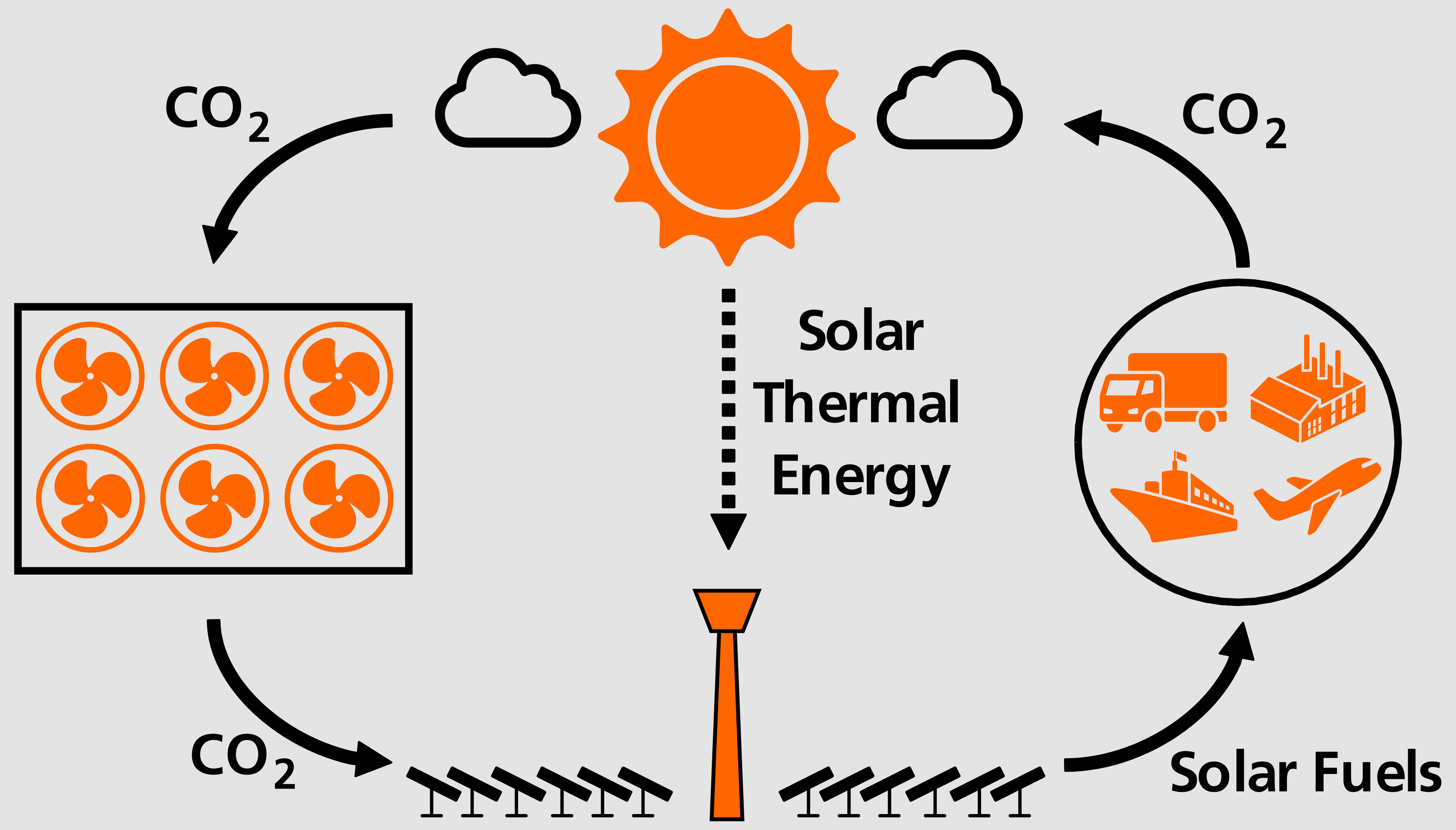
Synergies between Direct Air Capture and Solar Fuels

