



Hydrogen  
Europe

*Norsk e-Fuel alpha*

The background of the slide is a photograph of an industrial facility, likely a refinery or chemical plant, with various pipes, tanks, and structures. A semi-transparent blue overlay covers the entire image. On the right side, there is a white network diagram consisting of numerous nodes connected by lines, resembling a molecular structure or a complex system architecture.

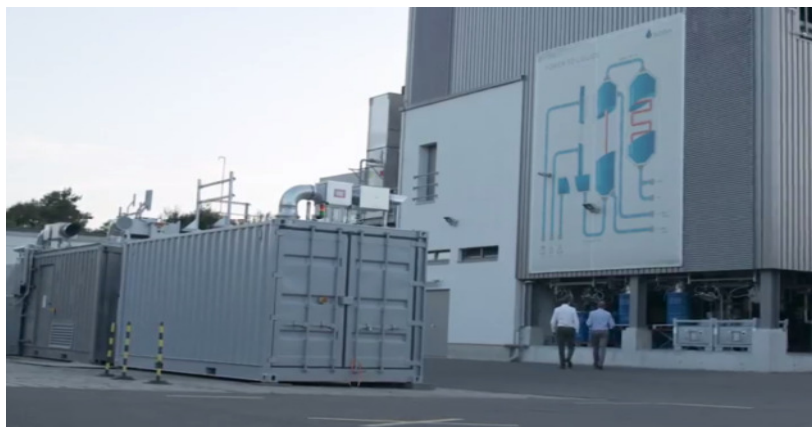
# Norsk e-Fuel

Renewable Jet Fuel and Chemicals  
from Electricity (CCU)

