

# Preliminary Work

## Project Energy System Transformation in Aviation

### Team

- 4 Professors
- 5 Postdocs
- 6 Doctoral Researchers
- International
- Interdisciplinary
- Aerospace, Mechanical, Thermodynamic, Electrical & Chemical Engineering
- Economics
- Design



### Methods

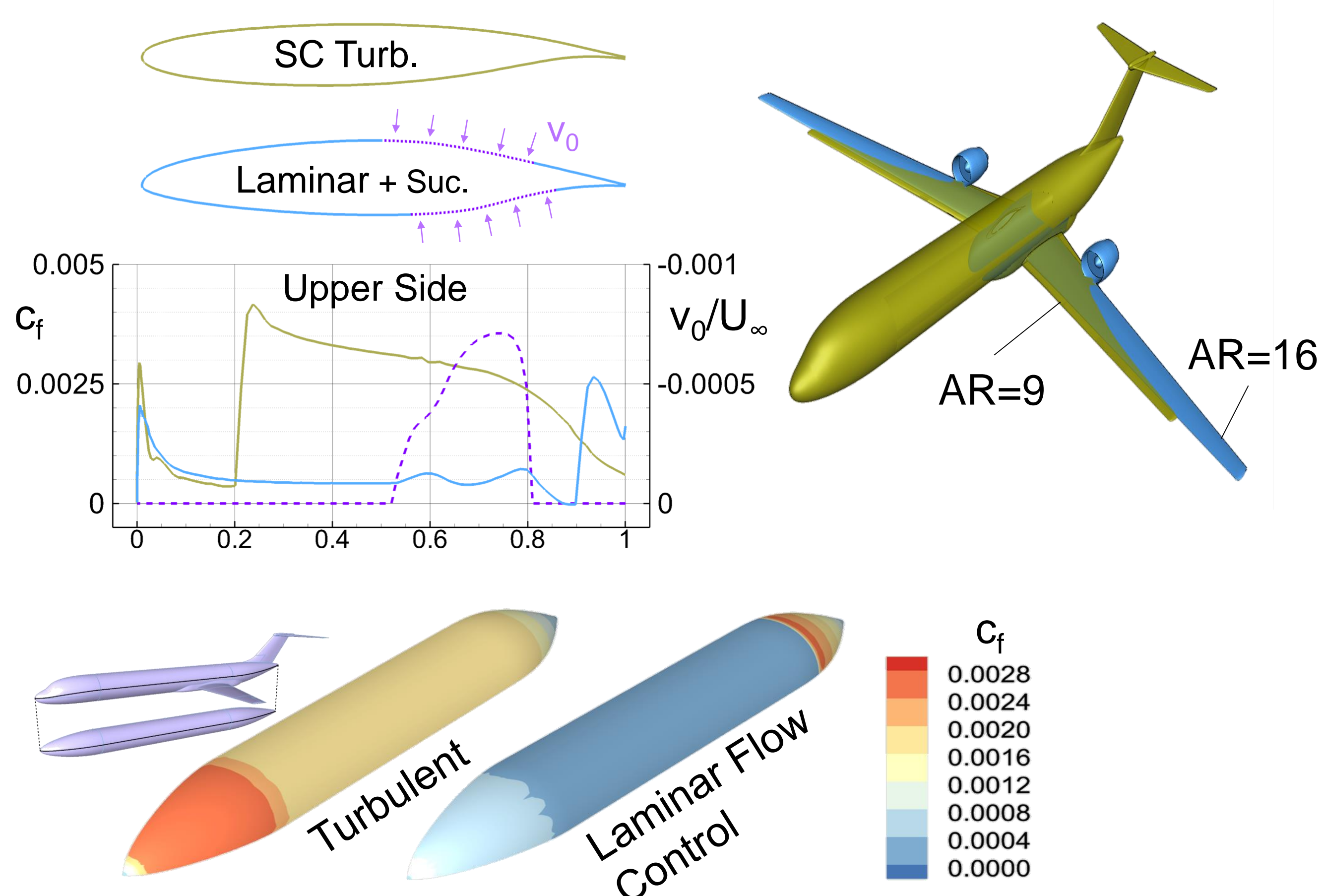
- Heuristic & linear optimization
- Parametric design and model generation
- Numerical simulations (CFD, FEM)

### Tools

- Scenario simulation model for air transport system
- Multi-level multi-fidelity noise assessment system
- Boarding simulation
- Preliminary aircraft design & evaluation tool
- LFC design tool incl. flow solver
- Parallel compressor model for BLI propulsor
- Multi-scale energy system model and optimization

