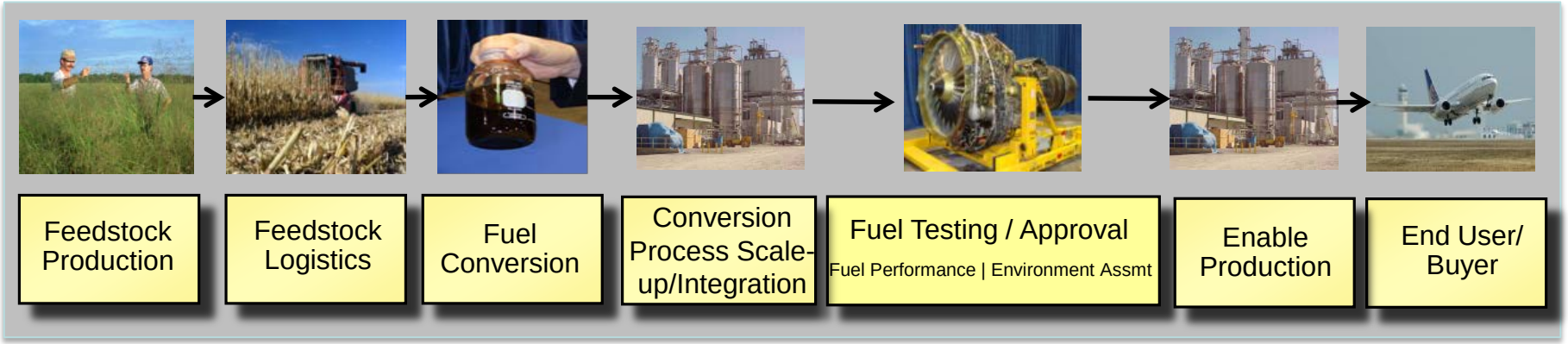
Coordinated U.S. Agency Efforts Across the Supply Chain



Agriculture: Biomass Crop Assistance Program & Crop Insurance Program

Agriculture: Feedstock Development Center Grants

Energy: R&D

Energy & Defense: R&D grants

Agriculture & Energy: R&D grants

FAA & Defense: C/Q Fuel testing

FAA, Defense, & NASA: Enviro Analysis

ASTM INTERNATIONAL

Agriculture, Navy, & Energy: Defense Production Act and Biorefinery Program

EPA: Renewable Fuel Standard

Agriculture, Energy, FAA: Farm to Fly 2.0

Airlines: fuel purchases

Defense: Farm to Fleet

FAA: Guidance for Airports

All: Federal Alternative Jet Fuel R&D Strategy

USDA · DOE · DOD · EPA · NASA · FAA · DOC · NSF

Building a Strong Biobased Economy with Partnerships

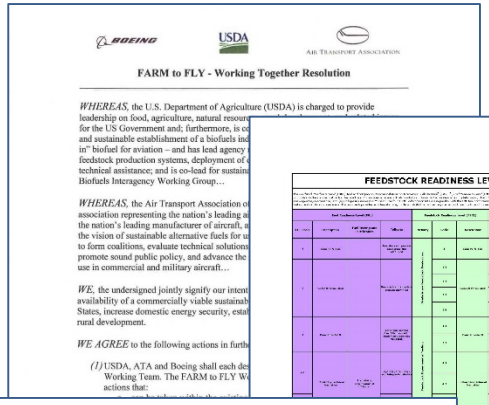
Todd Campbell

USDA Rural Development

COMMERCIAL AVIATION ALTERNATIVE FUELS INITIATIVE
BIENNIAL GENERAL MEETING
OCTOBER 25TH, 2016

Working Together with CAAFI/FAA, DOE, and U.S. Navy

Farm to Fly (2010, 2012 report) Navy/DPA/F2Fleet (2010, 2011, 2013) Farm to Fly 2.0 (2013, DOE 2014)


BOEING USDA AIR TRANSPORT ASSOCIATION

FARM to FLY - Working Together Resolution

WHEREAS, the U.S. Department of Agriculture (USDA) is charged to provide leadership on food, agriculture, natural resou... for the US Government and; furthermore, is co... and sustainable establishment of a biofuels ind... in" biofuel for aviation – and has lead agency ... feedstock production systems, deployment of ... technical assistance; and is co-lead for sustain... Biofuels Interagency Working Group…

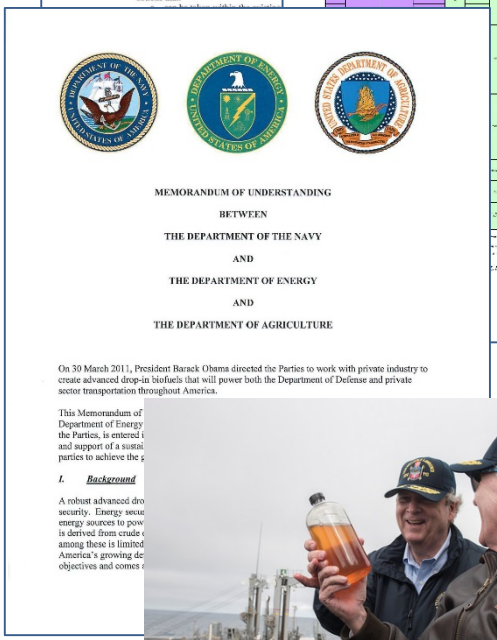
WHEREAS, the Air Transport Association o... association representing the nation's leading a... the nation's leading manufacturer of aircraft, ... the vision of sustainable alternative fuels for u... to form coalitions, evaluate technical solutions, promote sound public policy, and advance the ... use in commercial and military aircraft…

WE, the undersigned jointly signify our intent ... availability of a commercially viable sustainab... States, increase domestic energy security, estab... rural development.