2019

Carl Berninghausen, CEO, Sunfire





Sunfire demo plant, Dresden (GER) 2015



Climeworks demo plant, Zürich (HE) 2018



## Norsk e-Fuel Summary

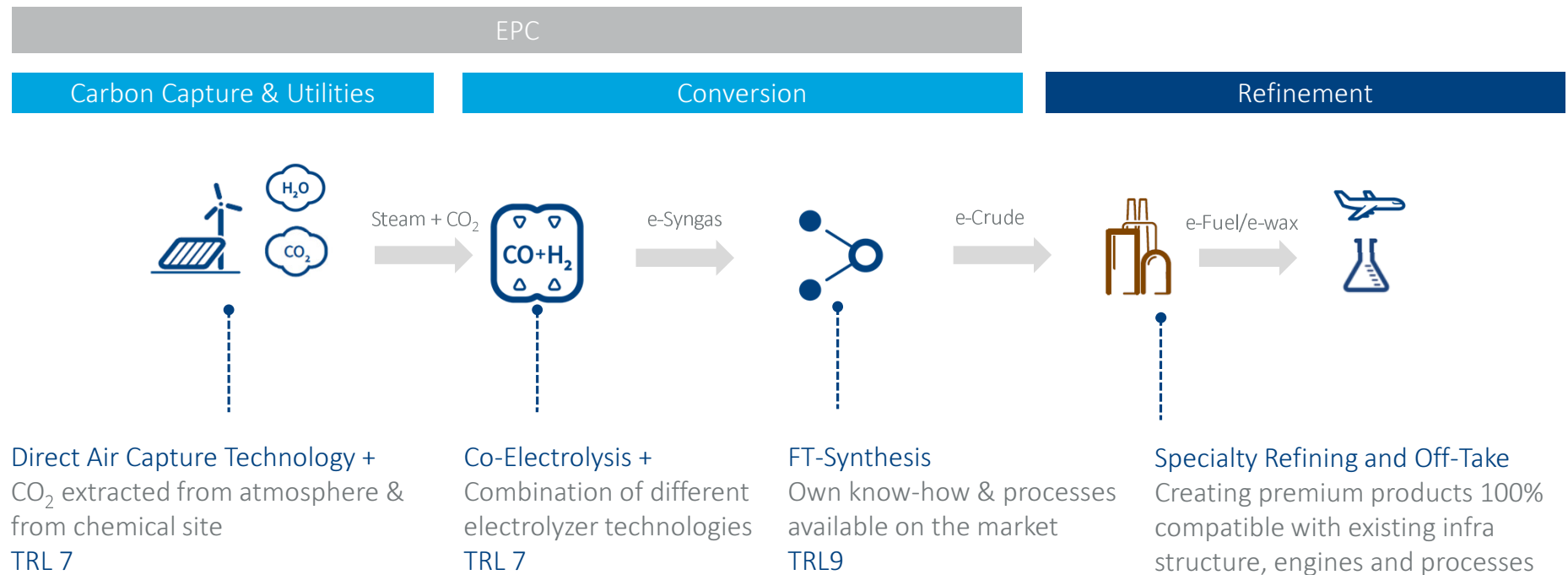


- European Consortium industrializing novel Power-to-Liquid (PtL) technology in Norway for the European Market.
- Norsk e-Fuel will realize a series of PtL projects using renewable electricity to produce synthetic fuels and chemicals from water and CO<sub>2</sub> (100 % renewable).
- **Proprietary technology and world-wide patents** – Norsk e-Fuel offers the most efficient and economic PtL pathway including world leading Direct Air Capture of CO<sub>2</sub>.



*Alpha* plant in Herøya (NOR) with 10mL/a capacity 2022

# Norsk e-Fuel Process



Concept and technology is building on multiple realized pilot projects  
PtL process with highest technical and economic efficiency

# Norsk e-Fuel Consortium



## MARKET & TECHNOLOGY LEADERS COMBINE THEIR STRENGTH



Climeworks (confirmed)  

Technology Leader Direct Air Capture of CO<sub>2</sub>: Synergetic to Sunfire PtL process enabling CO<sub>2</sub> supply also in remote locations with access to cheap electricity.



Sunfire (confirmed) 

Technology Leader Power-to-Liquid with SOC Technology and world-wide patent: Sunfire enables power to fuel conversion with top efficiency



Paul Wurth/SMS-Group (confirmed) 

Technology Leader System Integration and EPC: Large corporate resources to industrialize PtL. Paul Wurth will offer performance guaranty for the PtL process



Norsk Project Developer (in negotiation) 

Track record in energy project development in Norway: Shall secure sites and local resources and will drive the regulatory framework in Norway. Potential plant operator.



# Norsk e-Fuel Consortium



## ASSOCIATED PARTNERS IDENTIFIED FOR FIRST SPV



Nysnø (in negotiation)

Government Fund and Industry Developer in Norway: Driving the Norsk transition from fossil to renewables. Facilitates funding and access to the Norsk industry



BNP (in negotiation)

EU leading investment bank, focused on renewables with large portfolio of funding tools and industry links: Shall facilitate large scale debt funding in later stage



Hansen + Rosenthal (in negotiation)

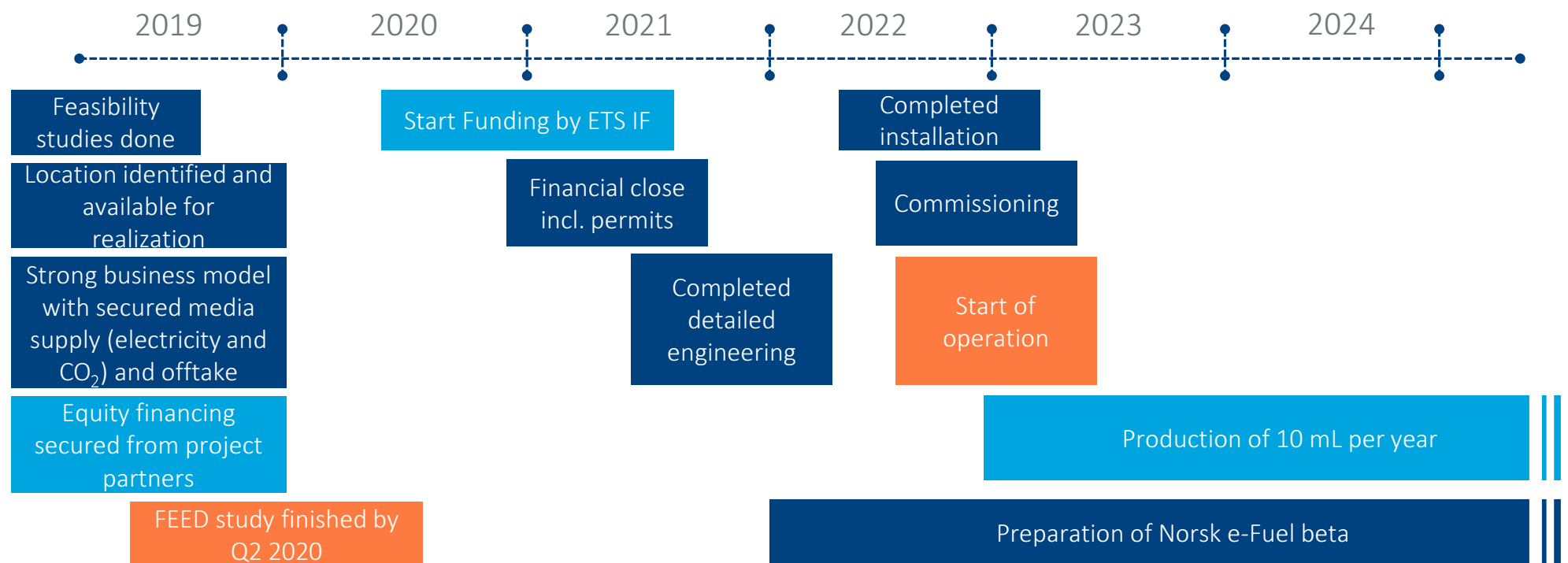
EU-Leader in specialty refining aims at large scale off-take for chemical applications: Considers investment into SPV's to secure product access.

