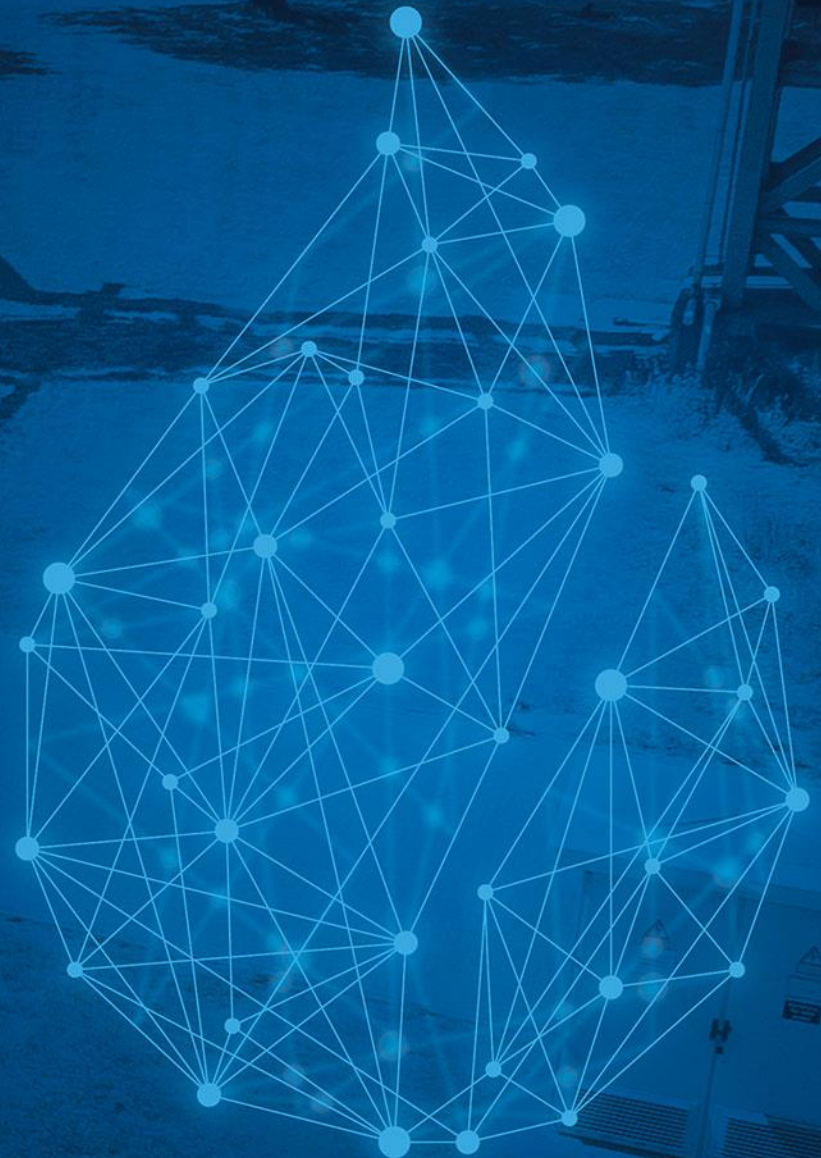


NORSK E-FUEL

Renewable Jet Fuel and Chemicals
from Electricity (CCU)

2019

Dr. Jens Baumgartner, Sunfire





NORSK E-FUEL BACKGROUND



DEVELOPING A LEADING EU POSITION IN E-FUELS

- European Consortium promoting novel Power-to-Liquid (PtL) technologies in Norway and Europe.
- Norsk e-Fuel will develop and implement PtL projects using renewable electricity to produce synthetic diesel, jet-fuel and chemicals from water and CO₂ (100 % renewable).
- Building on exclusive access to key technology and a world-wide patent, Norsk e-Fuel offers the most efficient and economic PtL pathway.
- Located at the Herøya industrial park, the first plant Norsk e-Fuel *alpha* is targeting 8,000 t/a of production capacity.