WE AGREE to the following actions in furth...

(1) USDA, ATA and Boeing shall each des... Working Team. The FARM to FLY W... actions that:

FEEDSTOCK READINESS LEVEL (FSRL) TOOL


MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF THE NAVY

AND

THE DEPARTMENT OF ENERGY

AND

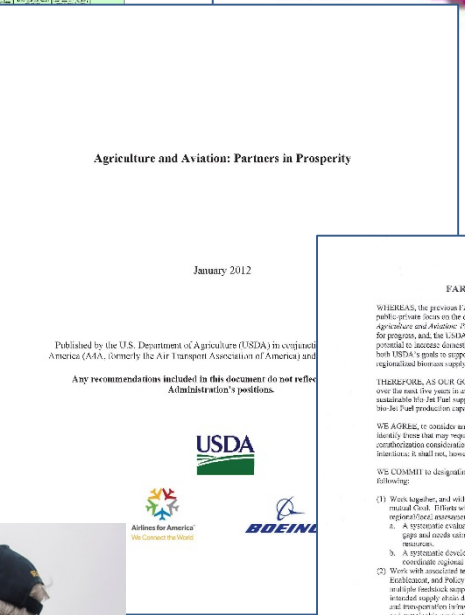
THE DEPARTMENT OF AGRICULTURE

On 30 March 2011, President Barack Obama directed the Parties to work with private industry to create advanced drop-in biofuels that will power both the Department of Defense and private sector transportation throughout America.

This Memorandum of ... Department of Energy ... the Parties, is entered i... and support of a sustai... parties to achieve the g...

I. Background

A robust advanced dro... security. Energy secur... energy sources to pow... is derived from crude ... among these is limited ... America's growing de... objectives and comes ...


Agriculture and Aviation: Partners in Prosperity

January 2012

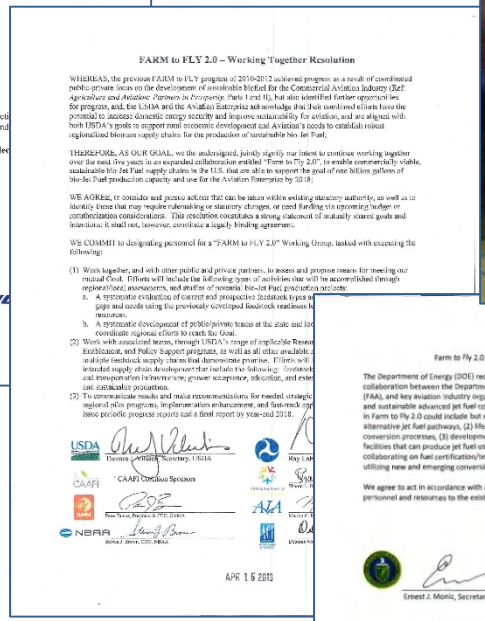
Published by the U.S. Department of Agriculture (USDA) in conjunct... America (AIA, formerly the Air Transport Association of America) and...

Any recommendations included in this document do not reflec... Administration's positions.

USDA

Airlines for America

BOEING


FARM to FLY 2.0 – Working Together Resolution

WHEREAS, the previous FARM to FLY program of 2010-2012 achieved progress as a result of coordinated public-private focus on the development of sustainable biofuel for the Commercial Aviation Industry (Ref: *Agriculture and Aviation: Partners in Prosperity*, Parts I and II), but also identified further opportunities for progress, and; the USDA and the Aviation Enterprise acknowledge that their combined efforts have the potential to increase domestic energy security and improve sustainability for aviation, and are aligned with both USDA's goals to support rural economic development and Aviation's needs to establish robust regionalized biomass supply chains for the production of sustainable bio-Jet Fuel;

THEREFORE, AS OUR GOAL, we the undersigned, jointly signify our intent to continue working together over the next five years in an expanded collaboration entitled "Farm to Fly 2.0", to enable commercially viable, sustainable bio-Jet Fuel supply chains in the U.S. that are able to support the goal of one billion gallons of bio-Jet Fuel production capacity and use for the Aviation Enterprise by 2018;

WE AGREE, to consider and pursue actions that can be taken within existing statutory authority, as well as to identify those that may require rulemaking or statutory changes, or need funding via upcoming budget or reauthorization considerations. This resolution constitutes a strong statement of mutually shared goals and intentions; it shall not, however, constitute a legally binding agreement;

WE COMMIT to designating personnel for a "FARM to FLY 2.0" Working Group, tasked with executing the following:

(1) Work together, and with other public and private partners, to assess and propose means for meeting our mutual Goal. Efforts will include the following types of activities that will be accomplished through regionalized assessments, and studies of scenario bio-Jet Fuel production projects:
   a. A systematic collection of current and prospective feedstock types and ...
   gaps and needs using the previously developed feedstock readiness l...
   b. A systematic development of public/private teams at the state and lo...
   coordinate regional efforts to reach the Goal.
(2) Work with associated teams, through USDA's range of applicable Resear... Enthusiast, and Policy Support programs, as well as all other available ... multiple feedstock supply chains that demonstrate promise. Efforts will ... intended supply chain development that include the following: feedstock ... and transportation infrastructure; grower acceptance, education, and exte... are sustainable production.
(3) To communicate results and make recommendations for needed strategic ... regional pilot programs, implementation enhancement, and fast-track ... issue periodic progress reports and a final report by year-end 2018.

USDA Thomas J. Vilsack, Secretary, USDA

CAAFI Coalition Sponsors

NBAA

AIA

APR 15 2013

Farm to Fly 2.0 – Department of Energy Signature Amendment

The Department of Energy (DOE) recognizes the value of the "Farm to Fly 2.0" Program as a critical collaboration between the Department of Agriculture (USDA), the Federal Aviation Administration (FAA), and key aviation industry organizations. DOE supports the development of commercially viable and sustainable advanced jet fuel conversion technologies in the US. Specific areas of DOE involvement in Farm to Fly 2.0 could include but not be limited to: (1) techno-economic analysis of innovative alternative jet fuel pathways; (2) life-cycle greenhouse gas emissions assessments of alternative jet fuel conversion processes, (3) development and support of pilot and/or demonstration-scale conversion facilities that can produce jet fuel using promising process technologies, and (4) assisting and collaborating on fuel certification/testing/approval processes for jet fuels from sustainable feedstocks utilizing new and emerging conversion technologies.

We agree to act in accordance with and support the "Farm to Fly 2.0" Initiative, and commit DOE personnel and resources to the existing "Farm to Fly 2.0" working groups as appropriate.

Ernest J. Moniz, Secretary, DOE

The Biomass Research & Development Board

- Created through the enactment of the Biomass Research and Development Act of 2000.
- The Board facilitates coordination among federal government agencies that affect the research, development, and deployment of biofuels and bioproducts.

Agency	Feedstock Supply	Biomass Conversion	Bioenergy Distribution	Bioenergy End Use
DOE	● ● ● ●	● ● ● ● ●	● ● ●	● ● ● ● ●
USDA	● ● ● ● ●	● ● ● ●	● ● ● ● ●	● ● ● ●
DOT	● ● ● ●	● ● ●	● ● ● ● ●	● ● ● ● ●
EPA	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ●
DOI	● ●	●		
NSF	● ● ●	● ● ● ●	●	
DoD		● ● ●	● ● ● ●	● ● ● ●

● Use an integrated systems approach
● Provide the science and the technology
● Public and private collaboration to overcome barriers and accelerate deployment
● Develop a workforce for the future bioeconomy
● Understand and inform policy

BR&DB
BIOMASS RESEARCH & DEVELOPMENT BOARD

Federal Activities Report on the Bioeconomy (FARB)

In February, the Biomass R&D Board released the Federal Activities Report on the Bioeconomy. This report aims to educate the public on the wide-ranging, federally funded activities that are helping to bolster the bioeconomy.

- The **vision** for the Billion Ton Bioeconomy is to sustainably reach the full potential of biomass-derived products as a way of expanding our nation's economy. In doing so, the bioeconomy will provide multiple economic, environmental, and social benefits to the Nation.
- The **goal** of the Billion Ton Bioeconomy is to develop and provide innovative ways to remove barriers to expanding the sustainable use of Nation's abundant biomass resources for biofuels, bioproducts, and biopower, while maximizing economic, social, and environmental outcomes.

A BILLION DRY TONS OF SUSTAINABLE BIOMASS

HAS THE POTENTIAL TO PRODUCE

1.1 MILLION Direct Jobs
and keeps about
$250 BILLION
in the U.S.
(direct contribution and inflation adjusted)

85 BILLION* kWh of electricity to power **6 MILLION** households. Plus **1050 TRILLION BTUs** of thermal energy.

50 BILLION gallons of biofuels displacing almost **25%** of all transportation fuels.

50 BILLION POUNDS of biobased chemicals and bio-products, replacing a significant portion of the chemical market.

400 MILLION TONS of CO_2e reductions every year.

STEPS TO BUILDING THE BIOECONOMY

1. Accelerate research & technology development
2. Develop production, conversion and distribution infrastructure
3. Deploy technology
4. Create markets and delivery systems

Projections based on:

- 2016 Billion Ton Study Report (Forthcoming)
- EIA 2015 AEO
- 2015 USDA Long-Term Forecast
- Various data sources

* Includes 27 billion kWh and 90 TBtu from livestock anaerobic digestion

For more information on USDA Programs that support Energy and the Biobased Economy, visit:

www.usda.gov/energy

todd.campbell@osec.usda.gov

In announcement inviting applications for 9003 Program…

"The bioeconomy is a catalyst for economic development in rural America, creating new jobs and providing new markets for farmers and ranchers. Investing in the businesses and technologies that support the production of biofuels and biobased products is not only good for farm incomes. The whole economy benefits from a more balanced, diversified and consumer-friendly energy portfolio, less dependence on foreign oil and reduced carbon emissions."