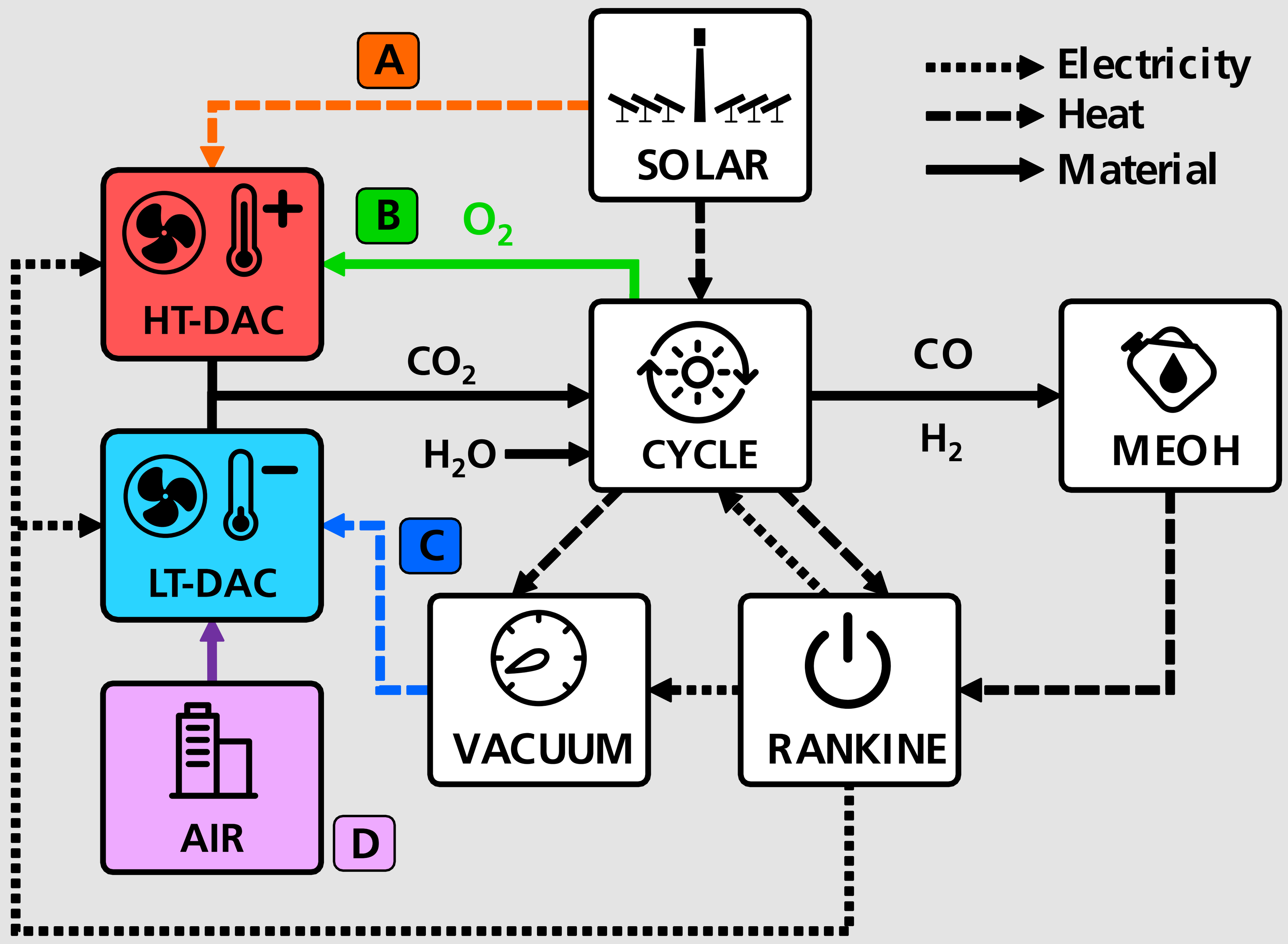
Enric Prats-Salvadó, Nathalie Monnerie, Christian Sattler

INTRODUCTION AND MOTIVATION

- **Carbon-neutral fuels** play a critical role in the energy transition
- Direct Air Capture (**DAC**) is a suitable carbon feedstock for solar fuels
- Solar **thermochemical cycles** are a promising option to produce fuels
- DAC and the production of solar fuels are **energy-intensive** processes

