

Alternative Jet Fuels - Feedstock Development, Processing and Conversion Research & Regional Supply and Refining Infrastructure

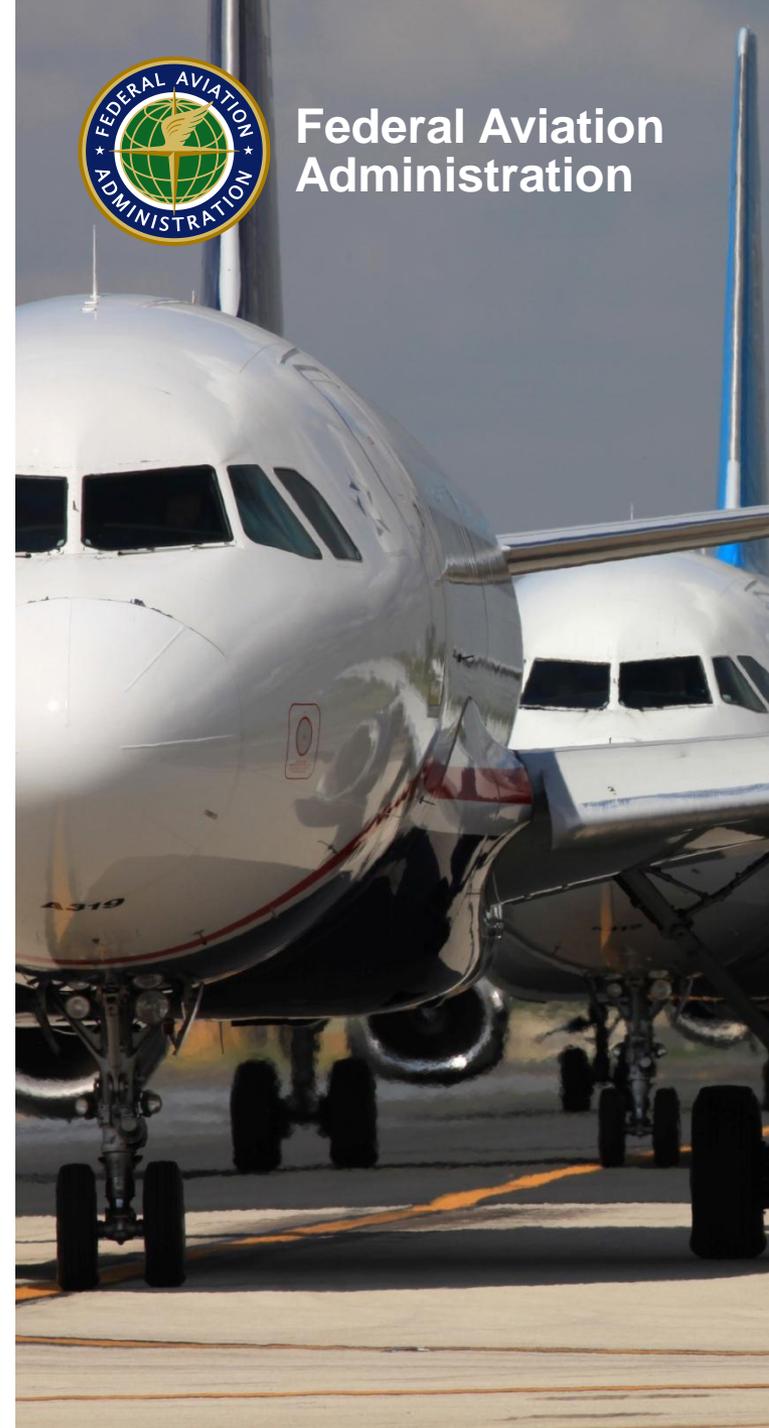
Presented to: Public Meeting for Center of Excellence
for Alternative Jet Fuels and Environment

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Date: November 15, 2012



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Overview: Definitions

Alternative jet fuels:

