Aviation’s Active Commitment to Sustainable Alternative Fuels
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Michael Lakeman, Ph.D.
Director, Biofuel Technology Strategy
The Boeing Company
A track record of success …
Cleaner and quieter with each new model

90% reduction in noise footprint
70% fuel improvement and reduced CO\textsubscript{2}

Noise footprint based on 85 dBA
Aviation’s strategy for reducing emissions

- **Forecasted emissions growth without reduction measures**
- **Airplane Technology**
- **Operational Efficiency**
- **Sustainable Biofuel & Market Measures**

**Industry CO₂ Emissions**

**Industry Baseline**
**Status of biofuel industry**

- **Technically viable**
  - ASTM and Def Stan approved
  - High-quality standard, drop-in fuels
  - Five pathways approved since 2011

- **In demand**
  - Airline offtake contracts signed
  - Airline support – Countless commercial flights
  - Continued global military interest

- **Sufficient supply**
  - Limited but growing refinery capacity
  - Shrinking premium for approved fuels
  - Parity on incentives with ground transport needed
Announced airline offtakes of aviation biofuel

375 million gallons, est. 2019

24 million gallons, est. 2019

330 million gallons, est. 2019

915 million gallons, ‘16-’19

2.5 million gallons, 2016

24 million gallons, est. 2019

Source: 1. Lufthansa commitment of 2.5 million gallons out of Oslo Airport in 2015 2. United Airlines commitment to 5 million gallons over 3 years from AltAir Fuels from 2015 onwards; equity investment in Fulcrum over 10 years from 2018 onwards 3. Offtake from Red Rock Biofuels from 2017 for 3 million gallons per year for 5 years 4. Offtake from Red Rock Biofuels for 3 million gallons per year over 5 years 5. Commitment to Solena for minimum 10 years 6. Equity stake and offtake with Fulcrum for 10 years

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https://planefinder.net/custom/icao-fuel.php

- United Airlines and KLM flights departing from LAX
- Lufthansa, SAS and KLM / KLC flights departing from OSL
- SAS, KLM and Braathens flights departing from ARN
Challenges to commercialization remain

Expansion of options

Financing and affordability

Project execution
Boeing’s role and actions

**Boeing’s role**
- Protect the environment
- Assure industry growth
- Address customers’ needs

**Act as industry catalyst to accelerate commercialization**

**Core activities**
- Support and advocacy
- Feedstock and pathway R&D
- Fuels approval

*Ultimate goal is to catalyze a vibrant commercial market*
Boeing’s global biofuel engagements

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

**US & EUROPE**
HEFA+

**CHINA**
Waste cooking oil

**UNITED ARAB EMIRATES**
Saltwater-tolerant desert plants

**WASHINGTON STATE**
Feasibility study

**SOUTH AFRICA**
Nicotine-free tobacco plant

**JAPAN**
Roadmap to 2020 Olympics
Boeing and the aviation industry are committed to partnering for a better future.