



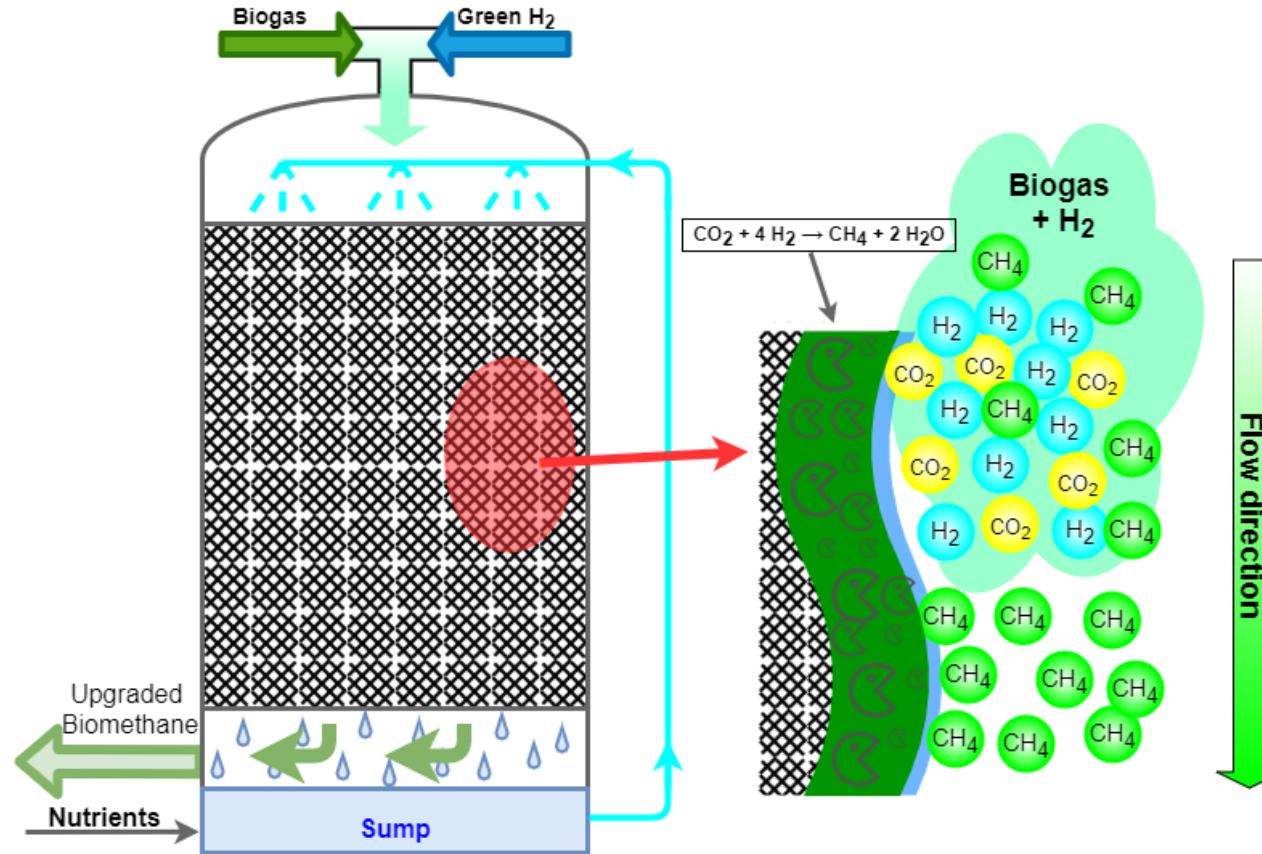
nature
energy

Power-to-x er rykket ud fra laboratoriet og ind på et storskala biogasanlæg. Proces, udfordringer – og kan der tjenes penge?

