



ICAO

ENVIRONMENT

ICAO STOCKTAKING SEMINAR  
TOWARD THE 2050 VISION FOR  
SUSTAINABLE AVIATION FUELS



# U.S. efforts for SAF deployment

**Nate Brown**

Alternative Jet Fuel Project Manager  
U.S. Federal Aviation Administration  
Office of Environment & Energy





# Guiding Principles

Sustainable Aviation Fuel must be “drop-in” – have equivalent safety and better environmental performance and must be cost competitive

Aviation should be lead user of alternative fuels

Government role is to assist in overcoming barriers

Rely on Public-Private Partnerships

Fund university research

Credit the use of SAF in domestic and international programs

Address the whole supply chain

Leverage domestic and international expertise and resources

Enable all possible fuels that meet criteria



ICAO

ENVIRONMENT

ICAO STOCKTAKING SEMINAR  
TOWARD THE 2050 VISION FOR  
SUSTAINABLE AVIATION FUELS



## Three areas of effort

- Testing — certification/qualification
- Analysis — environment, economics, supply, tools
- Coordination — public-private, domestic, regional & international



NextGEN





ICAO

ENVIRONMENT

ICAO STOCKTAKING SEMINAR  
TOWARD THE 2050 VISION FOR  
SUSTAINABLE AVIATION FUELS



# Commercial Aviation Alternative Fuels Initiative (CAAFI)

- Public-Private coalition for commercial aviation to engage the emerging sustainable aviation fuels industry
- Communicate the Value Proposition of SAJF
- Enhance the Fuel Qualification Approach
- Develop the U.S. SAJF Supply by Aligning Efforts to Enable Commercial Deployment
- Implement Frameworks & Share Best Practices

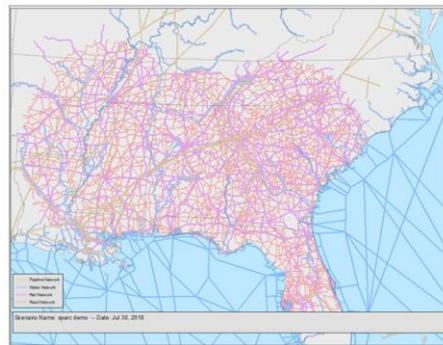




## Alternative Jet Fuel Supply Chain Analysis & Tools

### Understand benefits, costs and potential supply

- Considering entire supply chain via analysis:
  - Feedstock production
  - Techno-economics of pathways
  - Existing infrastructure
  - Community assets
  - Transportation routes and capacity
  - Economic Impacts
- Three regional studies:
  - Inland Pacific Northwest
  - Hawaii
  - Southeast/Tennessee
- Developing open source tools for evaluation of supply chains

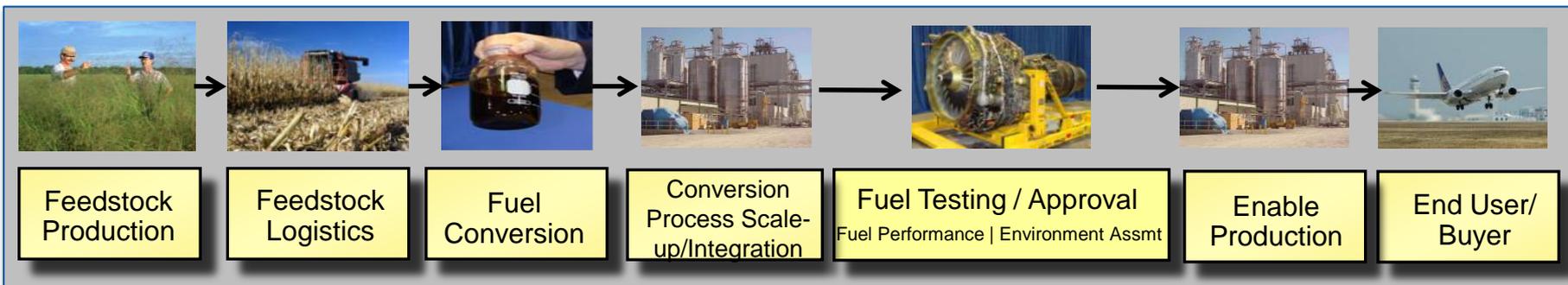


#### Research Team:

- ASCENT: Washington State U., MIT, Purdue, U. Tennessee, U. of Hawaii, Penn State U.
- U.S. DOT Volpe Transportation Center, DOE Argonne National Lab & National Renewable Energy Lab (NREL)