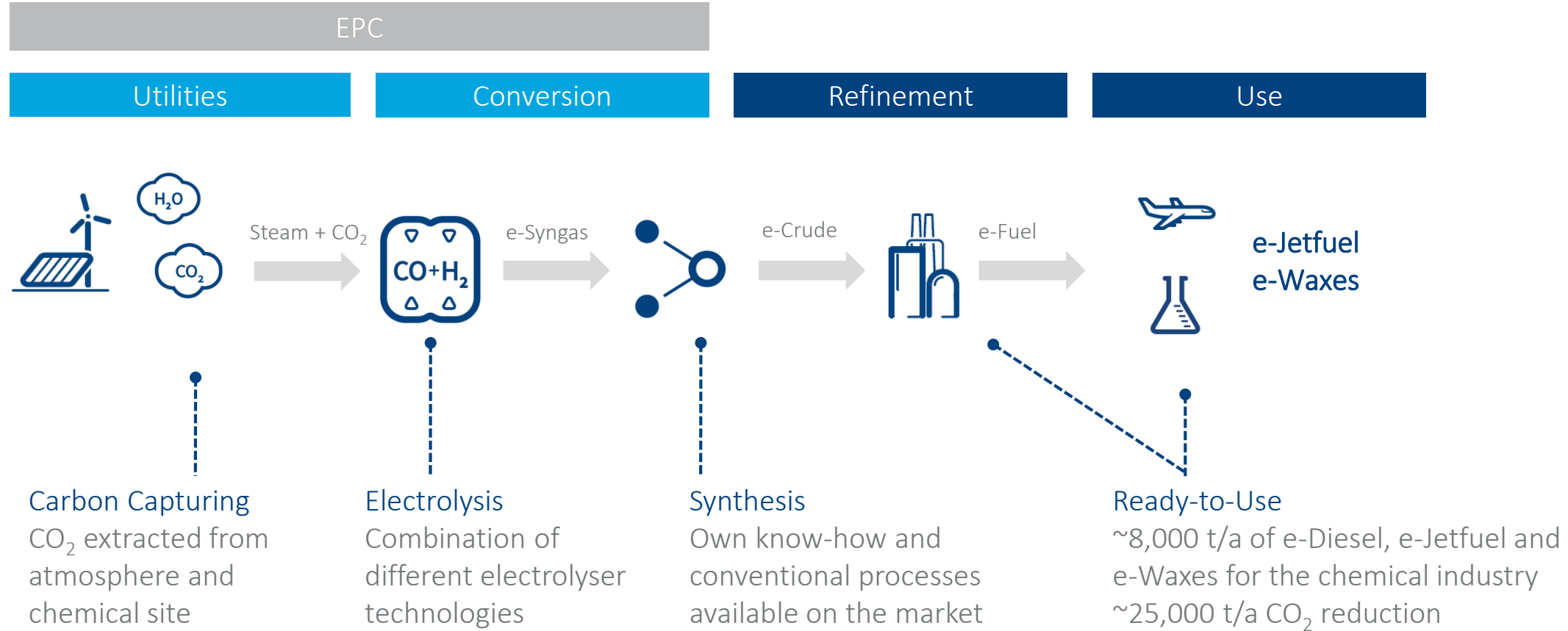


ADVANTAGES OF E-FUELS

TRANSFORMING ENERGY, SAVING THE EARTH

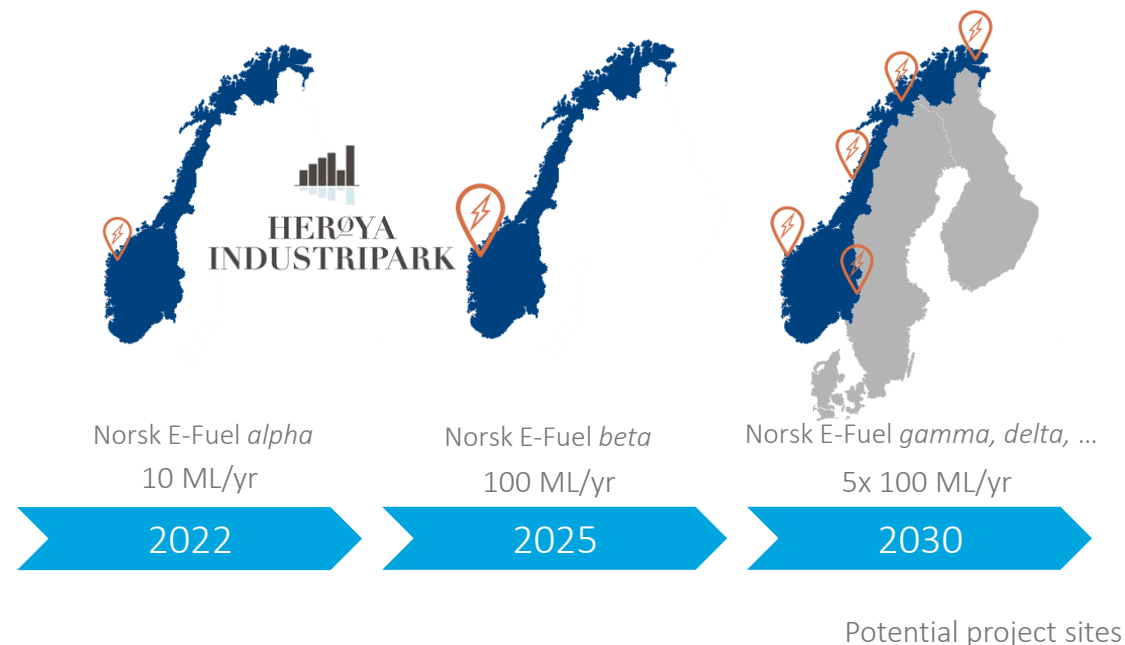
- Renewable oil-substitute for hard-to-abate sectors such as aviation, long distance transport and chemical industry
- Zero cost for infrastructure by using existing assets
- Certified for use in aviation (up to 50 % drop-in capable)
- Clean combustion: No sulphur content and reduced particle emissions
- High value for specialty chemicals due to advantageous product properties and purity