### Aerodynamic Drag Reduction

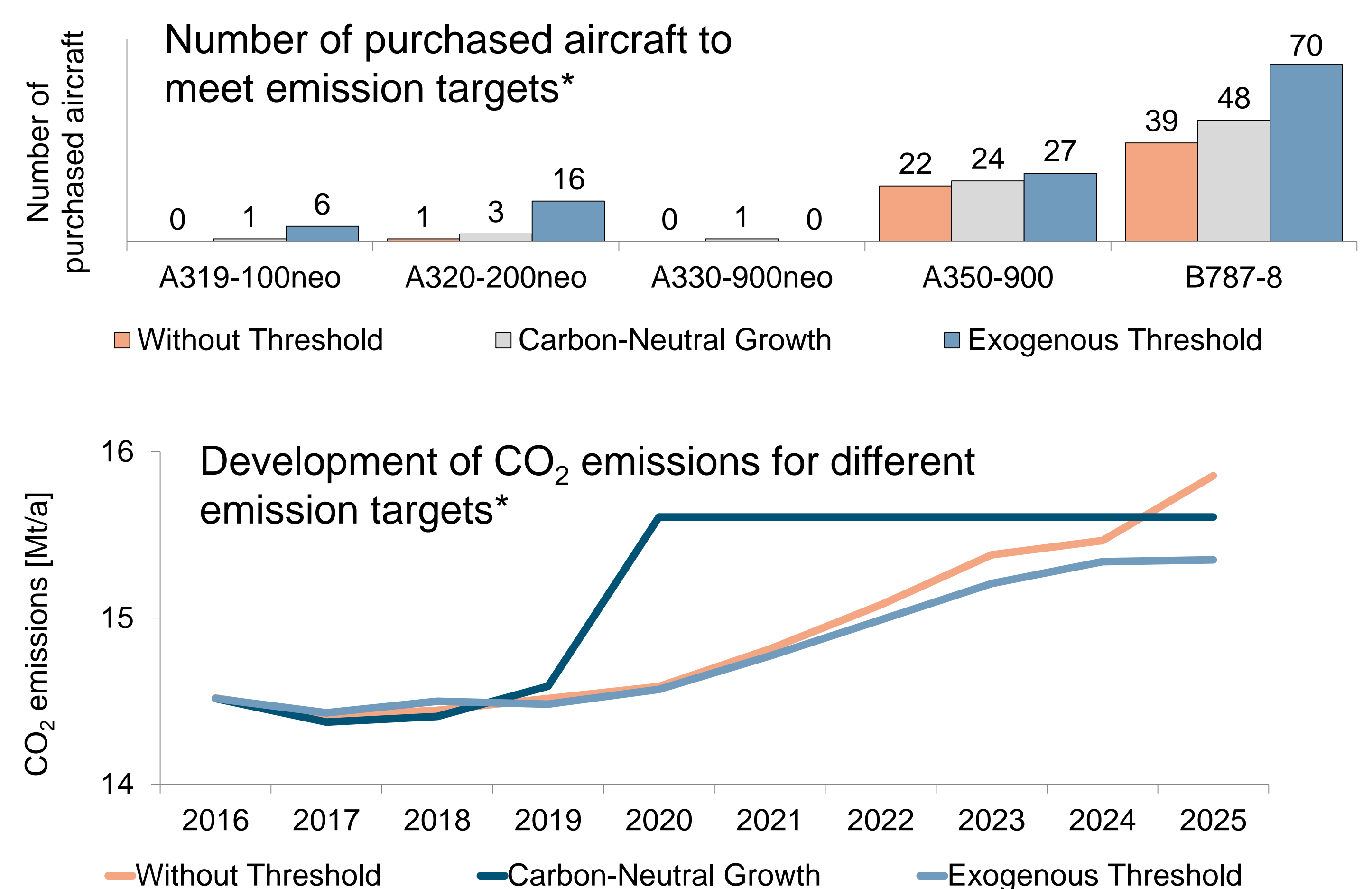
- LFC by boundary layer suction reduces skin friction drag
- Optimized wing with higher aspect ratio reduces induced drag
- Optimized aircraft has 50 % lower total drag\*



\*Beck, Nils; Landa, Tim; Seitz, Arne; Boermans, Loek; Liu, Yaolong; Radespiel, Rolf (2018): Drag Reduction by Laminar Flow Control. *Energies* 11, 1.

### Airline Fleet Optimization

- Optimization model for airline fleet planning to study impact of CO<sub>2</sub> emission targets and reduction potential of existing aircraft technologies



\*Müller, Christoph; Kieckhäfer, Karsten; Spengler, Thomas S. (2018): The influence of emission thresholds and retrofit options on airline fleet planning. An optimization approach. *Energy Policy* 112

### Fuel Cell Systems

- System modeling necessary for optimal component dimensioning\*
- LH<sub>2</sub>-storage with significantly higher energy density compared to kerosene (25 kWh/kg vs. 10 kWh/kg)\*
- Air supply by adaptive compressor with wide operation range
- Increase of converter power density and electric motors

\*Kadyk, Thomas; Winnefeld, Christopher; Hanke-Rauschenbach, Richard; Krewer, Ulrike (2018): Analysis and Design of Fuel Cell Systems for Aviation. *Energies* 11, 375.