Fuel Refining Partner under NDA (in negotiation)

World leader in renewable fuel aims at large scale fuel off-take and refining: Considers investment into SPV's to secure new raw material base

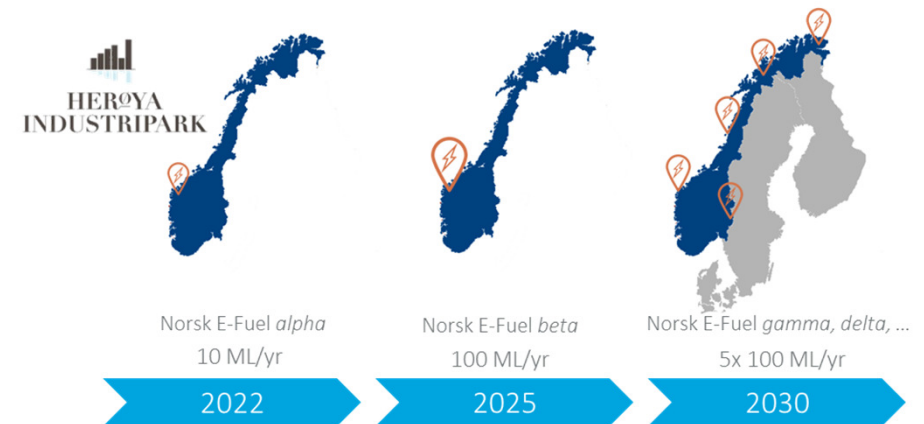


# Norsk e-Fuel Alpha Plant Timeline



# Norsk e-Fuel Budget & Impact

- Equity financing secured by consortium (25 M+)
- Off-Take secured for initial plant and 10x scale up  
Market potential 8 GW/a installed capacity 2020+  
*prognos*
- Large scale-up potential based on hydro and wind in Norway and in other European Countries with abundant solar and wind power.
- Cost differential of renewable SynFuel vs. fossil SynFuel (e.g. Shell/Katar) should be subsidized.
- Under condition of subsidy SMS/Paul Wurth, world leading steel EPC will give a Performance Warranty for the Alpha Plant and hence secure full financing
- No further support for next PtL plants necessary since technology will be bankable and RED2 in place.



	Norsk e-Fuel <i>alpha</i>	Norsk e-Fuel <i>beta, ...</i>
Output	10 Mio. to/y	100 Mio. to/y
GHG avoidance	250,000 to/y	2,500,000 to/y
CAPEX differetial for 10 y incl. stack replacement *1	35 Mio. €	No funding
OPEX differential for 10 y *2	58 Mio. €	No funding

\*1 Electrolyzer plus RWGS-Reactor + stack replacement. vs SMR-Reactor (estimate)

\*2 Renewable power plus CO2 from yara and DAC vs. fossil methan (estimate)



# RENEWABLES EVERYWHERE

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