



# Sustainable Aviation Biofuels

Ethanol Summit – 27 June 2017

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Environmental stewardship Is our shared Value



Our inheritance

Our responsibility

Our legacy



# Aviation industry commitments

## Aggressive goals to reduce CO<sub>2</sub> emissions



# 2010

1.5% per year  
fuel efficiency



Working towards  
carbon-neutral  
growth

# 2020

Carbon-neutral  
growth



Implementation  
of global sector  
approach

# 2050

-50% CO<sub>2</sub>



Half the net  
aviation CO<sub>2</sub>  
of 2005

ICAO achieved historic 2016 decisions with implementation beginning in 2020

# Aviation needs “drop-In” biofuel

Reduces lifecycle CO2 by 50 – 90 %



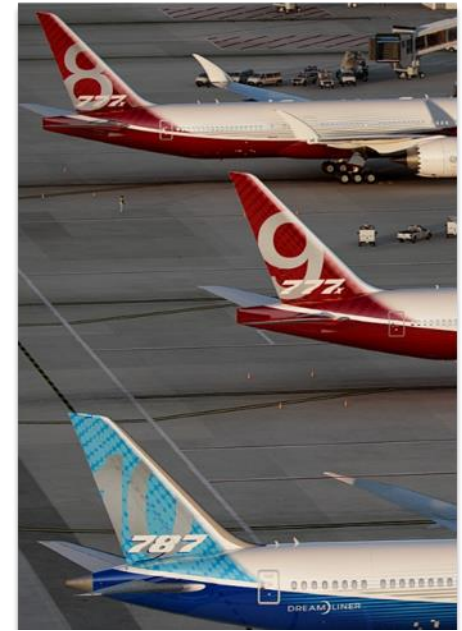
Sustainable, new ways to make the same fuel



Blend directly with petroleum jet fuel



Meets or exceeds performance standards of petroleum

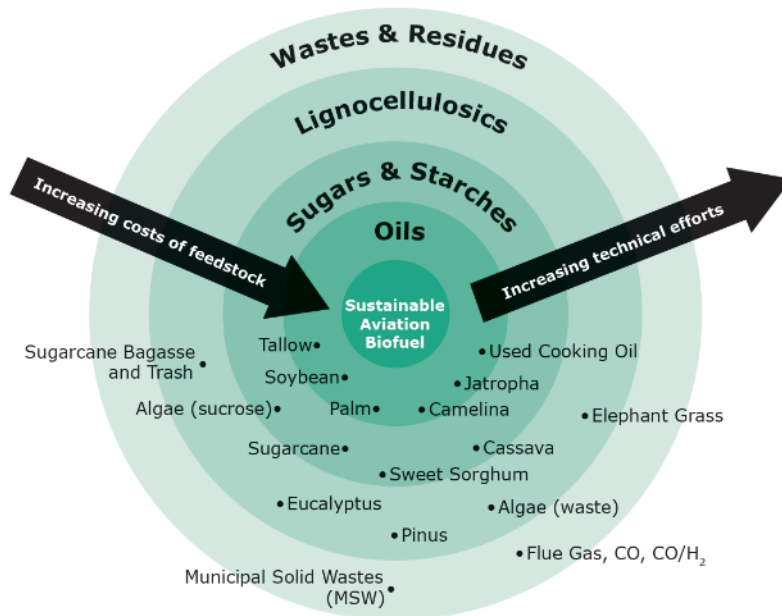


No change to airplanes, engines & fueling infrastructure



# Brazil

## Feedstock Diversity



Eucalyptus



Macaba



Halophytes



Waste gases



Soybean



Bagasse

- Brazil has one of the cheapest sources of biomass. **It's scalable and it's sustainable**
- **Solutions need to be per region**
- Focus on Carbon footprint and Viability assessment

**Feedstock agnostic: not a priority feedstock**

# Brazil

## Joint Research Center for Aviation Biofuels



- Office at Technologic Park - São José dos Campos - Sao Paulo – Brazil

### Mission

- Research and development of aviation biofuels in Brazil
- Support development of public policies – public consultations – national framework – national program for aviation biofuels