natur
energy

Biological Trickling Filter

Biologisk metanisering



Fordele

- Robust mikrobiel kultur da der bruges mikroorganismær fra biogasanlæggets egen reaktorer
- Kan benytte rå biogas
- Udnytter potentialet af mikroorganismærne med det store overfladeareal.
- Høj effektivitet ($10 \text{ m}^3 \text{ CH}_4 / \text{reaktor m}^3 / \text{dag}$)
- Bruger velkendt teknologi fra svovl-fjernelse
- Billig teknologi VS katalytisk metanisering

Udfordring

- Svært at monitere bakteriernes tilstand

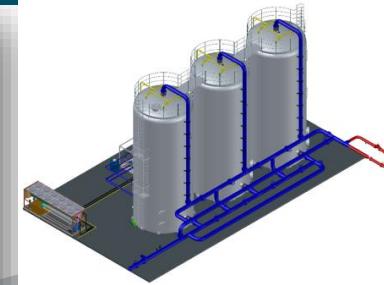
Tidslinje til 2025



2019-2020 – Lab skala



2021 – Pilot skala



2022-2023 – Demo skala



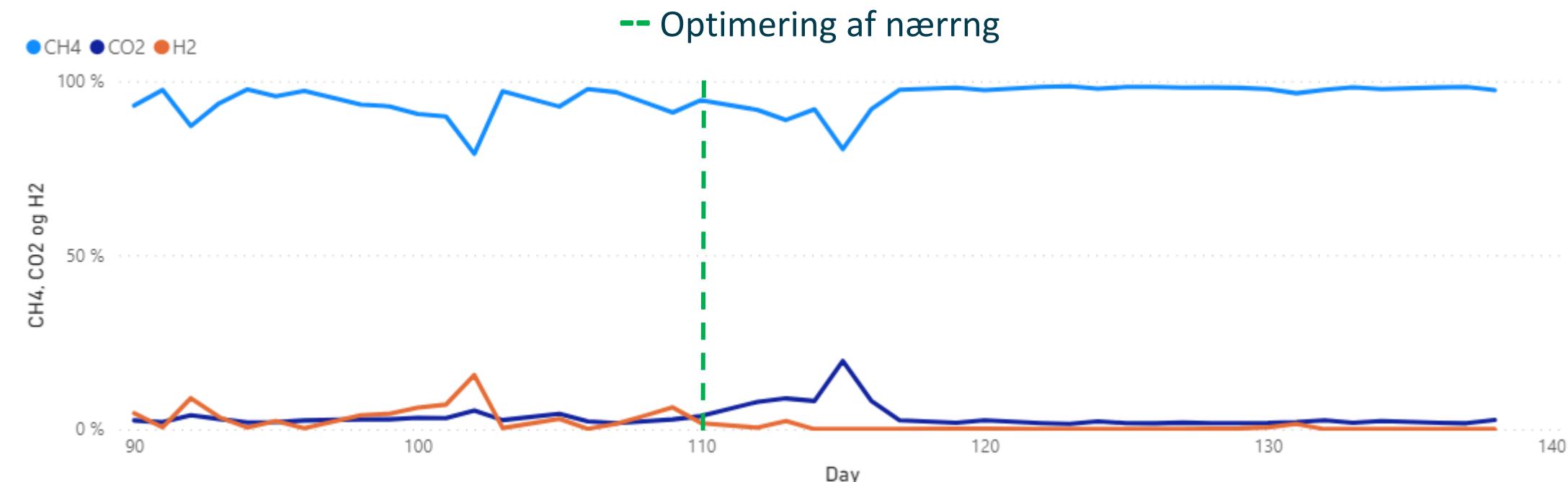
2024 – Full skala



	Lab skala	Pilot skala	Demo skala	Full skala
Størrelse [m ³]	4 x 0,008	2 x1	3 x 400	10 x 400
+CH ₄ [m ³ CH ₄ /dag]	0,08	20	12.000	40.000
-CO ₂ [% of normal prod.]	-	0,05%	30%	100%
Effekt [fra elektrolyse]]	-	0,009MW	6MW	20 MW

