Montreal – Aviation Decarbonisation Forum

Why we need PtL-based Fuel Solutions for a Sustainable Future of Aviation

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Why we need PtL-based Fuel Solutions for a Sustainable Future of Aviation

Environmental Impacts of Aviation

- Noise
- Climate
- Air Quality
- Land Use

*Picture: A. Fechter*
International Agreements for Climate Protection

Climate Action Plan 2050

2050 Energiewende targets in 2017

*bis 2015 Ist-Werte (2015 Schätzung UBA), ab 2020 Ziele
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The Climate Challenge of Aviation (CO₂ only)

- ICAO: Carbon Neutral Growth from 2020 = no reduction
- Alarming gap between ICAO and Paris Agreement
UBA-Study: GHG-Neutral Germany in 2050

cross sectoral coupling needed

Source: UBA 2014
Important additional question: resources used for the transformation
Why PtL Fuels?

Top priorities:
1. avoid flights
2. shift to other modes of transport
3. use efficiency potentials of aviation

Not sufficient for Paris goals. Aviation needs in addition sustainable alternative fuels

Biofuels: Not sustainable if produced on a large scale (cultivated biomass)

PtL Fuels: Could supply aviation but requires research, investments and cost degression
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What are „Power-to-Liquids“?

Source: LBST/BHL, 2016 Power-to-Liquids – Potentials and Perspectives for the Future Supply of Renewable Aviation Fuel
Advantages of PtL

GHG Emissions \( [\text{g}_{\text{CO}_2\text{eq}}/\text{MJ}] \)

| Source: adopted from LBST/BHL, 2016 |

- Crude Oil: 87.5
- Oil Sand: 103.4
- Natural Gas to Liquid: 101.0
- Coal to Liquid: 194.8
- Power to Liquid: 11-28

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Advantages of PtL

Achievable air mileage for an A320neo per ha of land [km/(ha·yr)]:

<table>
<thead>
<tr>
<th>Method</th>
<th>Minimum</th>
<th>Bandwidth</th>
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</thead>
<tbody>
<tr>
<td>PtL wind power</td>
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<tr>
<td>PtL photovoltaics</td>
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<td>BtL short rotation forestry</td>
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<td>HEFA oil crops</td>
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<tr>
<td>Alcohol-to-Jet sugar crops</td>
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Water demand:  

Source: LBST/BHL, 2016
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**Economies and Scalability**

Jet fuel costs projected for future PtL plants in 2050 [€/t]

- Crude Oil
- Concentrated CO2 source
- Direct air capture of CO2

*Source: adopted from LBST/BHL, 2016*
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Location Important for Utilization:
Full Load Hours of Renewable Electricity Production

Hybrid PV1-Wind cumulative FLh for cost year 2030

Source: Fasihi et al. 2016
NASA - Technology Readiness Level (TRL)

- PtL produced from concentrated CO$_2$ sources: TRL 8 – 9 -> flight proven/qualified
  - !! Drop In Fuel

- PtL full system integration recently progressing due to demonstration plants in Iceland, Finland, Germany and soon in Norway

- Improved processes for CO$_2$ extraction from air (DAC) and high-temperature electrolysis at demonstration/development level -> e.g. companies Climeworks, Sunfire
A resource efficient pathway towards a greenhouse gas neutral Germany

-95% Greenhouse gas emissions until 2050

-60% Raw materials use

UBA Scenarios
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UBA 2018 „A Resource efficient Pathway towards a Greenhouse Gas neutral Germany“ Scenario GreenEe: Imports of PtL/PtG

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Elements of a Introduction Strategy

Fast action needed ..... 

• Drop in ...

• Quotas / Sectoral Emissions Trade System

• Business aviation / tax exemptions

• A feed-in tariff scheme to encourage production

• First Mover Sectors – Business – Remote Airports ....

Consider...

• Lack of PtL production capacities vs. complete switch to PtL by 2050

• Economical restraints: higher production costs, even long-term
In May 2018, a coalition of Business Aviation Associations including EBAA, GAMA, NATA, IBAC, NBAA, CAAFI and ATAG launched the Sustainable Alternative Jet Fuels Initiative (SAJF), which is also supported by IASA (FT/PtL-based JetFuels).

Latest FT-reactor technologies promise to allow decentralized production, e.g. direct at an airport.

Currently, IASA and partners are gearing up financial support to start a FT/PtL-JetFuel demonstrator plant directly located at an airport frequently used by business and corporate aviation.
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**Summary**

- International climate protection requires decarbonization of aviation
- Reality: continuous growth of aviation CO\textsubscript{2} & non-CO\textsubscript{2} emissions
- Aviation requires sustainable alternative fuel
- PtL is able to provide near-zero net GHG emissions if produced from renewable electricity and CO\textsubscript{2}
- Sustainability advantages over biofuels
- Challenge: Fast and sufficient big introduction - production costs
Thank you

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www.umweltbundesamt.de/publikationen/germany-in-2050-a-greenhouse-gas-neutral-country

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