THE NORSK E-FUEL PROCESS



NORSK E-FUEL PROJECT POTENTIAL

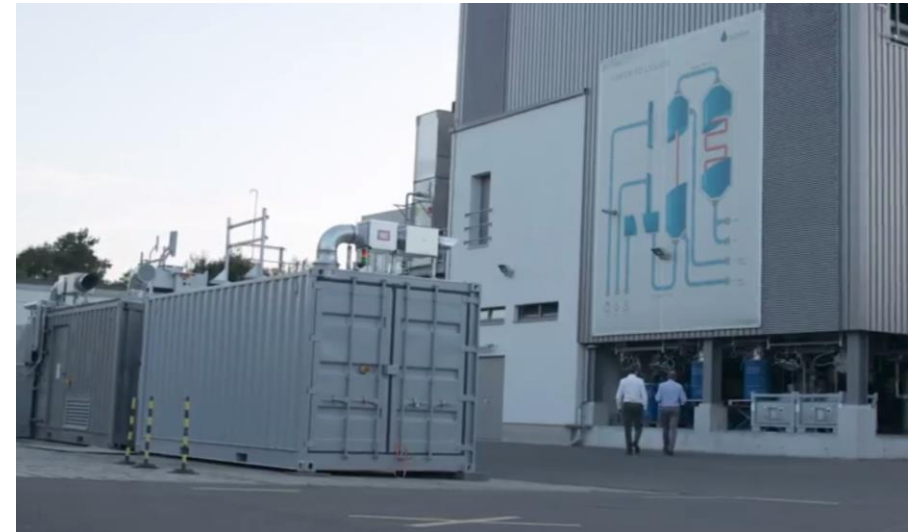
- Concept and technology is building on multiple realized pilot projects
- Herøya industrial park offers unique advantages:
 - Low electricity prices (3.5 ct€/kWh)
 - Continuous supply (> 8,000 h/a)
 - Distribution shipping terminal at site
- No further support for implementation of Norsk E-Fuel *beta* required, if successful.
- Large scale-up potential at Herøya industrial park by factor of 10 and 5-10 further potential projects in Norway



	Unit (per 10a)	Norsk e-Fuel <i>alpha</i>	Norsk e-Fuel <i>beta</i>
Output	Tons/a	80,000	800,000
GHG avoidance	Tons CO2	250,000	2,500,000
CAPEX / Funding	M€ / M€	80 / Tbd	No funding
OPEX / Funding	M€ / M€	70 / Tbd	No funding
Project efficiency	€/tCO2	Tbd	

NORSK E-FUEL ALPHA PROJECT MATURITY

- Project location identified and available for realization
- Strong business model with secured media supply (electricity and CO₂) and offtake
- Market Potential. Fossil: Diesel 280 Mt/yr, Jet Fuel 60 Mt/yr EU; renewable share depends on legislation.
- Feasibility studies 2x done. FEED until 2020Q2.
- Equity financing secured from project partners
- Financial close expected within next 12-24 months, if subsidies can be secured.
- Low performance risk due to warranty from Paul Wurth, world leading iron and steel EPC








Existing pilot plant, Dresden (GER)



Designated project location, Herøya (NOR)

NORSK E-FUEL ALPHA SELECTION CRITERIA

	Degree of Innovation	First of its kind large-scale Power-to-Liquid plant
	GHG emissions avoidance	250,000 tCO ₂ over project duration
	Project maturity	Equity financing, site and offtake secured FEED ongoing Project start depends on subsidy support and debt financing.
	Scalability	Blueprint design for worldwide project replication.
	Cost efficiency	Less than 60% funding required to close financing gap.

RENEWABLES EVERYWHERE

Dr. Jens Baumgartner
Business Development Manager Electrolysis
jens.baumgartner@sunfire.de

[Sunfire GmbH · Gasanstaltstraße 2](http://www.sunfire.de)
01237 Dresden · Germany
www.sunfire.de

