

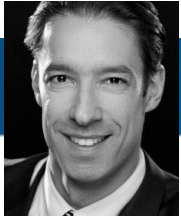


Creating a Hydrogen Market based on Sustainable Trade

Annual Conference – Financing Powerfuels Pathways

Virtual, 09 September 2020

Aram Sander, Head of International Business Development, ENERTRAG AG



Aram Sander



Relevant Experience

- Extensive experience in management along the entire life cycle of wind energy projects from cradle to operation and in different markets covering development, EPC contracting, component production, financing, M&A
- Development of extended business models for renewable energy power plants (storage, hydrogen, e-mobility, extended grid services)

Professional Background

- 2020 – today: **Head of International Business Development** at ENERTRAG, developing foreign activities in the areas of wind, solar and green hydrogen production
- 2015 – 2020: **Director of ENERCON Uruguay S.A.**, Leading ENERCON's business in Uruguay, South America. Cradle-to-sale realization of 150 MW wind farms including local production.
- 2013 – 2015: **Coordinator for International Special Projects** to the board of ENERCON, Aurich, Germany.
- 2008 – 2011: **Project Assistant** at FIRSTCLIMATE, development of carbon neutral products, based on Kyoto project CO₂ emission trading.



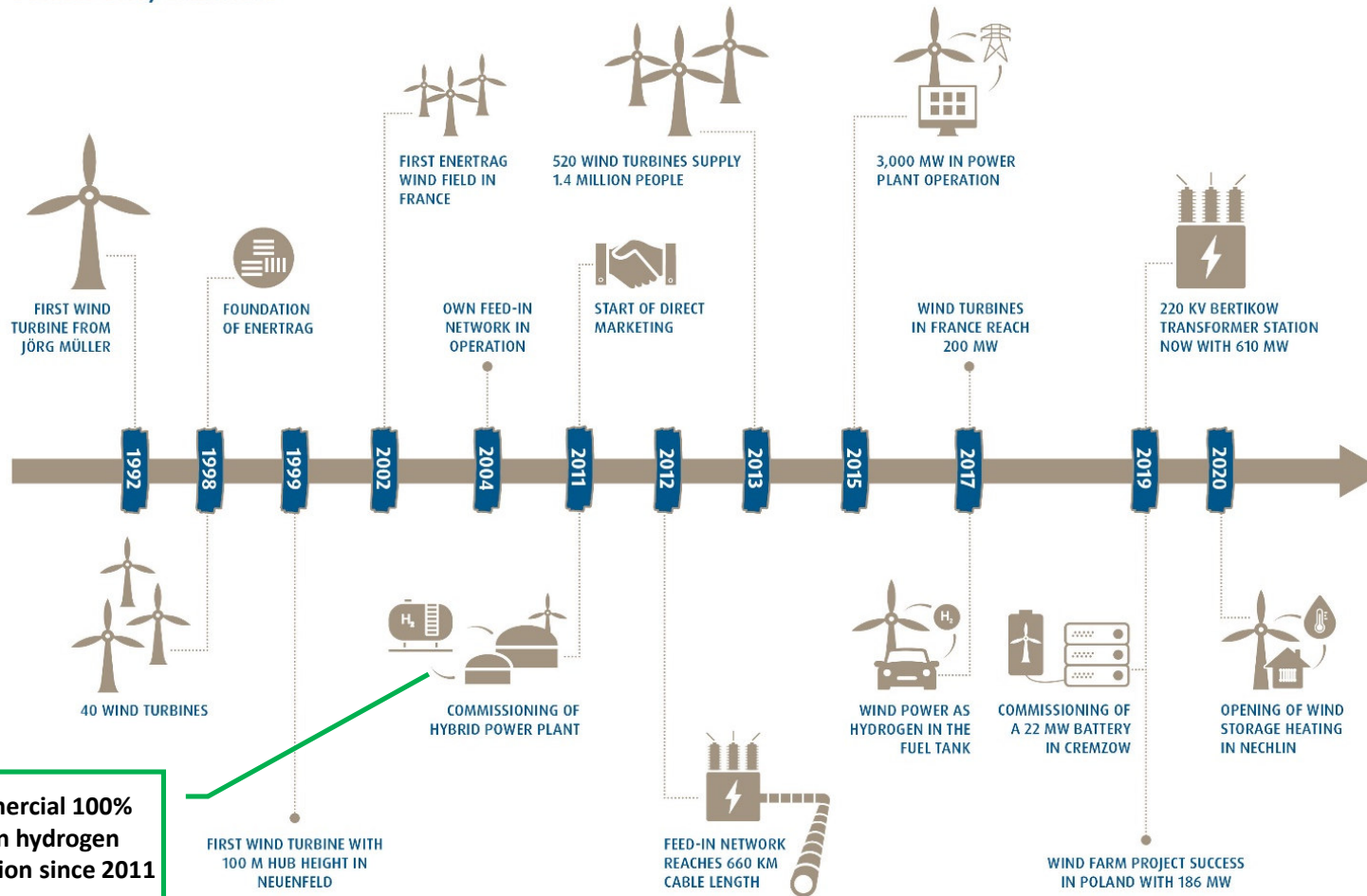
Education

- Dipl.-Ing., Studies of Industrial Engineering and Management (Wirtschaftsingenieurwesen) at Technische Universität Berlin