# 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

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

EPA: Renewable Fuel Standard

Airlines: fuel purchases

Defense: Farm to Fleet

FAA: Guidance for Airports

All: Federal Alternative Jet Fuel R&D Strategy

Agriculture, Energy, FAA: Farm to Fly 2.0





# Policy Incentives

## U.S. Renewable Fuel Standard (RFS2)

- Requires fuel producers to blend volumes of renewable fuel in fuel supply
- Primarily designed to replace surface transportation fuels
- Jet fuel qualifies under program for incentive

## State of California Low Carbon Fuel Standard (LCFS)

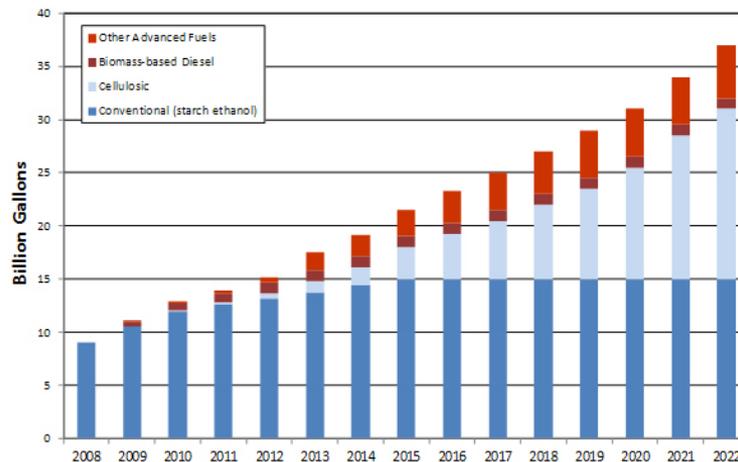
- Incentivizes carbon intensity reduction for transportation
- In January 2019, included SAF

## State of Oregon Clean Fuels Standard

- Incentivizes carbon intensity reduction for transportation
- In January 2019, included SAF