# Brazil

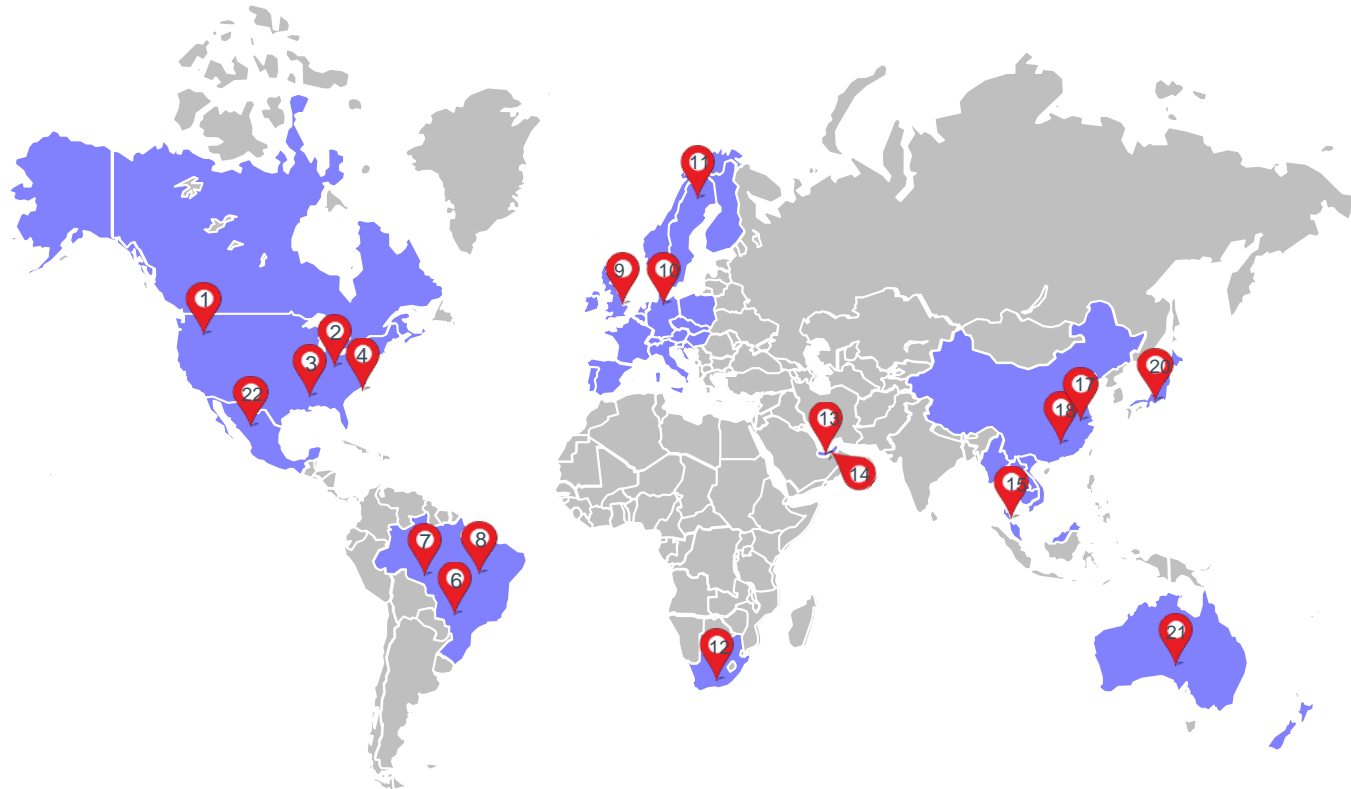
## Supporting New Policy Framework for Biofuels



- Public Consultation (Senate Hearing) for RenovaBio
- Support for creation of incentive mechanisms – National Program for Aviation Biofuels
- Definition of sustainability criteria and environmental performance