*"Are there **synergies** between the DAC and the production of solar fuels?"*



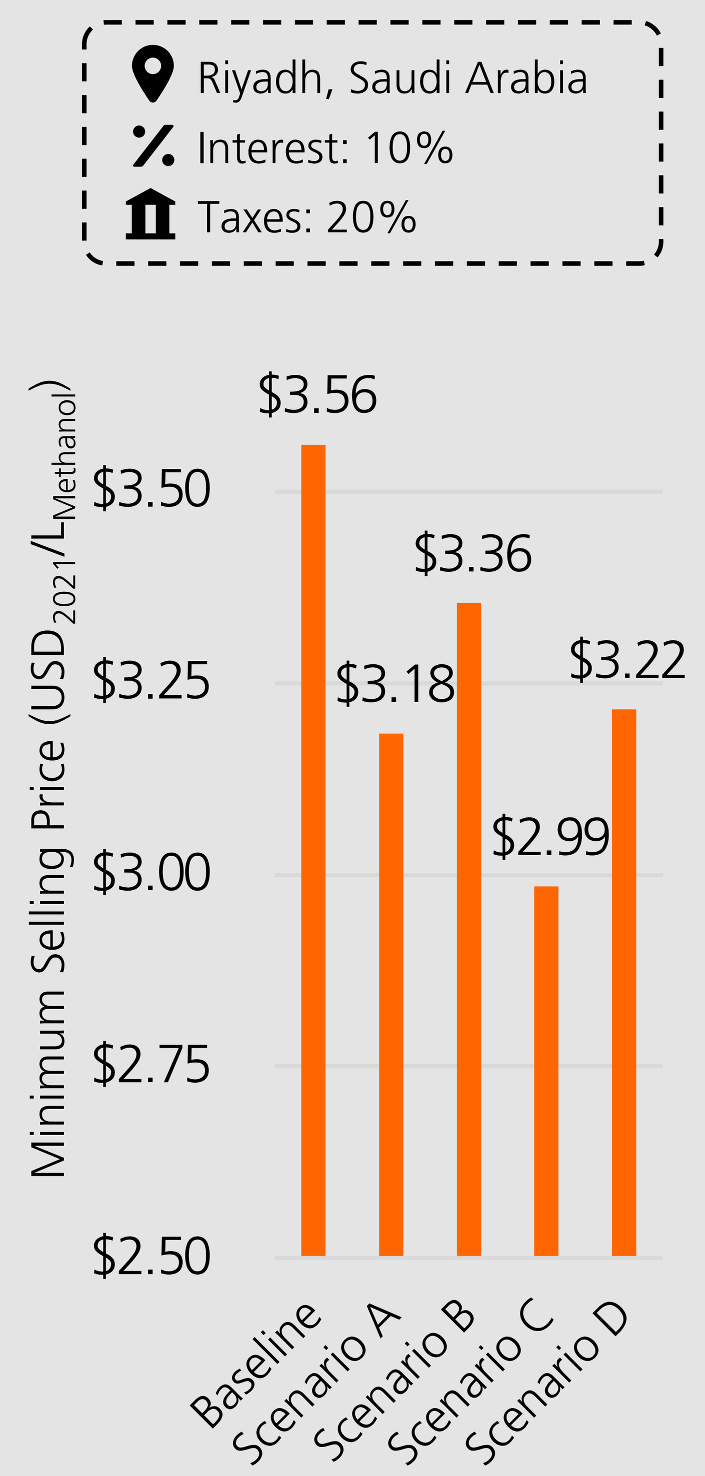


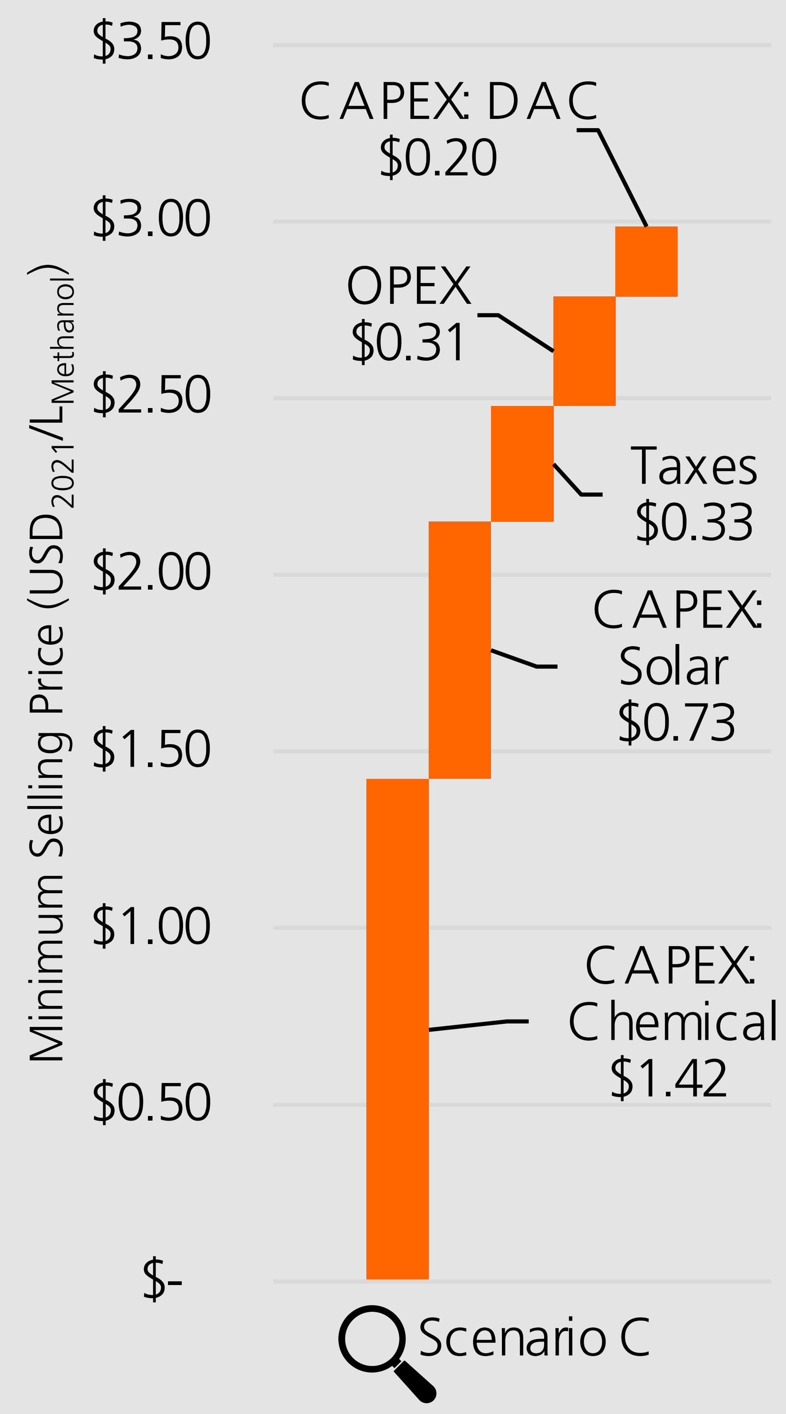
MATERIALS AND METHODS

- H_2 and **CO** are obtained with the solar **thermochemical cycle** and fed to the **methanol** synthesis
- **Waste heat** from the cycle is used to produce **vacuum** and **electricity**
- Two DAC technologies are considered: **high-** and **low-temperature DAC**
- **Four** synergies are identified: **A, B, C & D**
- The process is modelled in **Aspen Plus** and the solar field in **HFLCAL**
- Solar fluctuations are considered with the meteorological data from **Meteonorm**

RESULTS AND DISCUSSION

- For a **280 MW** solar field, the optimal methanol production is **11.8 kt/y**
- The **main capital** expense for all cases is the **chemical** process (mostly due to the Rankine cycle, the heat exchangers and the storage)
- The **scenario C** shows the **lowest capital** and **operational** expenses
- The integration of the DAC and the solar fuels production allows significant **savings**
- **Cost reductions** for thermochemical cycles and solar thermal energy are expected
- The **carbon-neutrality** of the produced methanol will be quantified with an **LCA**





enric.pratssalvado@dlr.de

LinkedIn Publication

DLR Deutsches Zentrum für Luft- und Raumfahrt