South African Airways
Biofuel Program

25 October 2016
The South African Airways Group aspires to conduct business in the most sustainable way possible and aims to actively contribute to the South African National Climate Change Response goals and global industry commitments and to become the most environmentally sustainable airline group in the world.
SAA’s footprint

Carbon Footprint - SAA

- 3%
- 97%
Biofuels, biofuels and biofuels

Biofuels can be created from:

- Waste Gas
- Sunlight
- Waste oils
- Municipal Solid Waste

Seemingly, almost anything
Project Solaris—The Right Project for Africa

- Low tech—small hold farmers already do it;
- Proven technology—HEFA process;
- By-product or co-product—Not solely for biofuel;
- Rotation crop—Excellent rotation crop that mitigates food vs fuel;
- Labour intensive;
- Regional aggregation and development;
- Central refinery (complex tech) requires Hydrogen
Project Solaris—the right project for Africa
- Social protection
- Environmental sustainability—water, food vs fuel
- Credibility
- WWF-SA|RSB Biofuel Project—no unintended consequences
THE END GAME

Goals
Utilise 20 million litres of Bio Jet fuel by Q4 2017
Produce 500 million litres of bio jet fuel by Q4 2023

The ‘HOW’
• Regional approach- Solaris to be grown throughout the region
• Beneficiation in each region and in each country-each region or country presses it’s own production and produces seed cake and oil.
• Oil to be sold to South Africa
• South Africa to establish a bio-refinery for bio diesel and bio jet fuel

Macro economics for the region
• Security of supply-SA to produce it’s own fuels and de-couple from the global oil supply and the volatility around the oil price
• Social impacts-thousands of jobs + empowerment of small hold farmers
• Retained tax revenues
• Balance of payments-contribute to a positive trade balance and currency appreciation
• Reduced currency exposure and outflows of foreign currency
THANK YOU
The future of climate-friendly aviation: Ten percent alternative aviation fuels in Germany by 2025
Project No. 1

- Feasibility Study for a commercial scale HEFA bio-refinery in Germany with hydrogen supply based on Biomethane reforming and PtG Power-to-Gas
- Sponsored by BMVI (German DOT)
- Headed by DBFZ (German Biomass Research Institute, Leipzig)
Project No. 2

- Benchmark study IATA 2050 – requirements and next steps based on German Air Traffic development and jetfuel uplift
- Sponsored by BMVI (German DOT)

- Headed by Technical University Hamburg-Harburg
Project No. 3

- Multiblend Study consisting of
  - AtJ blend
  - BtL blend
  - Farnesan blend
  - HEFA blend
Four blends to be mixed with JET A-1 from one batch

- Sponsored by BMVI (German DOT)

- Headed by DBFZ (German Biomass Research Institute, Leipzig)
Project No. 4 (planned)

- Behaviour of jetfuel blends in airport fuel storages and hydrant systems in daily operations at MUC airport
- „Fit-for-purpose“ test during regular airport operations
- To be sponsored by the Bavarian State Ministry of Economics, Munich
- Headed by aireg, Berlin
Celebrating 5 years....

• aireg was founded in June 2011 in Berlin under the patronage of Secretary of Transport, Dr. Peter Ramsauer

• aireg enjoys partnering with CAAFI, the world’s leading initiative for sustainable aviation!

• aireg is a strategic partner of IATA
WHAT’S BEEN DONE
Perfect Flight: Rio+20 UN Sustainable Development

- Airbus and SkyNRG
- Cooking Oil feedstock
- AC991 Toronto-Mexico City
- Airbus A319
- 40% CO2 emission reduction

Olympic Biofuel Flight

- Flew Canadian Olympic Team Members to London Games
- Used remainder of fuel from Perfect Flight
- AC864 Montreal-London
- Airbus A330
- 10% CO2 emission reduction
1.5% target per year fuel efficiency improvement until 2020 from a 2005 baseline

2% aspirational goal per year fuel efficiency improvement until 2020 from a 2005 baseline

Carbon neutral growth
Support for ICAO’s 2020 MBMs
Fuel Efficiency Improves

- Net emissions continues to grow with increased traffic demand
CARBON PRICING
Minimum cost on Carbon
- 10$ per tone by 2018
- 20$ per tone by 2019
- 30$ per tone by 2020
- 40$ per tone by 2021
- 50$ per tone by 2022

Left for the Provinces to implement
Not feasible to manage 10 different carbon tax systems
NEGATIVE IMPACTS OF CARBON PRICING

- Move passengers towards competing airports
- Reduces access to travel lower & middle income families
- Indirectly increase cost of goods moving in Canada
- Indirectly impacts northern and aboriginal communities
- Revenue is not required to be recycled into an Aviation Solution
NEGATIVE IMPACTS OF CARBON PRICING

- Move passengers towards competing airports
- Reduces access to travel lower & middle income families
- Indirectly increase cost of goods moving in Canada
- Indirectly impacts northern and aboriginal communities
- Revenue is not required to be recycled into an Aviation Solution
- Does not reduce Carbon Emissions
Canada’s Sustainable Aviation Bio-Fuels Opportunity
With Canada’s abundance in natural resources, scientific leadership and experience with fuel refinement, we believe there is a Canadian potential for:

- Canadian sourced feedstock
- Refinement of final product in Canada
- Supply fulfill all types of energy demands

This can be achieved with the development of the right policy and government incentives.
LOOKING AHEAD

AIR CANADA’S BIO-FUEL PROJECTS
Project Scope:

- Assess the feasibility, cost, and environmental impact of establishing aviation biofuel supply chains at key locations in Canada

Canadian Assessment of

- Feedstock
- Sustainability
- Economics
- Supply chain
- Policy
## CTI: Understanding Canada’s Potential

<table>
<thead>
<tr>
<th>Biojet Scenario</th>
<th>Technology Scenario</th>
<th>West</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>Hydrotreated Esters and Fatty Acids (HEFA)</td>
<td>AB: Edmonton Region</td>
<td>ON: Southwestern Ontario / Sarnia</td>
</tr>
<tr>
<td>2025</td>
<td>Hydrotreated Depolymerized Cellulosic Jet (HDCJ) via pyrolysis</td>
<td>AB: Northern Alberta / Edmonton Region</td>
<td>ON: Southwestern Ontario / Sarnia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BC: Prince George</td>
<td>QC: Montreal/Quebec City</td>
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</tbody>
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### Completed

![Map of Canada with regions highlighted](image)
Directly introducing bio-fuel into a shared airport fuel tank
Assessment of likely Technology Maturation pathways used to produce biojet from forest residues

* Double counting of areas certified to more than one standard has been removed from this figure.
Trailing aircrafts with contrails with a T33 collecting Biofuel particle emissions data.
THANK YOU