ENERTRAG is an Innovative Renewables Utility

Success Story ENERTRAG

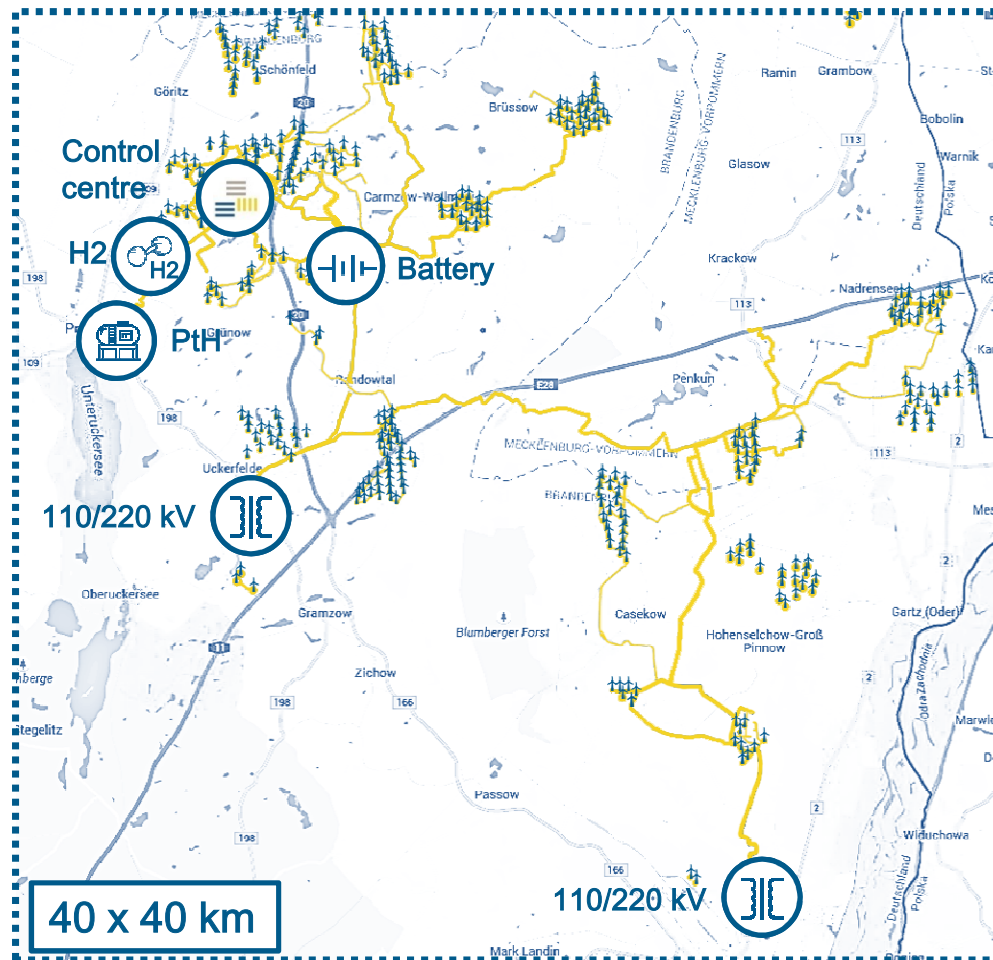


Commercial 100% green hydrogen production since 2011

ENERTRAG in 2020

- **1,500 MW** wind implemented
- **€2 billion** debt / equity raised
- **750 MW** wind on balance sheet
- **6,000 MW** renewables in Germany, France, South Africa in remote control
- **2 TWh** annual electricity production/sales
