
- Global Fuel specifications
- Single environmental regulatory framework
- Concentrated distribution hubs (Airports)
- Aviation skilled at technology risk management / deployment
- Combined commercial and military demand and R&D capabilities
- Limited number of key evaluators / implementers can drive consensus

FAA Alternative Aviation Fuel Activities

- **Commercial Aviation Alternative Fuels Initiative (CAAFI)** www.caafi.org
  - Stakeholder coalition; four sponsors
  - Fuel Certification; R&D roadmapping; Environmental Analysis; Commercialization
- **Continuous Lower Energy, Emissions and Noise (CLEEN) Technology program**
  - Includes Alternative fuel testing and development
- **FAA PARTNER Center of Excellence** www.partner.aero
  - Project 17 - Alternative Fuels
  - Project 20 - Emissions Characteristics of Alternative Aviation Fuels
  - Project 27 - Environmental cost-benefit analysis of Ultra Low Sulfur Jet Fuels
  - Project 28 - Environmental Cost-benefit Analysis of Alternative Jet Fuels
- **Airport Cooperative Research Program** www.trb.org/ACRP/Public/ACRP.aspx
  - ACRP 02-07 - “Handbook for Analyzing the Costs and Benefits of Alternative Turbine Engine Fuels at Airports”
  - ACRP 02-18 - “Guidelines for Integrating Alternative Jet Fuel into the Airport Setting”

Alternative fuels Development, Demonstration, and Deployment challenges

- **R&D:**
  - Identifying appropriate fuels, feedstocks and feasibility
  - Coordinate & leverage necessary R&D
- **Certification/Qualification:**
  - Develop a standard fuel approval process and approve fuels to ensure safety and enable use
- **Environment:**
  - Measuring AQ emissions, Life Cycle GHG benefits
  - Ensuring Sustainability (land use, water, food etc.)
- **Commercialization:**
  - Communicating aviation strengths as a customer
  - Establishing Market
  - Financing for fuel supply development

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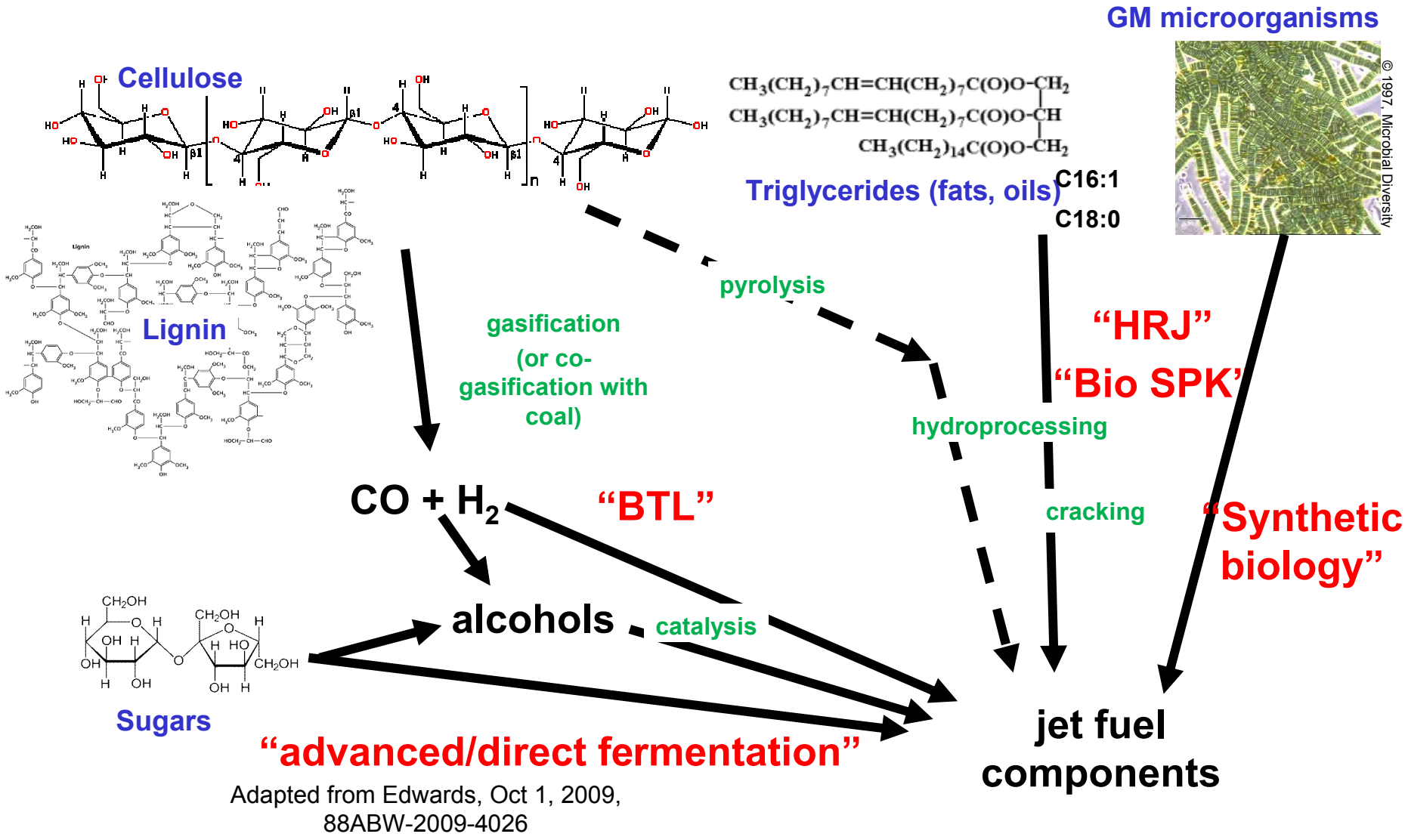
R&D Status