--Secretary Tom Vilsack, USDA

http://www.usda.gov/wps/portal/usda/usdahome?contentid=2016/07/0174.xml&navid=NEWS_AUSUMS&navtype=RT&parentnav=ENERGY&edeployment_action=retrievecontent

Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program (9003)

- The program now provides loan guarantees of up to $250 million to develop, construct and retrofit commercial-scale biorefineries and to develop renewable chemicals and biobased product manufacturing.
- For this announcement, USDA will seek applications in two cycles. Applications for the first funding cycle are due **October 3, 2016.** Applications for the second cycle are due **April 3, 2017**.
- Newly implemented two-phase application process to help identify projects that have made most progress in the development stage, greatest capacity for implementation and loan closing.
- First two cycles under the new process yielded complete applications from projects producing biogas, biodiesel, cellulosic ethanol, biobased lubricants and oils, lignin cake and syrup, and fertilizers.
- For more information, p. 48377 of the July 25, 2016, Federal Register.
- Application materials on USDA's Rural Development website.
- More to come from Energy Division Director Mark Brodziski

Small Business Innovation Research (SBIR) Program

- More than $8.3 million in available funding through National Institute for Food and Agriculture (NIFA) for the Small Business Innovation Research (SBIR) program to support small businesses in the creation of advanced research and development projects that will lead to innovative solutions for American agriculture.
- The SBIR program stimulates technological innovations in the private sector and strengthens the role of federal research and development in support of small businesses, encourages participation by women-owned and socially or economically disadvantaged small businesses.
- Companies initially apply for Phase I feasibility studies, which may be followed by Phase II research and development projects. Phase I grants are limited to $100,000 and a duration of eight months, while Phase II grants are limited to $600,000 and a duration of 24 months.
- Applications are due October 6. See the request for applications for more information: https://nifa.usda.gov/funding-opportunity/small-business-innovation-research-program-phase-i

Agriculture and Food Research Initiative (AFRI) Coordinated Agricultural Project and Alcohol-to-Jet

- A major milestone was reached in June when two commercial Alaska Airlines flights departed Seattle-Tacoma Airport fueled by 1,500 gallons of alcohol-to-jet (ATJ) fuel made by Gevo, Inc., blended at 20% with petroleum based jet fuel.
- These flights represent the first-ever commercial flights on the recently ASTM qualified fuel.
- Gevo's ATJ conversion process can utilize sugars and starches that originate from multiple sustainable sources, including agriculture, silviculture, and industrial process waste streams.
- Alaska Airlines also anticipates flying a demonstration flight on Gevo ATJ fuel produced from sugars derived from saccharification of forestry residuals (slash piles from forest harvest, chips or sawdust from timber production, and residues from pulp and paper processing) through a project with Washington State University's Northwest Advanced Renewables Alliance, recipient of one of the largest USDA NIFA grants.

66 Million Dead Trees in Southern Sierra Nevada

- U.S. Forest Service announced that it has identified an additional 26 million trees dead in California since Oct. 2015.
- Trees located in six counties, 760,000 acres in southern Sierra Nevada region, and are in addition to the 40 million trees that died statewide from 2010 to Oct. 2015, bringing the total to at least 66 million dead trees.
- Four consecutive years of severe drought, dramatic rise in bark beetle infestation and warmer temperatures are leading to historic levels of tree die-off.
- Efforts to protect watersheds and restore forests resilience are being squeezed out of budget; Last year fire management alone consumed 56% of the FS's budget.
- Link to Photos and video of the May survey

Public-Private Partnership to Help Reduce Wildfire Threat

- U.S. Forest Service and the Natural Resources Conservation Service announced a new partnership with the American Forest Foundation to conduct critical restoration work to address catastrophic wildfire risk across 3.5 million acres of private land in order to protect water supplies for Western communities.
- Combined $5 million initial investment, Aiming to restore more than 11,000 acres in the first two years.
- A portion of the funds will help AFF and partners including state forestry agencies, conduct outreach and education to 17,500 private landowners in important water supply watersheds.
- The remainder of the funds will provide cost-share dollars directly to landowners in one of the project landscapes, the Upper South Platte Watershed in Colorado.
- Also Rocky Mountain Front, MT; Blue Mountains, OR; Sierra Nevada region, broader CA; Four Corner States (AZ, CO, NW, UT)

Addressing the Challenges & Opportunities of Advancing the Billion Ton Bioeconomy