- **€300 million** revenues from electricity sales and project business
- **680 employees** in Germany, France, Poland, South Africa, Vietnam, Ghana

ENERTRAG's integrated power plant in Germany, North of Berlin



400 MW wind

21 MW biogas

22 MW / 34 MWh battery

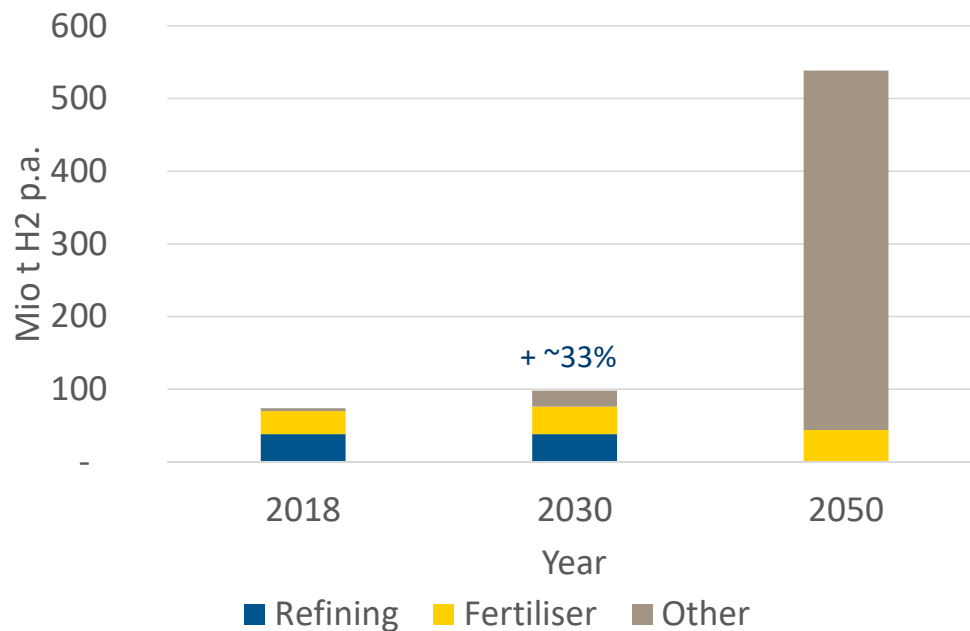
0.5 MW hydrogen

1,000 km MV/HV grid

1,000 m³ heat storage



Growth in World's Pure H2 Demand



Source: iea (2019), Hydrogen Council (2017)