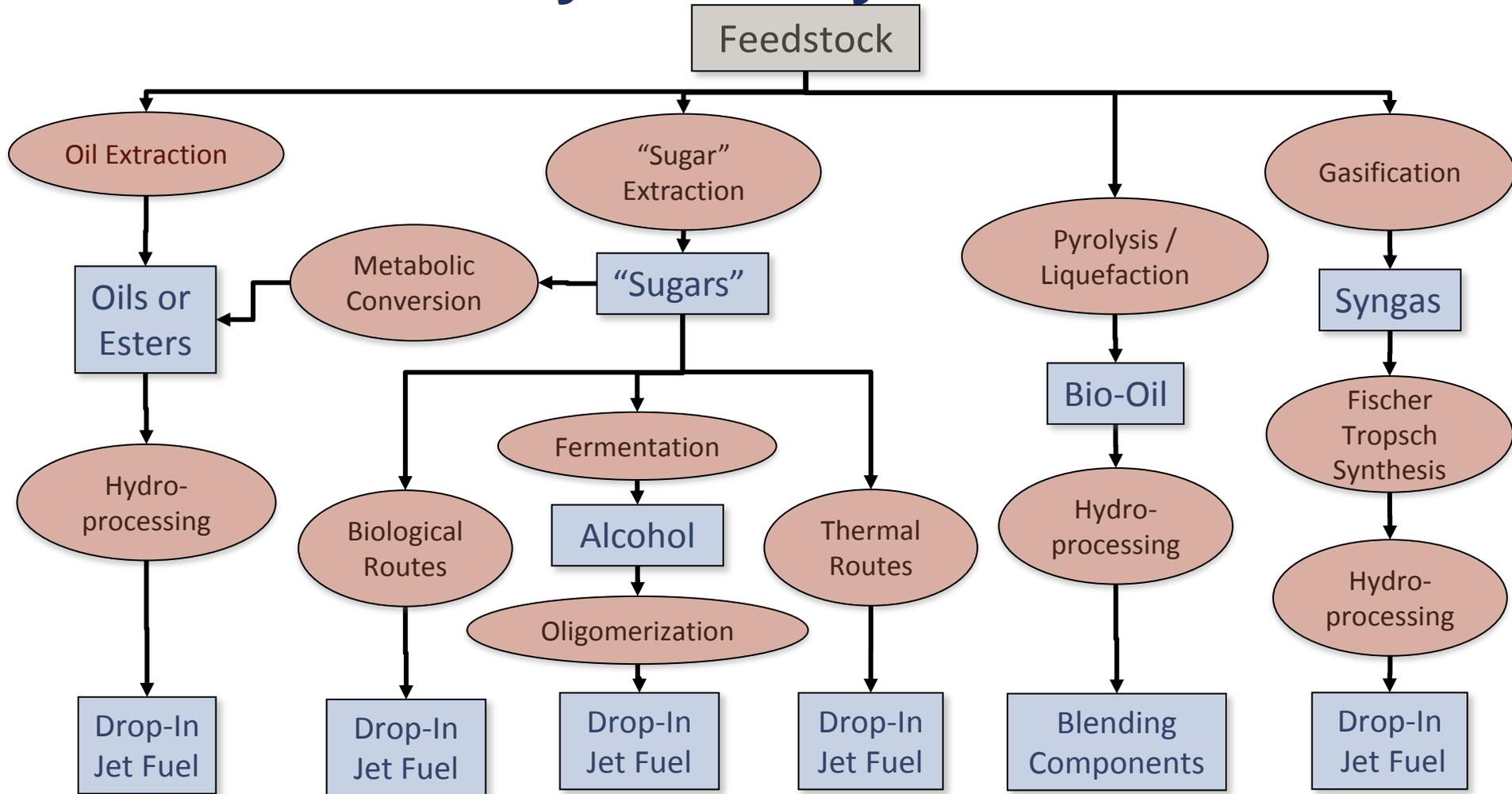
Hydrocarbon-based, drop-in fuels that are derived from non-petroleum sources.

FAA is:

- Agnostic on feedstock and conversion process
- Seeking sustainability over petroleum based jet fuel
- Seeking solutions that can be commercial



Overview: Many Pathways to Jet Fuels



These pathways all result in a hydrocarbon fuel (no oxygen) that would have similar properties to conventional jet fuel.