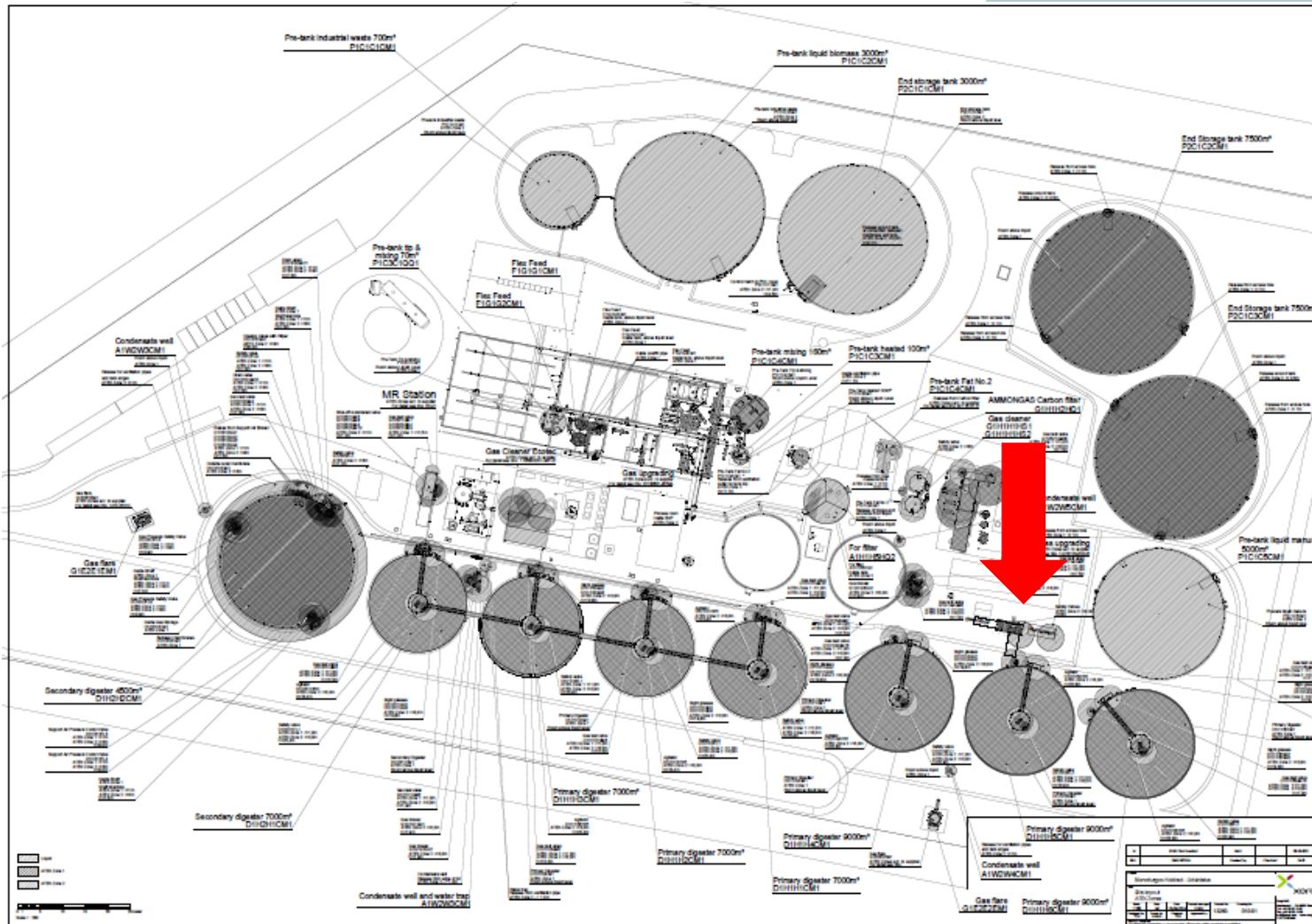
Resultater fra laboratorie – rigtig næring er vigtig

- Skift til en ny type næring har haft stor indflydelse på H₂ i outlet
- H₂ er næsten fuldstændig optaget efter ændringen af næring
- En uge efter næringsoptimering var CH₄ –indholdet på 98%
- Disse nærringsresultater er en fordel for pilotskala