- Agricultural Technology Innovation Partnership (ATIP) Foundation --- a consortium of State Economic Development organizations --- develop and co-host with a coordinating entity, a series of regional Bioeconomy Forums to garner input from a broad range of stakeholders on the Bioeconomy challenges & opportunities to help shape a multiyear implementation plan, to be prepared by the Biomass R&D Board by the end of the calendar year.
- Foundation will co-host five Bioeconomy Forums throughout the United States, in partnership with the U.S. Departments of Agriculture and Energy.
- Forums are confirmed for Atlanta, Georgia (September 16), Mineral Wells, TX (September 29), Seattle-Tacoma, Washington (October 3), Orono, ME (October 18), and Columbus, OH (November 15)
- Follows listening sessions on the Vision, conducted by USDA and DOE, in April and May through a national webinar and at four major conferences including the 2016 Advanced Bioeconomy Leadership Conference; 2016 International Biomass Conference in Charlotte, NC; World Congress on Industrial Biotechnology in San Diego, CA; and the Symposium on Biotechnology for Fuels and Chemicals in Baltimore, MD.

Federal Alternative Jet Fuels R&D Strategy

Research, Development, Demonstration, & Deployment (RD3)

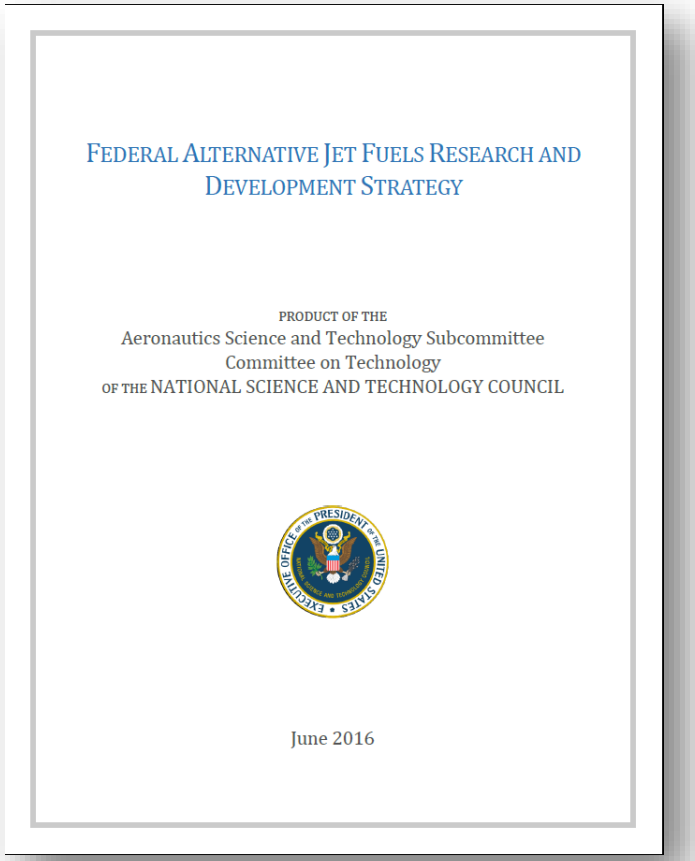
Mohan Gupta (FAA), Barbara Esker (NASA)
Co-Chairs

Interagency Representatives:

USDA	Harry Baumes*, Bill Goldner*
DOC	Dan Friend*
DOD	Bret Strogen*, Tim Edwards*, Chris Tindal
DOE	Zia Haq*
EPA	Aaron Levy*, Diana Galperin, John Kinsey
FAA	Mohan Gupta*, Nathan Brown*
NASA	Barbara Esker*, Angela Surgenor
NSF	Greg Rorrer*, Carole Read
DOS	Dan Birns*

* Strategy authors with writing support from:

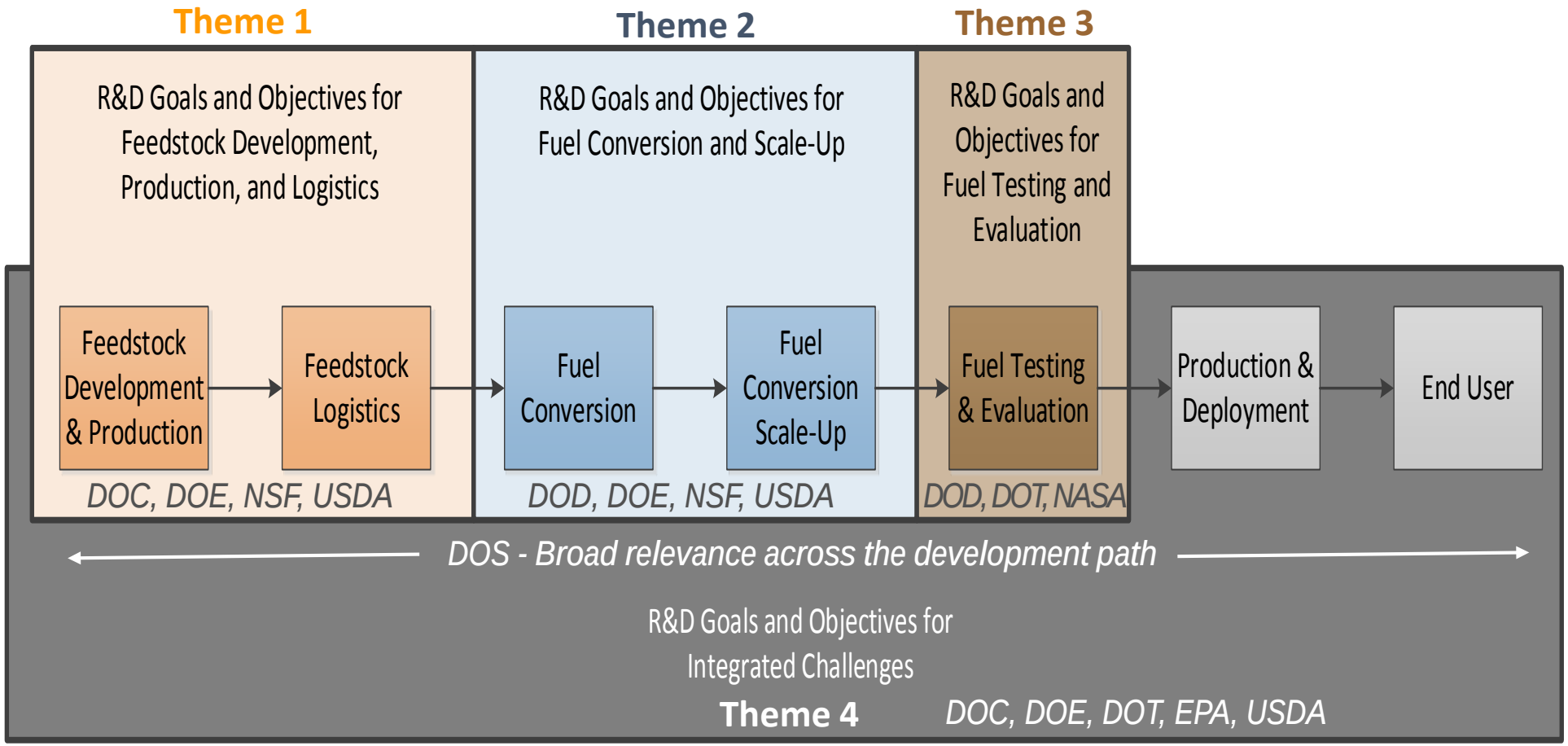
STPI	Bhavya Lal, Emily Sylak-Glassman



CAAFI Biennial General Meeting 2016
Washington DC

https://www.whitehouse.gov/sites/default/files/federal_alternative_jet_fuels_research_and_development_strategy.pdf
Released by OSTP on July 27, 2016

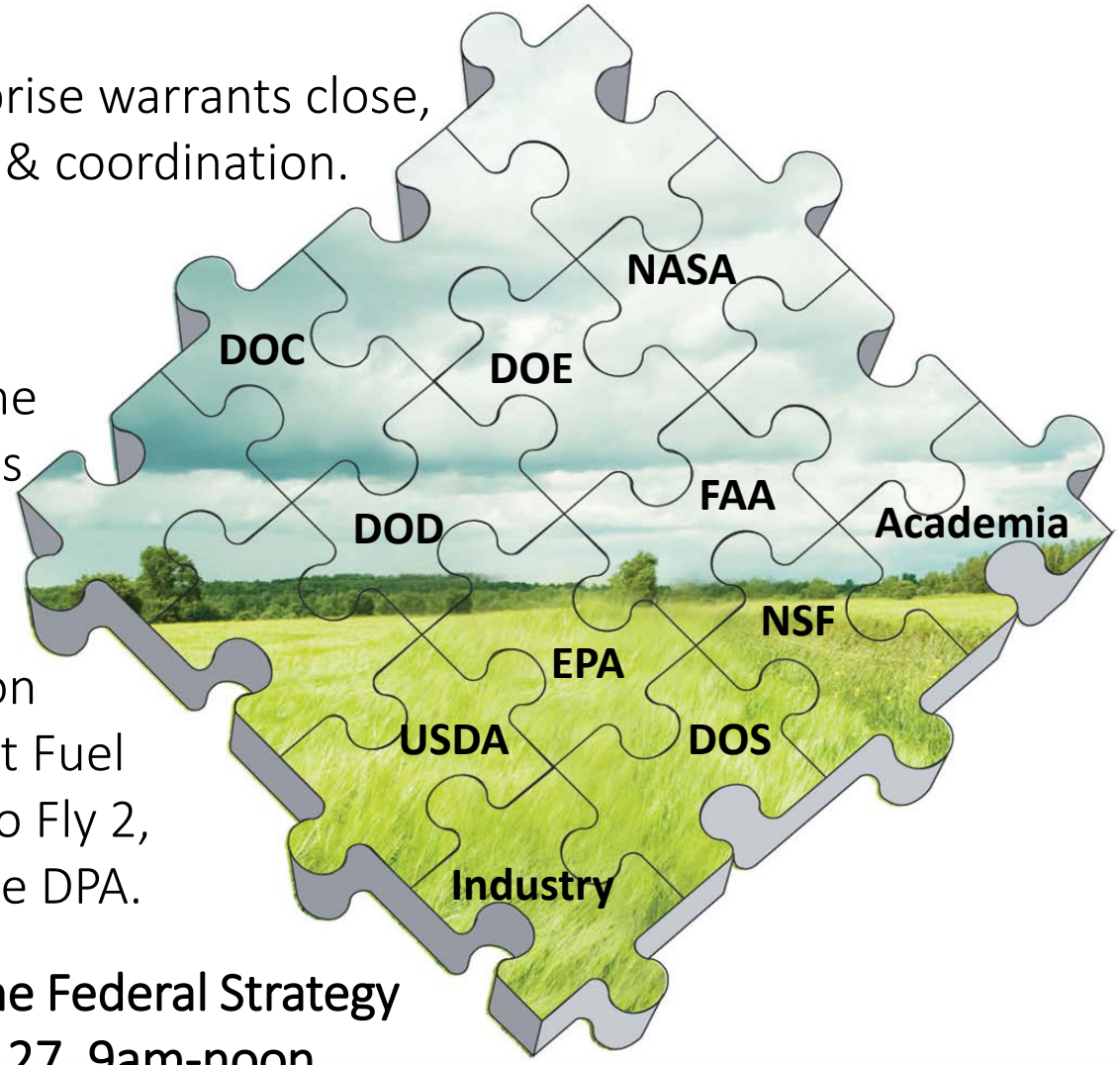
Strategy Construct:
AJF Development Path and Agency Engagement