Key Implications

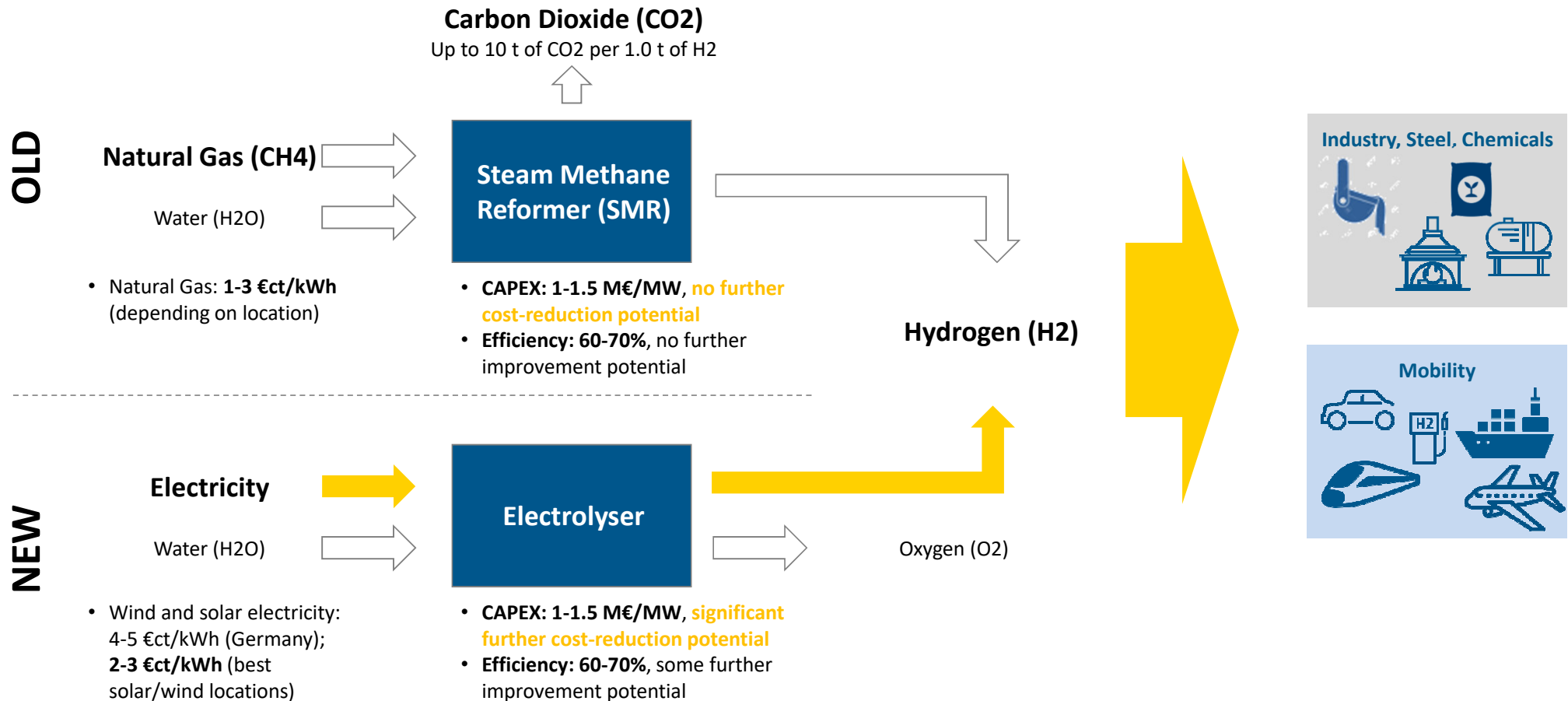
Substantial increase in H2 demand to 2030 and accelerated to 2050

- Refinery demand declining
- Fertiliser demand raising, especially with population growth
- But main driver are new demands to decarbonize sectors such as transport (heavy-duty, shipping, aviation), steelmaking, industrial energy use, building heat and power