- CAAFI Research & Development roadmaps support coordination
- Establishment of CLEEN Alt. Fuels projects
- Fruitful collaboration between FAA, DoD, NASA etc. on testing
- Cooperation with USDA and DOE being established on feedstocks and fuels

Some ways to make bio-based jet fuel.



Adapted from Edwards, Oct 1, 2009,
88ABW-2009-4026

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Certification/Qualification Status

- **ASTM D7566 – passed September 2009!**
  - Approval of 50% fuel blend Fischer Tropsch SPK
  - Cross referenced to existing D1655
  - Annexes for additional fuels
- **ASTM D4054 Industry Qualification Process -- accepted**
- **Hydroprocessed Renewable Jet (HRJ) currently undergoing evaluation process (aka Bio-SPK)**

HRJ Fuel Status (ASTM D4054 Process)

Specification
Prop

Component/Rig

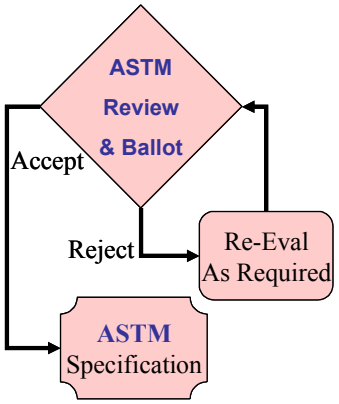
Engine/APU Testing

We Hope to be Here by Dec 2010

We Are Here Now

ASTM Research Report

FAA & OEM Review & Approval



ASTM Balloting Process

ASTM D7566 Revision

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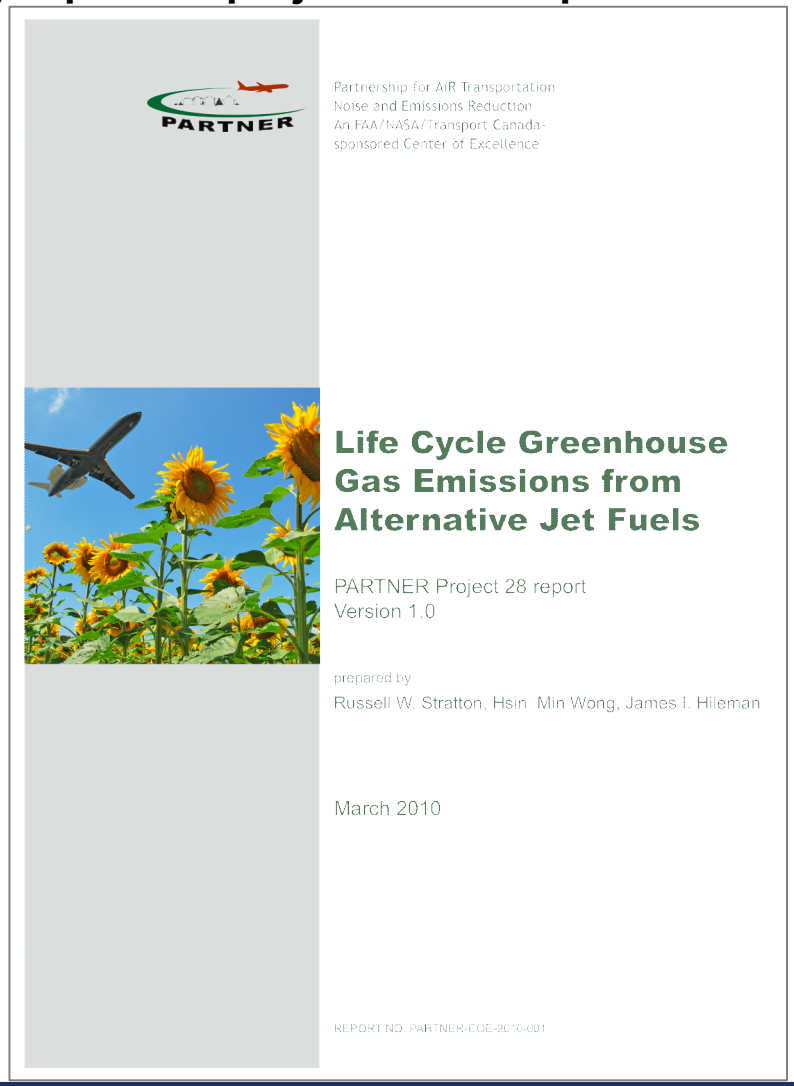
Environment Status

- Emissions measurements showing benefits (NASA, PARTNER 20)
- ULS Jet Fuel Cost Benefit Analysis (PARTNER 27)
- Interagency “Guidance and Framework” for Alternative Jet Fuel GHG LCA developed and peer reviewed (CAAFI)
- Report on Life Cycle GHG Emissions just released (PARTNER 28)