Prioritized Federal R&D goals and objectives to address key scientific/technical challenges that currently inhibit the development, production, and use of economically viable alternative jet fuels – enabling environmental and social benefits compared to conventional fuels while enhancing U.S. energy security.

Summary

- US Agencies recognize the complex, inter-related nature of the sustainable alternative jet fuel enterprise.
- The complexity of this enterprise warrants close, inter-agency communication & coordination.
- Federal Agencies have self-organized to more closely coordinate & have codified the coordination & common goals in an actionable Federal Strategy.
- Examples of early coordination successes include National Jet Fuel Combustion Program, Farm to Fly 2, and recent progress under the DPA.
- **More detail & discussion at the Federal Strategy session on Thursday, October 27, 9am-noon**



2016 CAAFI General Meeting

U.S. Leadership and Cooperation to Advance Deployment

October 25, 2016

SHARYN LIE, DIRECTOR

CLIMATE ECONOMICS AND MODELING CENTER

OFFICE OF TRANSPORTATION AND AIR QUALITY

Aviation Fuels in the RFS Program

The RFS program was primarily designed to ensure that gasoline and diesel are replaced with increasing volumes of renewable fuel.

The definition of renewable fuel in the RFS regulations includes jet fuel.

- The term **"renewable fuel"** means fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in a **transportation fuel**.
- The term **"additional renewable fuel"** means fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in **home heating oil or jet fuel**.

Renewable jet fuel can generate Renewable Identification Numbers (RINs) if there is an approved fuel pathway and all of the other requirements are met.

- A renewable fuel pathway includes three critical components: (1) feedstock, (2) production process and (3) fuel type. Each combination of the three components is a separate fuel pathway.

Renewables Enhancement and Growth Support (REGS) Rule (signed Oct. 3, 2016)

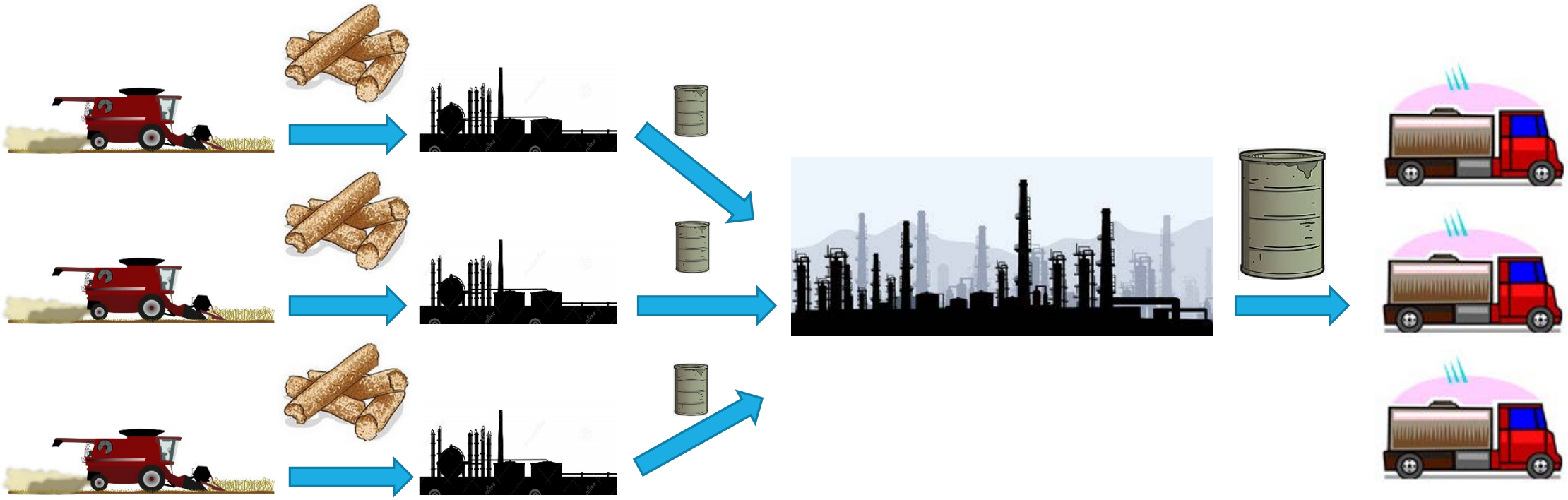
Biointermediates

Renewable biomass collected in multiple areas

Biomass is sent to local collection/pre-processing facility to produce biointermediate