Therefore: Huge new investments in hydrogen production necessary

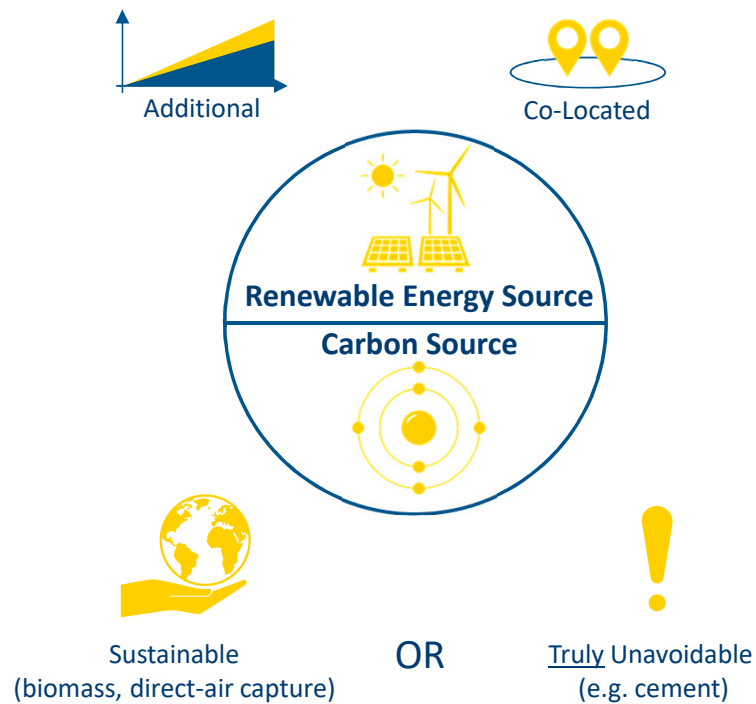
- Green hydrogen projects will compete against grey (and blue) hydrogen projects on greenfield level
- Competition based almost on pure CAPEX

In Greenfield Setting, Green Hydrogen Close to Competitiveness



Sustainability Criteria Important for Long-term Acceptance

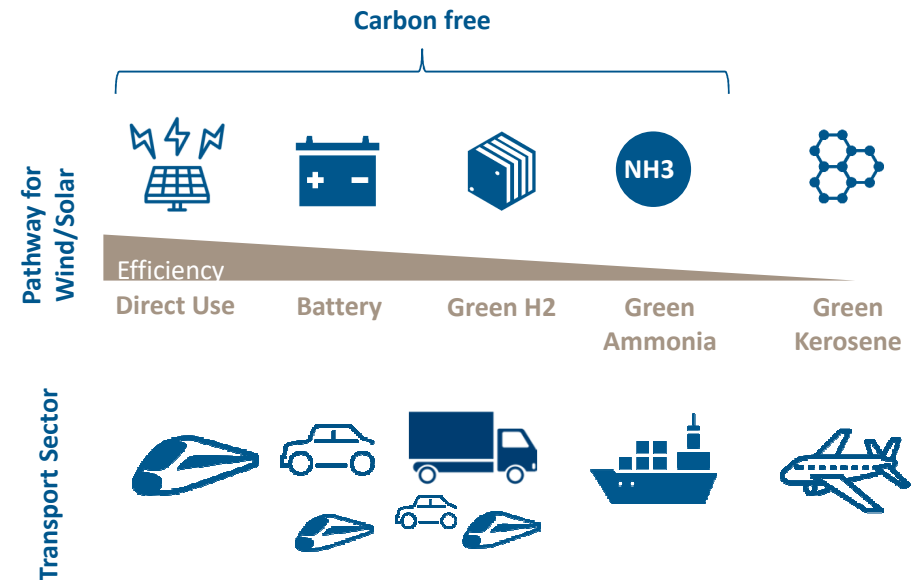
Sources of Energy and Carbon

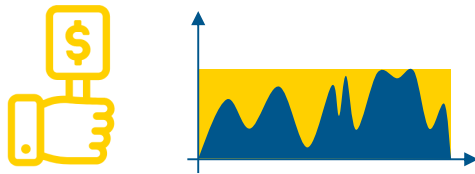


Application

Power Fuel free of carbon wherever possible

H2-based fuels whenever more direct use of wind/solar not possible





Market-Based Auction Systems (e.g. CfD)

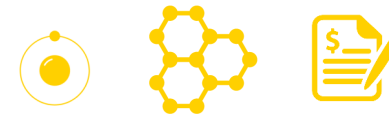
CfD optimizes risk allocation, which leads to

- Project-financeability
- Optimal allocation of capital from a risk/return perspective (low-return debt into low-risk-part of the project)

Long-term off-take leads to

- Long-term commitment of all participants
- Establishment of trade markets/routes
- Establishment of local industries
- Deployment of high-quality technology

→ Lowest cost of the product



Physical vs. Contractual Delivery

Physical:

- High logistic costs if physical delivery is enforced, as parallel logistics to existing one (e.g. ammonia)
- Could be a starting point to give comfort to all participants

Contractual:

- Separates product (e.g. ammonia, aviation fuel) from green property
- Based on tradable certificates for the green property of the green hydrogen and its derivatives
- Reduces inefficiencies and leads to a liquid market quickly

ENERTRAG with (local) partners is developing a sustainable aviation fuel (SAF) project in South Africa

Sasol has vast experience in creation of synthetic liquid fuels (8-10 million t/a)

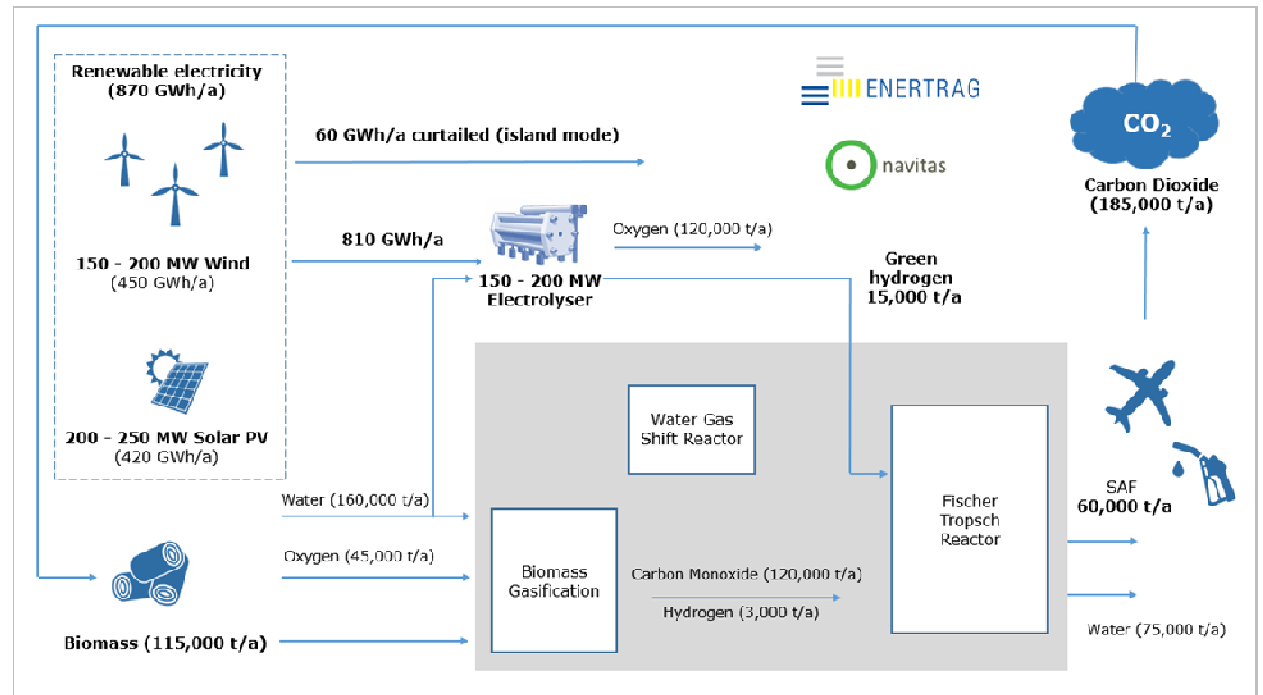
Supply of green hydrogen and biomass into existing plant to produce SAF

Planned installed capacities

- Electrolysers: 150-200 MW
- Wind and solar: 350-450 MW

Planned production volumes

- Green hydrogen: 15,000 t/a
- Biomass: 115,000 t/a
- Aviation fuel: 60,000 t/a (approx. enough for two planes to fly daily from Johannesburg to Europe)



Green hydrogen & biomass project in advanced planning/permitting stage. Commercial operation possible as early as 2023/24. ⁹

Together „one energy ahead“!



Eine Energie
voraus

Thank you for your attention! Questions?



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