Overview: Challenges for Alternative Jet Fuels

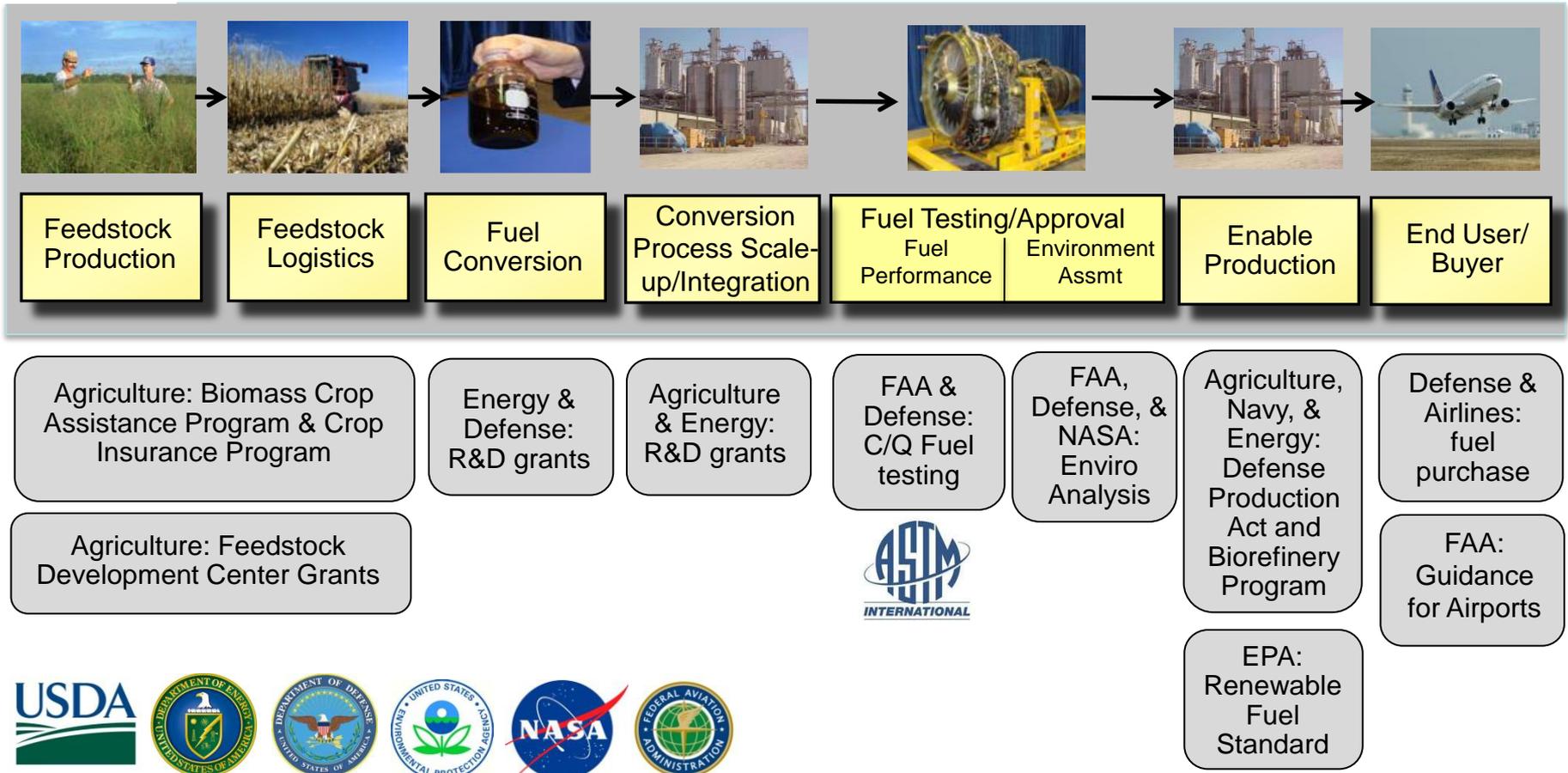
- **Feedstock Availability**
- **Competitive cost for alternative fuel**
- **Approved for performance/safety**
- **Environmentally sustainable**
- **Commercially produced**