Biointermediates from multiple facilities are sent to a renewable fuel production facility

Renewable fuel is produced and distributed to blenders



Other Relevant REGs Provisions

Short-Rotation Trees

- Proposing to add short-rotation hybrid poplar and short-rotation willow as new cellulosic biofuel feedstocks, allowing producers to generate cellulosic RINs (D3 or D7)
- Defining “short-rotation” to mean that qualifying hybrid poplar and willow have harvest rotations of less than 10 years

Cellulosic Diesel

- Currently no pathway for cellulosic biomass that is co-processed with petroleum to produce diesel, jet fuel, or heating oil
  - In order to generate D7 cellulosic RINs, our regulations require that these fuels meet both “cellulosic biofuel” and “biomass-based diesel” definitions, the latter of which does not allow for co-processed fuels
- Proposing to redefine D7 RIN category as “cellulosic biomass-based diesel” and revise definition of cellulosic diesel to remove BBD requirement
- Will allow diesel, jet fuel, and heating oil produced from cellulosic biomass that is co-processed with petroleum to generate cellulosic D3 RINs

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Federal Agency Initiatives - CAAFI

Zia Haq[1], Borislava Kostova[1], Craig Brown[2]

[1] Bioenergy Technologies Office
U.S. Department of Energy

[2]National Renewable Energy Laboratory

October 25, 2016

Defense Production Act (DPA) Initiative

In July 2011, the Secretaries of Agriculture, Energy, and Navy signed a Memorandum of Understanding to commit $510 M ($170 M from each agency) to produce hydrocarbon jet and diesel biofuels in the near term. This initiative sought to achieve:

- **Multiple, commercial-scale integrated biorefineries.**
- **Cost-competitive biofuel with conventional petroleum (without subsidies).**
- **Domestically produced fuels from non-food feedstocks.**
- **Drop-in, fully compatible, MILSPEC fuels (F-76, JP-5, JP8).**
- **Help meet the Navy's demand for 1.26 billion gallons of fuel per year.**
- **Contribute to the Navy's goal of launching the "Great Green Fleet" in 2016.**
- **Demonstration of the production and use of more than 100 million gallons per year will dramatically reduce risk for drop-in biofuels production and adoption.**

On September 19th, 2014 three projects were selected for construction and commissioning:

Company	Location	Feedstock	Conversion Pathway	Off-Take Agreements	Capacity (MMgpy)
Emerald Biofuels	Gulf Coast	Fats, Oils, and Greases	Hydroprocessed Esters and Fatty Acids (HEFA)	TBD	82.0
Fulcrum BioEnergy	McCarran, NV	Municipal Solid Waste	Gasification – Fischer Tröpsch (FT)	United, Cathay Pacific	10.0
Red Rock Biofuels	Lakeview, OR	Woody Biomass	Gasification – Fischer Tröpsch (FT)	FedEx, Southwest Airlines	12.0

DOE Joins Farm to Fly 2.0

- We appreciate the hard work in approving alternative fuels and commitment to sustainable growth made by the aviation industry.
- DOE is actively committed to accelerating the adoption of alternative fuels by this market.
- In 2013, USDA and FAA made a commitment to the aviation industry to help meet their goals with the Farm to Fly 2.0 agreement. This effort seeks to enable the use of commercially viable and sustainable renewable jet fuel in the United States.
- In July 2014, Secretary Moniz signed an amendment officially making DOE the newest partner agency in this significant initiative.
- Welcome input on specific areas of collaboration for DOE via F2F2

Farm to Fleet (Navy & Agriculture)

- Commodity Credit Corporation Funds available to pay for USDA-approved domestic feedstock costs for bulk buys of naval distillate and jet fuels (F-76 & JP-5) alternative fuel blends
- Rocky Mountain/ West Coast bulk fuels contract awarded 77.6 MM gallons of F-76 with 10% synthetic fuels content
  - Covers San Diego, Bremerton, Hawaii
  - Synthetic fuel supplied by AltAir (Paramount, CA) using the HEFA process
  - **Provided the fuel for RIMPAC 2016**
- Inland/ East/ Gulf Coast solicitation recently closed for fuel delivery starting 1 April 2017
  - Covers Norfolk, Mayport, and Jacksonville
  - All services will accept synthetic fuel blends in Jet A and JP-8 in accordance with published fuel specifications
  - Awardees (including any information on synthetic fuel content) will be announced 1 March 2017