Pilot skala ved Holsted

- Reaktorer er placeret bagerst på Holsted anlægget
- Commissioning fase er igang, hvilket inkludere test og opstart

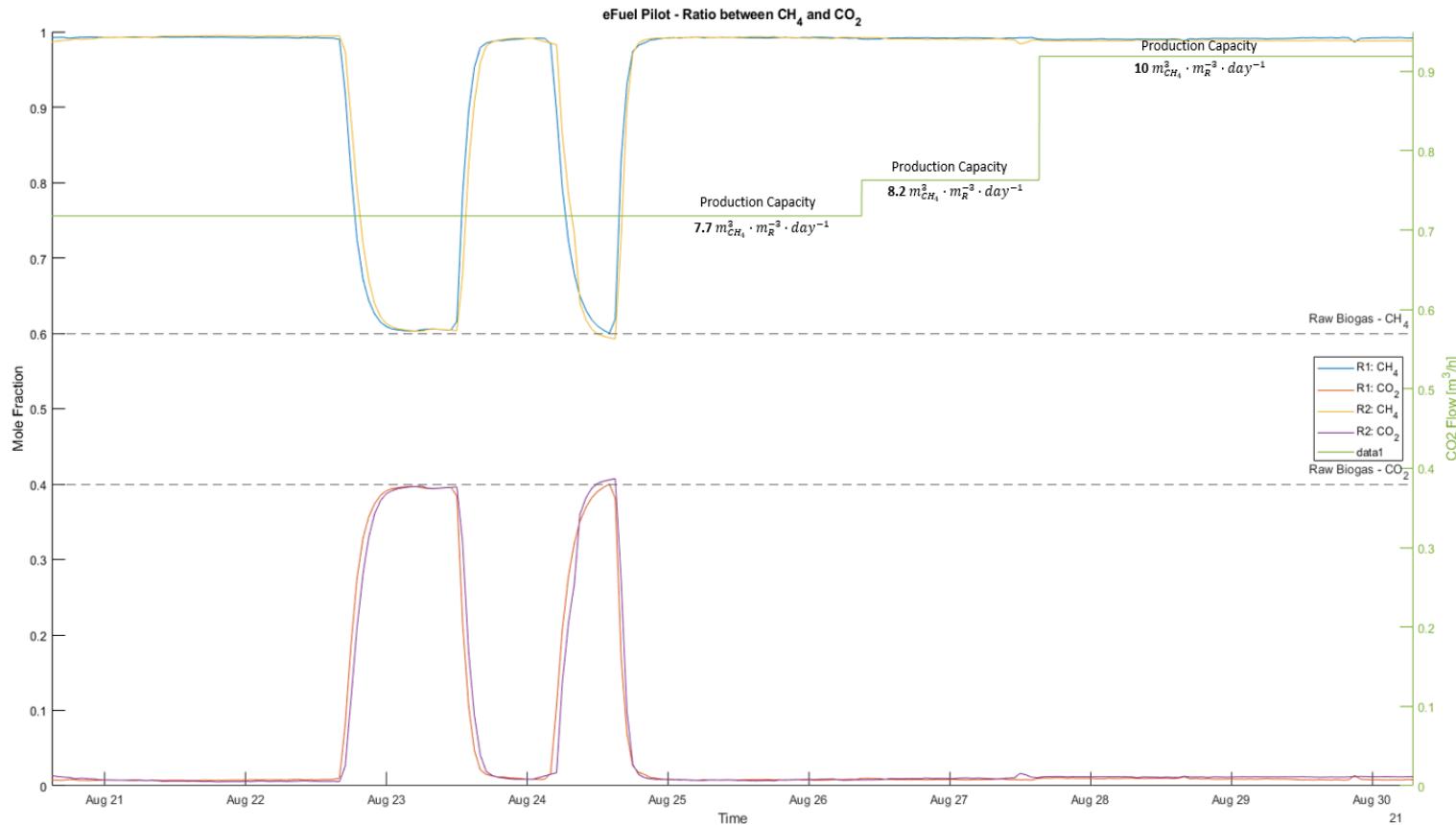


Pilot skala ved Holsted



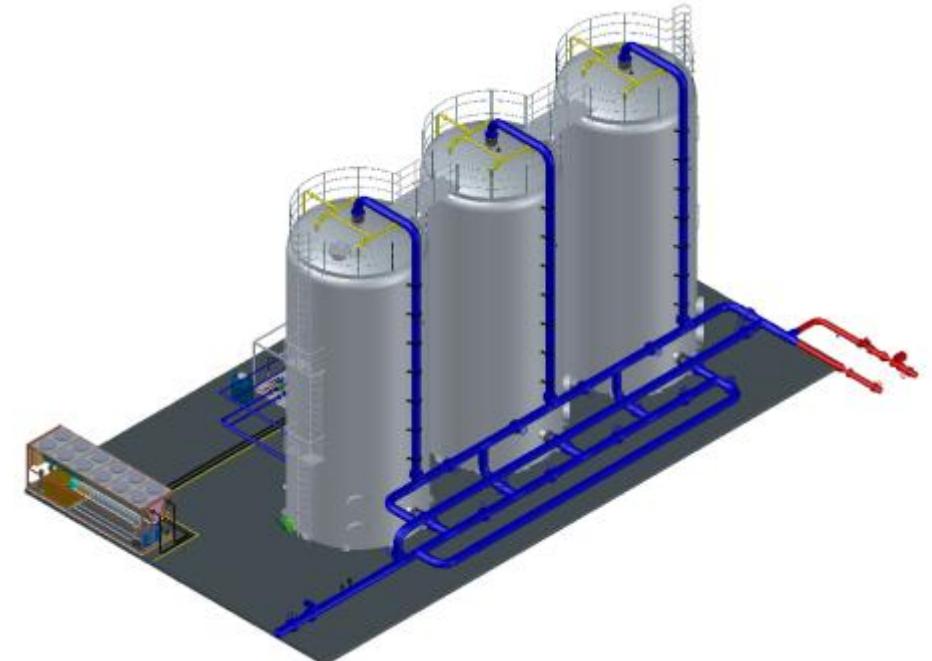
Pilotreaktorer i Holsted

- Commissioning fase er igang, hvilket inkludere test og opstart
- Produktionskapacitet på $10 \frac{m^3_{CH_4}}{m_R^3 \cdot dag}$
- Nedlukning af elektrolysen under operationen af pilot skala reaktorerne, har valideret robustheden af reaktorerne, og deres evnen til at producere igen inden for få timer
- Reaktorerne er blevet åbnet for at kigge på det indvendige
 - Ingen tilstopning blev observeret