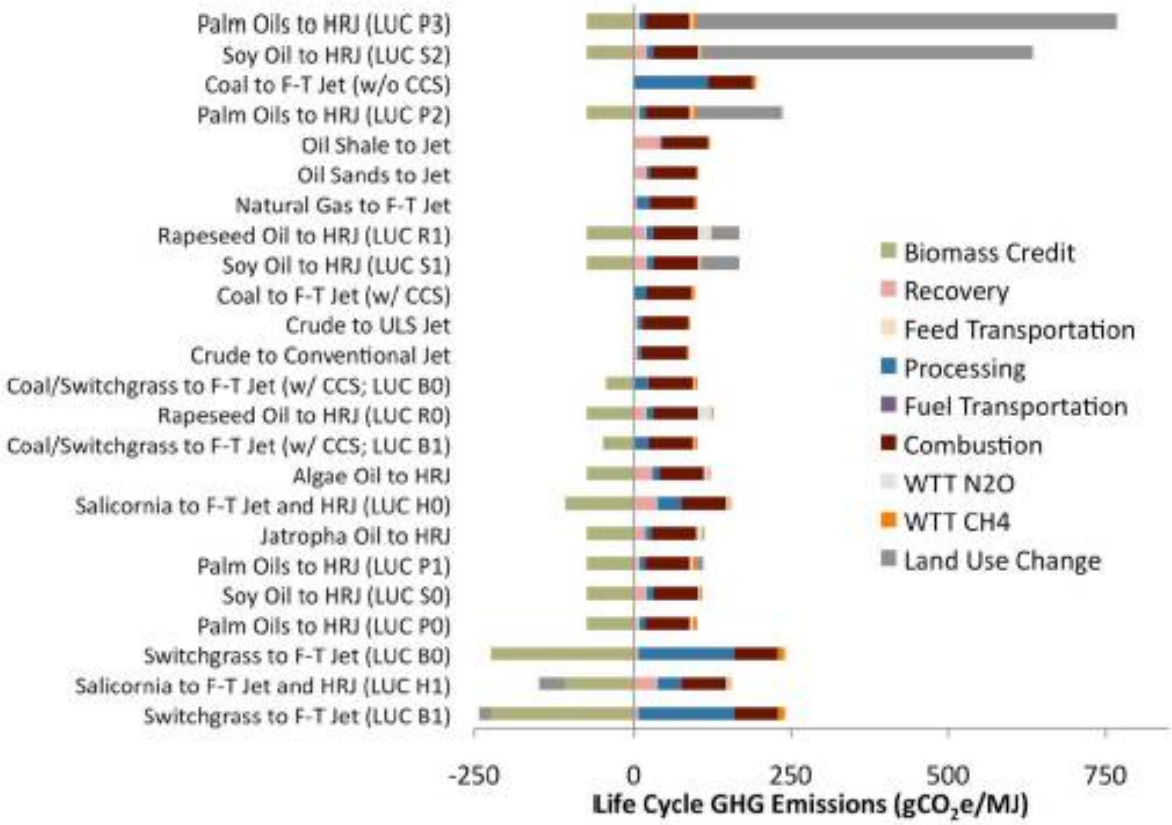
Report on Life Cycle GHG Emissions

http://web.mit.edu/aeroastro/partner/reports/proj28/partner-proj28-2010-001.pdf

- **Life cycle GHG of alt jet fuel from sixteen different feedstocks**
  - Considerable detail
  - Emphasizes influential aspects of life cycle analysis
  - Pressure points within each pathway identified
- **Other issues considered: land, water, invasiveness**
- **Expanding analysis to newly emerging fuel pathways (e.g. FRJ and PRJ)**
- **Case studies planned for CBTL, soy, algae based fuels**



Summary of GHG Emissions by Pathway



Soy HRJ Pathway Scenarios	
LUC-S0	No land use change
LUC-S1	Grassland conversion to soybean field
LUC-S2	Tropical rainforest conversion to soybean field
Palm HRJ Pathway Scenarios	
LUC-P0	No land use change
LUC-P1	Logged over forest conversion to palm plantation
LUC-P2	Tropical rainforest conversion to palm plantation
LUC-P3	Peatland rainforest conversion to palm plantation
Rapeseed SPK Pathway Scenarios	
LUC-R0	No land use change
LUC-R1	Set-aside land converted to cultivation
Salicornia SPK Pathway Scenarios	
LUC-H0	No land use change
LUC-H1	Desert converted to salicornia cultivation
Switchgrass to BTL and CBTL	
LUC-B0	No land use change
LUC-B1	Carbon depleted converted to switchgrass cultivation

To reduce GHG emissions, need biofuels created from waste products or from crops that do not incur positive land use changes.

Data from Stratton et al (2010)

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Commercialization Status

- **Biofuels Digest recognition of jet biofuel producers 2009**