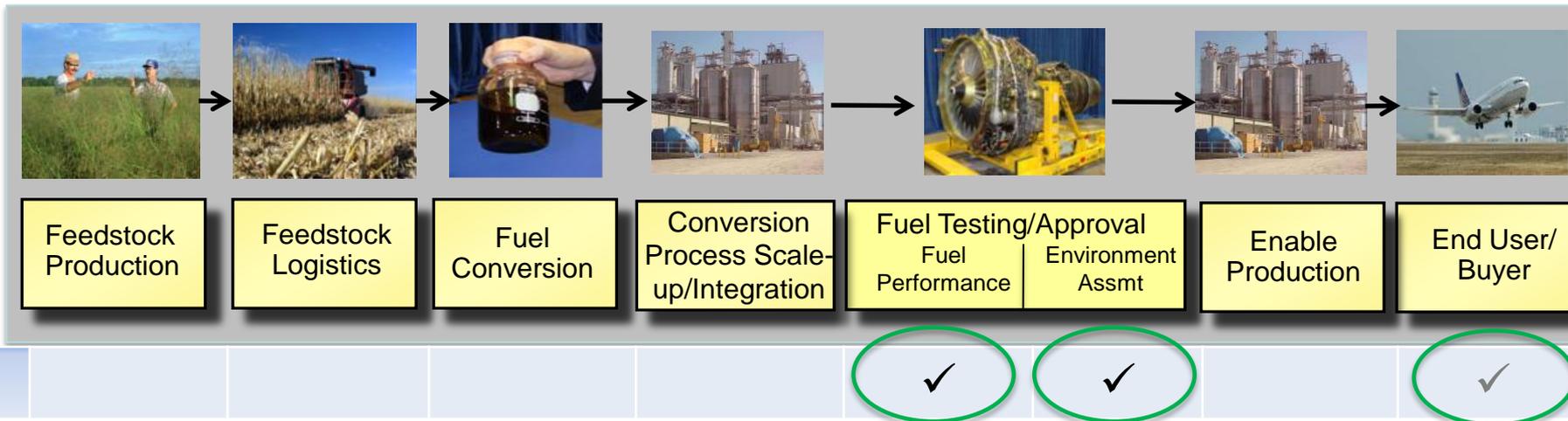
Overview: USG Efforts across Supply Chain



Facilitating Deployment and Investment



Overview: FAA Role in Supply Chain



Agency	Interest	Role	Goal
FAA	Enabling aviation growth by reducing aviation air quality and GHG impacts and energy security with alternative aviation fuels.	Emissions certification & standards for aircraft, engines; Facilitation of qualification/certification of aviation fuels at ASTM Intl; Environmental impacts assessment & measurement, analysis & analytical tools development; maturation of promising alt. fuel candidates; Info exchange/coordination; key sponsor of CAAFI.	1B gallons by 2018. CO ₂ neutral growth by 2020 using a 2005 emissions baseline. Net reductions of air quality health & welfare impacts despite aviation growth.

FAA address key aspects

- Conduct environmental and cost analysis/tools
- Fund Cert/Qualification testing to inform ASTM
- Enable government & aviation industry coordination



Current FAA Alt Jet Fuels R&D Activities

- Analysis
 - Environmental sustainability
 - Techno-Economic
 - Future scenarios
- Testing
 - Material compatibility
 - Certification/Qualification
 - Emissions
- Coordination
 - Interagency
 - State & Regional
 - International

University
Research



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Commercial Aviation Alternative Fuels Initiative

- Coalition focused on efforts of commercial aviation to engage the emerging alternative fuels industry
- Goal is development of alt jet fuels with:
 - Equivalent safety/performance (Drop-in)
 - Comparable cost
 - Environmental improvement
- Comprehensive approach to key issues:
 - Environment Team
 - Certification-Qualification Team
 - R&D Team
 - Business Team



For more information: www.caafi.org



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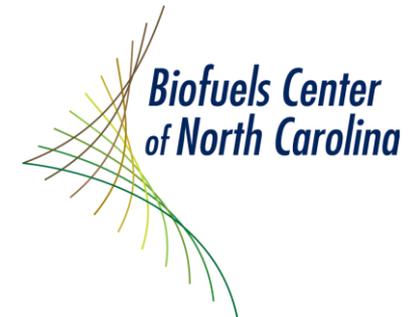
CAAIFI State & Regional Deployment

- Working with local lead organizations/POCs
- Provide context, advice, strategy, benchmarking
- Facilitate networks & links between stakeholders



States:

Arizona	New England (CT, VT, MA, NH, ME)
California	New York/New Jersey
Florida	North Carolina
Georgia	Ohio
Kansas	Oklahoma
Louisiana	SAFN (WA, OR, ID)
MASBI (IL)	South Carolina
Michigan	Virginia
Mississippi	



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U.S. Alternative Jet Fuel Availability?

- FAA goal is 1 Billion gallons of advanced biofuels by 2018 in U.S.
- How much advanced biofuel production in U.S. will be jet fuel?
- Competition for feedstock? Ground transport, power, chemicals, jet?
- What is the potential of existing and emerging technology pathways for scaled production of jet fuel?
 - FT & HEFA
 - Alcohol to Jet
 - Pyrolysis
 - Direct Sugar to Hydrocarbon
 - Catalytic Sugar to Jet



Future fuels process development?