Other states are considering policies

Renewable Fuel Standard Volumes by Year

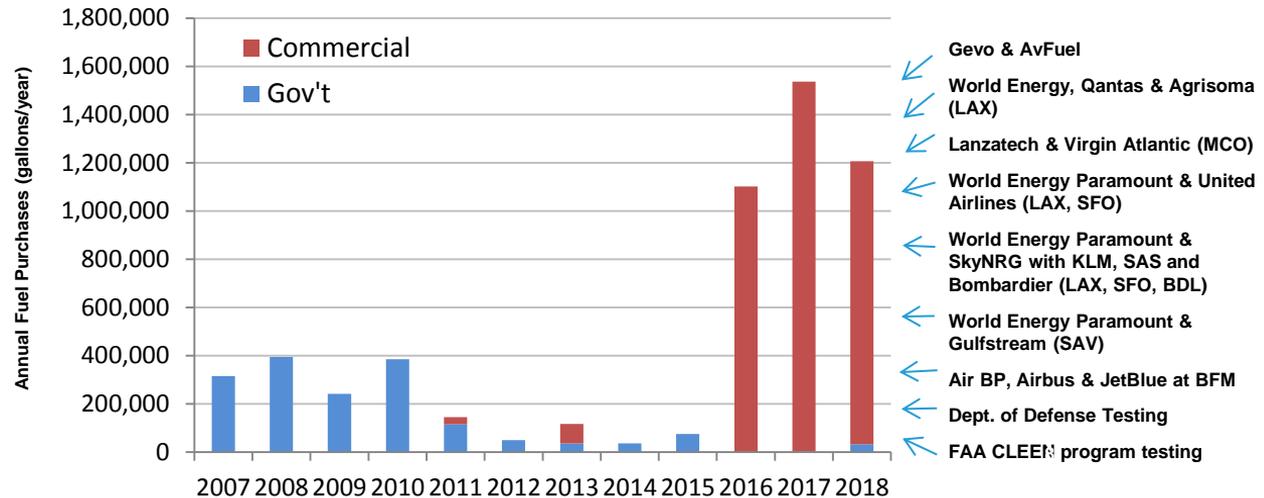




# Use of SAF in the U.S.

- Three years of sustained commercial use
- In 2018, >1.2 million gallons
- New fuels under evaluation & new facilities under construction
- New partnerships announced and General Aviation engaged
- In 2019, expanded production and new incentives

## U.S. Sustainable Aviation Fuel Procurements\*



\* Reflects voluntarily reported use by U.S. airlines, U.S. government, manufacturers, other fuel users, and foreign carriers uplifiting at U.S. airports.



# U.S. SAF Offtakes & Demonstrations

|  |   |                     |                  | neat quantities |  |
|--|---|---------------------|------------------|-----------------|--|
| <br><b>Production</b>  | + | <b>UNITED</b>       |                  | ≡               | <b>Up to 5 M gpy from 2016 (LAX)</b><br><b>3 yr agreement 30/70 blend</b><br><b>3 yr agreement Enabling LAX flights</b>  |
|  | + | World Fuel Services | Gulfstream       | ≡               |  |
|  | + | SkyNRG NORDIC       | <b>KLM</b>       | ≡               |  |
| * WEP also continues supplying fuel for multiple trial and research activities |   |                     |                  |                 |  |
| <br><br><b>Construction</b>  | + |                     | CATHAY PACIFIC   | ≡               | <b>37.5M gpy</b><br><b>90-180 M gpy</b><br><b>50 M gpy</b><br><b>3 M gpy each, 7 yrs (Bay Area, CA)</b><br><b>Up to 1M gpy, 5 yrs+</b><br><b>Brisbane Supply Demonstration</b> |
|  | + | <b>UNITED</b>       |                  | ≡               |  |
|  | + |                     | air bp           | ≡               |  |
|  | + | <b>Southwest</b>    |                  | ≡               |  |
|  | + | <b>FedEx</b>        |                  | ≡               |  |
|  | + |                     | AVFUEL           | ≡               | <b>10 yr agreements</b>  |
|  | + |                     | virgin australia | ≡               |  |



# U.S. SAF Offtakes & Demonstrations

neat quantities



10M gpy, 10 yrs (JFK)



4M gpy, 10 yrs (LAX)



**Potential for  
>250 Million  
gallons per year  
of production**

MSW-based  
FT-SPK evaluations



BTL #1, Natchez, MS  
1,400 bpd



SAJF Supply  
exploration



MOU to design &  
implement adoption



LAX demo & Carinata  
supply development



SAJF Supply  
collaboration



0.5M gpy, 10 yrs



ICAO

ENVIRONMENT

ICAO STOCKTAKING SEMINAR  
TOWARD THE 2050 VISION FOR  
SUSTAINABLE AVIATION FUELS



ICAO

North American  
Central American  
and Caribbean  
(NACC) Office  
Mexico City

South American  
(SAM) Office  
Lima

ICAO  
Headquarters  
Montréal

Western and  
Central African  
(WACAF) Office  
Dakar

European and  
North Atlantic  
(EUR/NAT) Office  
Paris

Middle East  
(MID) Office  
Cairo

Eastern and  
Southern African  
(ESAF) Office  
Nairobi

Asia and Pacific  
(APAC) Sub-office  
Beijing

Asia and Pacific  
(APAC) Office  
Bangkok



THANK YOU