  - aviation day at advanced biofuels leadership conference
- **ATW Joseph F. Murphy Award to CAAFI for industry service 2/2010**
- **3 MOUs between ATA airlines and two fuel suppliers – others in the works**
- **Strategic Alliance between Air Transport Association (ATA) and Defense Energy Support Center (DESC) 3/2010**

Aviation – Key to U.S. Biofuels Targets?

Utilize "Pre-established market outlets…with a concerted effort directed to our military and airline industry."

…White House Biofuels Interagency Working Group, February 2010. (http://www.whitehouse.gov/sites/default/files/rss_viewer/growing_americas_fuels.PDF)

FAA 2010 Goals and Next Steps

- **R&D: Expand range of feedstocks and fuels for aviation**
  - CLEEN alt. fuel engine/flight testing to support qualification of current and additional fuels
  - CAAFI advance feedstock understanding with USDA (FeRL)
  - RFP planned for testing and advancement of “Future Fuels”
- **Certification/Qualification: Complete approval of 50% HRJ**
  - Support any additional fuel testing
  - Investigate fuel quality control methods
- **Environment: Quantify benefits and reduce LCA uncertainty**
  - Support AQ emissions testing
  - Application of Life Cycle GHG framework to 3 case studies
  - Investigate sustainability validation processes
- **Commercialization: Witness deployment of alternative fuels**
  - Support supply chain financial risk analysis for HRJ
  - Maintain visibility with USDA, DOE funding programs
  - Provide ACRP tools to strengthen capability of airports, developers

Questions?

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