- Volpe Broad Agency Announcement (BAA)
 - Fuels with potential advantages over existing approved fuels
 - 100 gallons of novel alternative jet fuel for testing from 3 Awardees
 - Coordinated testing with AFRL
- DOE Integrated Bio-Refineries funding supporting jet fuel development

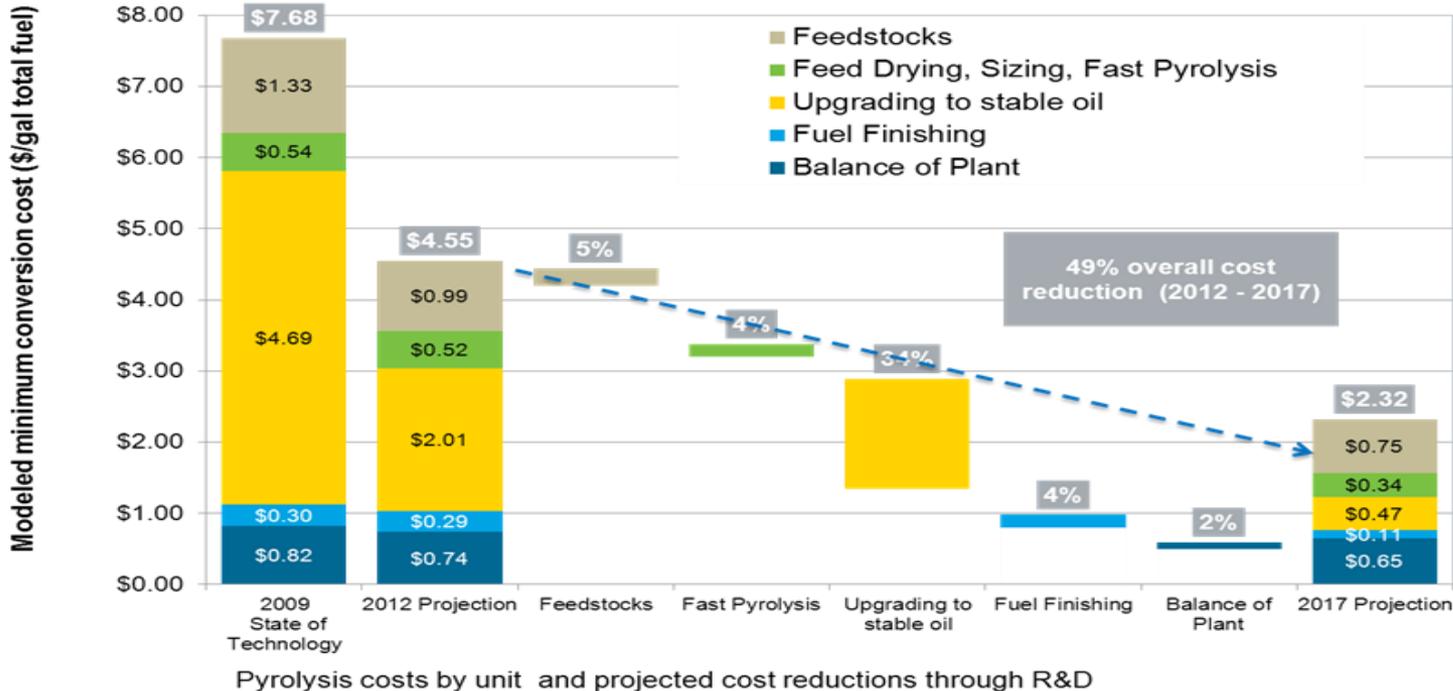


Projected Cost of Alternative Jet Fuels?

- What are the costs? How will costs evolve over time?
- Potential for significant cost reduction via feedstock and processing gains