- Boeing a member of Brazilian Research Network for Biokerosene

# Global Biofuels Engagements



- |  |  |   |
|--|--|---|
| 1. Pacific Northwest roadmap; Alaska / Sea-Tac Airport                         | 9. Virgin Atlantic / LanzaTech collaboration   | 13. UAE project with Etihad, Takreer and Masdar |
| 2. Midwest biofuel initiative  | 10. AIREG Membership                           | 14. BIOjet Abu Dhabi with Etihad                |
| 3. Green diesel commercialization  | 11. Nordic Initiative for Sustainable Aviation | 15. Southeast Asia smallhold farm initiative    |
| 4. Renewable Fuel Standard advocacy  | 12. South African Airways national roadmap     | 16. Biofuel R&D in China                        |
| 5. Canada forest-waste project   |  | 17. "Gutter oil" facility with COMAC            |
| 6. Brazilian Biojetfuel Platform   |  | 18. Hainan Airlines commercial flight           |
| 7. Joint research with Embraer   |  | 19. Agricultural waste project in China         |
| 8. GOL biofuel flights – Regional Platforms – National Research Network (2017) |  | 20. Japan biofuel roadmap                       |
|  |  | 21. Australia biofuel roadmap                   |
|  |  | 22. Mexico biofuel center of excellence         |



# Developing New Fuels for Aviation



## US & EUROPE

Green diesel



## CHINA

Waste cooking oil



## UNITED ARAB EMIRATES

Saltwater-tolerant desert plants



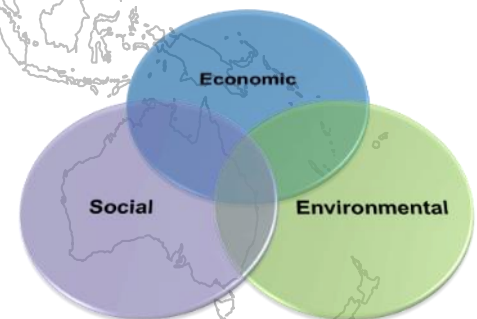
## BRAZIL

Feedstock scaling-up



## SOUTH AFRICA

Nicotine-free tobacco plant



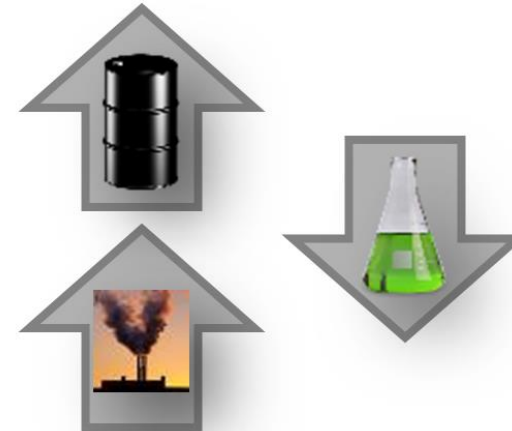
# EcoDemonstrator



- A collaboration between Boeing BR&T and Embraer on use of a locally sourced sustainable biofuel for the flight test program.
- Biokerosene used reduces CO2 emissions by approx. 82 percent.
- Final blend: 10% biokerosene and 90% fossil jetfuel
- **Key Differentiation (Unique or Never Done):** ecoDemonstrator flights in Brazil on a biofuel produced in Brazil with feedstock sourced in Brazil.

# Aviation Biofuels State of Play

Great progress. Superior Fuel. At Inflection Point.



- **Highly desired by airlines** at competitive prices
- **Technically proven** – economically viable
- **Public-private partnerships** working to break down barriers, lower risk and facilitate supply

- **Long term trends favorable:**
  - **Increasing cost of fossil fuel** production & emissions
  - **Decreasing costs** of biofuel production
  - Potential for **higher performance** fuels
  - Global recognition of **unique need for liquid fuels**

Boeing is committed to partnering for a better future

