



Lufthansa Group Perspective on E-Fuels

Jan Pechstein, FRA CE | April, 2021

SAF & e-fuel market trend: Mandates mainly drive demand and supply

SAF demand and supply



Demand

- EU mandate¹
- Nat'l mandates²
- Voluntary airline commitments
- Increasing customer interest



Supply

- Accelerating capacity ramp-up
- Mainly based on vegetable oil
- Few e-fuel sites

Resulting hypotheses



Aviation is in a transformation process

Customers want to travel / ship in environmentally friendly manner



E-fuels are best emission mitigation option (besides A/C tech advancements)

Environmental performance is superior to biogenic SAF



Most promising production potential is not in Europe

Even in ideal conditions e-fuels will remain more expensive than fossil fuel



Market introduction and scale-up will require significant investments

Policy support is key to accelerate the development



Level playing field in regulation and customer involvement are key

Flying will become more expensive with increasing share of e-fuels

1) The EU submandate for RFNBO's is 0,7 % in 2030 (~ 400 kt). 2) The German mandate targets only e-fuels with 0,5 % in 2026 (~50 kt); 1 % in 2028 (~100 kt) and 2 % in 2030 (~200 kt)

Level playing field will be distorted by geographically confined regulation

Regulation in the EEA (e.g. EU-ETS)

- Affects feeder flights to EEA hubs
- Incentive to fly via non-EEA hubs



— non-regulated
— regulated

Regulation for all flights departing the EEA (e.g. SAF mandate)

- Affects intercont pax departing EEA
- Incentive to tanker fuel
- Incentive to fly via non-EEA hubs



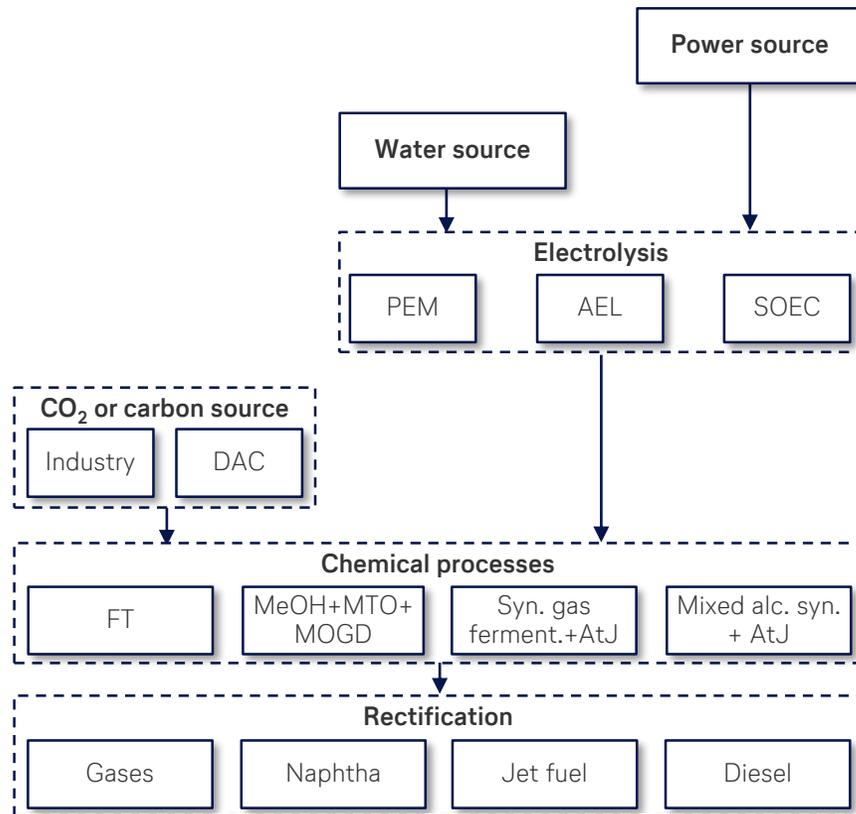
Several European countries plan or have implemented individual mandates, inducing risk of double regulation

Potential Solutions

1. Regulation on ICAO level
2. Include non-EEA hub airports in EU regulation
3. Market-neutral financing mechanism (e.g. fee based on final destination of passenger)
4. Confine regulation to „neutral scope“ (e.g. intra-EEA point to point traffic)
5. Carbon Border Adjustment Mechanism

Market ramp-up strategy to increase number of technologies & suppliers

E-fuels technology universe



Unresolved issues

Electricity	Implications of additionality? Grid connection?
Water supply	Sweet water availability? Desalinated sea water?
Hydrogen	Techno-economic performance? Fluctuating supply? Hydrogen storage?
Carbon supply	Direct air capture vs. biogenic? Eligibility of industrial point sources?
Synthesis	Techno-economic performance? Development potential? Partial load?
Product	Maximize jet fuel vs. process economics? Sustainability allocation mechanism?

! It is essential to de-risk investments to enable market ramp-up

- Coordinated demonstration of (different!) e-fuel technologies
- Certainty on eligibility criteria and long-term stability

Summary and „wish list“



- I First ensure that mandates are neutral to competition, then increase ambition and blending level
- II Harmonize European mandates and consider e-fuel submandate (e.g. at level proposed in Germany)
- III De-risk investments in e-fuels production with a dedicated ramp-up strategy
- IV Use revenues from environmental levies imposed on aviation to finance and accelerate the ramp-up
- V Ensure that e-fuels are only as expensive as they really need to be (eligible production outside of EU)