Pyrolysis costs (\$/g) and projected cost reductions through R&D

Renewable gasoline and diesel via pyrolysis



From DOE EERE
Office of the
Biomass Program

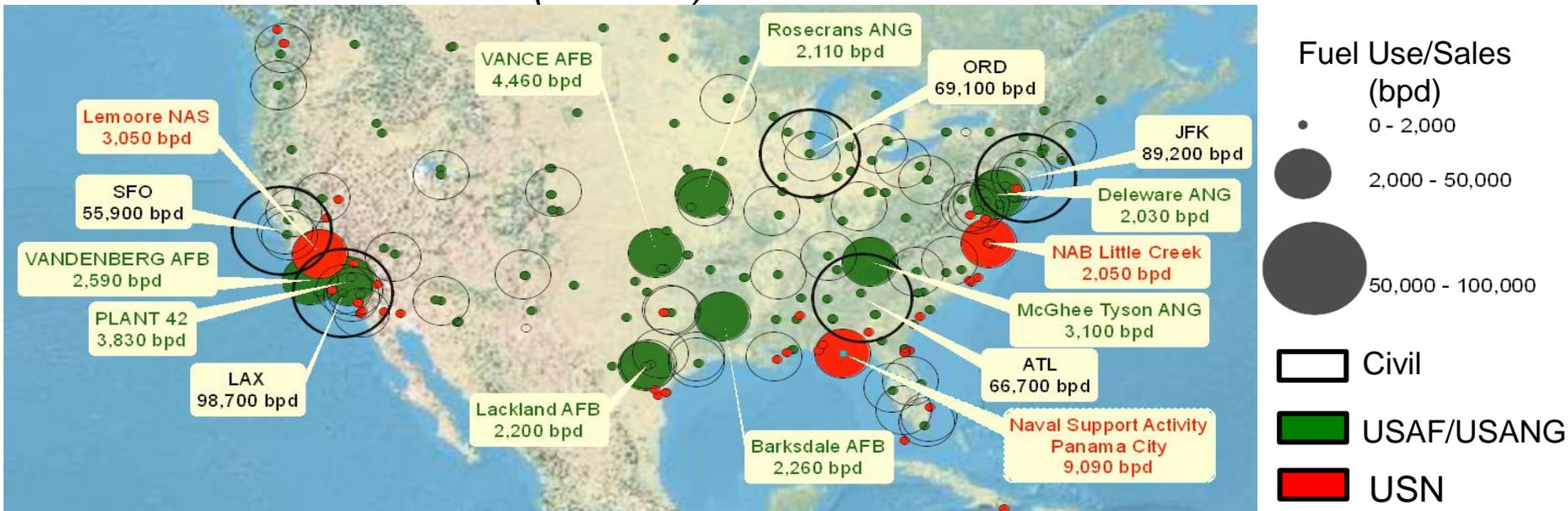
Pyrolysis costs by unit and projected cost reductions through R&D



Opportunities in States and Regions?

- Major fuel use by location of civil and military
- Total combined demand ~ 20 Billion gallons/year
- Majority of civil aviation fuel use locations are an order of magnitude larger than military counterparts
- Can we identify and match up demand, infrastructure and production in specific locations?

*Continental U.S. (CONUS) Jet Fuel Use**



* Carter et al., "Energy and Environmental Viability of Select Alternative Jet Fuel Pathways," American Institute of Aeronautics and Astronautics, AIAA 2011-5968, 2011.



Opportunities for Incentives?

- What is the impact of existing and potential policies on alternative Jet fuel production
 - Renewable Fuel Standard (RFS)
 - Domestic policy measures
 - International policy measures
- Multi-sector, economic model could be used with production costs to evaluate economic competition for feedstocks and potential impact of competition on alternative jet fuel availability



Research Goals

- Improve understanding of the potential availability of alternative jet fuel
- Complement work of other agency programs in addressing supply chain needs of alternative jet fuel
- Improve understanding of economics of alternative jet fuel pathways and levers for reducing costs and GHG emissions
- Support to state/regional supply chain development and deployment
- Identify impacts of different policies
- Understand path and progress to meeting FAA's goal



Alternative Fuels - Feedstock Development, Processing and Conversion Research

- Conduct small-scale development, testing, and technology evaluation related to the creation, processing, production, and transportation of alternative jet fuel.
- Develop a means for using techno-economic and environmental sustainability analyses to identify areas of research that could improve economic and environmental performance (see paragraphs 3.1.2 and 3.1.3) of alternative jet fuels and identify promising fuels for approval process.



Alternative Fuels - Regional Supply and Refining Infrastructure

- Conduct analyses to support state and regional feedstock-to-finished alternative jet fuel supply chain development and production efforts.
- Conduct techno-economic analyses of candidate alternative jet fuel pathways to evaluate their economic cost of fuel production.
- Examine the impact of economic competition for feedstocks on the availability of alternative jet fuels.
- Develop efficient mechanisms for tracking and reporting nationwide commercial aviation alternative jet fuel production and usage.
- Evaluate policy & incentive options that could facilitate alternative jet fuel deployment.