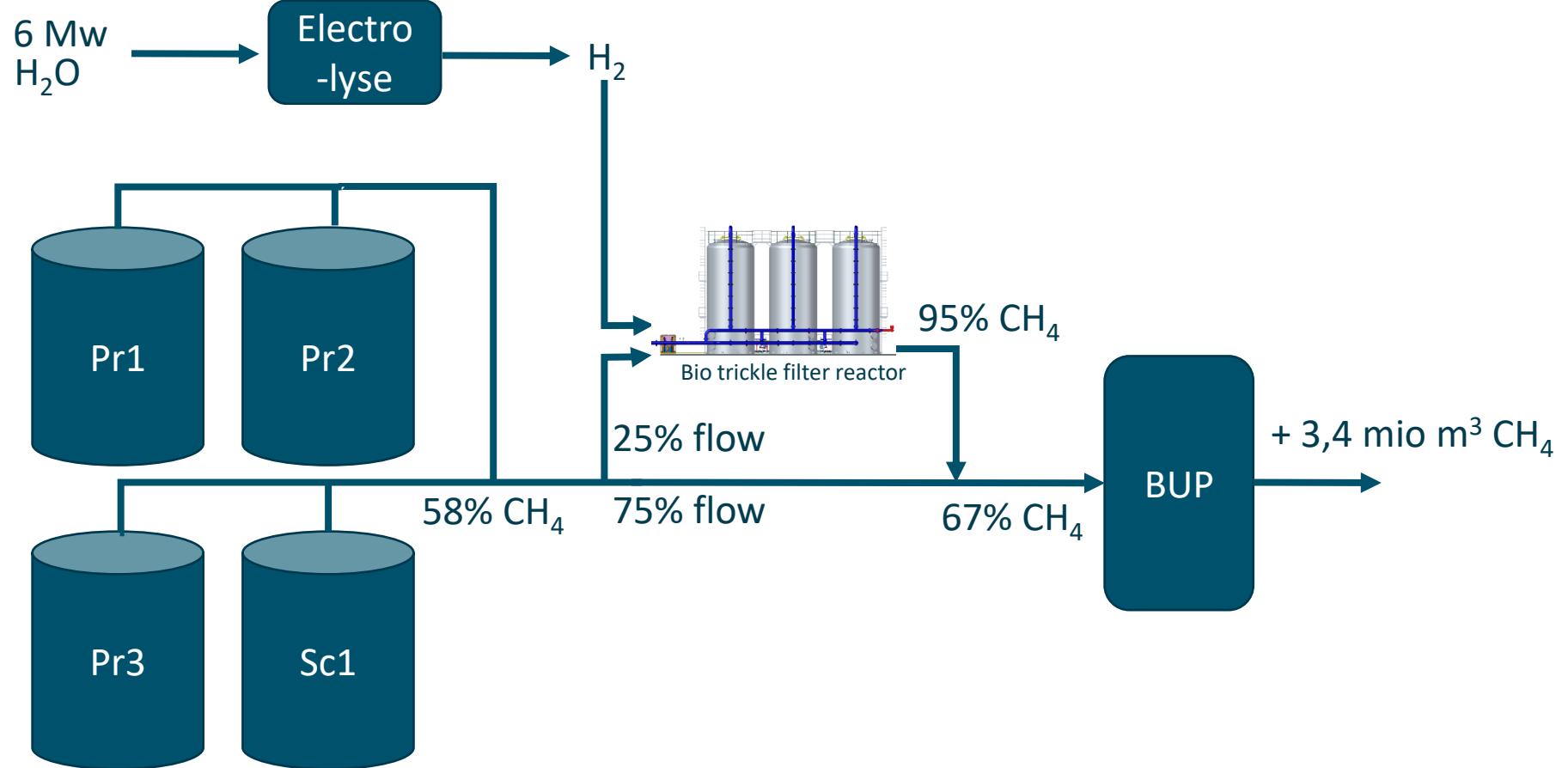


Demoskala PtX på Nature Energy Glansager

Demoskala i fuld størrelse dimension



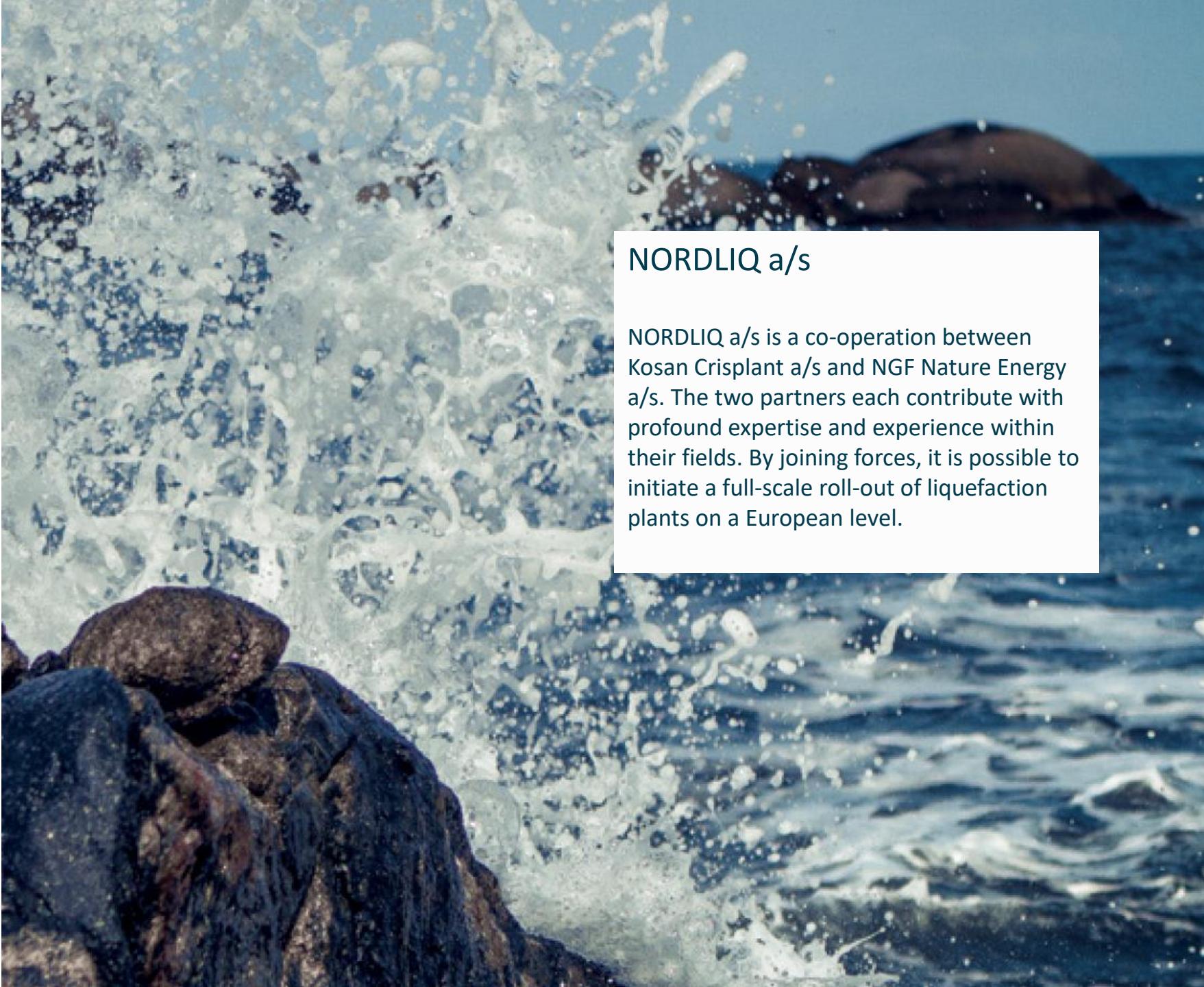
Demo skala PtX at Glansager



**Easy, safe and
green energy
from Frederikshavn**



NORDLIQ



NORDLIQ a/s

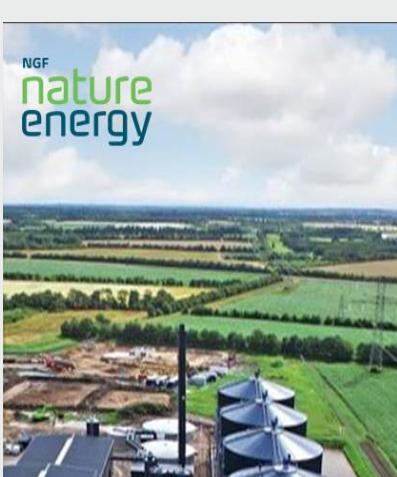
NORDLIQ a/s is a co-operation between Kosan Crisplant a/s and NGF Nature Energy a/s. The two partners each contribute with profound expertise and experience within their fields. By joining forces, it is possible to initiate a full-scale roll-out of liquefaction plants on a European level.

Partners in NORDLIQ



MAKEEN Energy a/s is a global, market-leading corporation that delivers equipment, solutions and services to the energy industry. In total, the corporation employs approx. 1,300 people across 6 continents and operates in over 140 countries. With a global reach, local presence and decades of experience, MAKEEN Energy can deliver responsible solutions that make a difference to people and planet.

KC LNG is Kosan Crisplant's division under MAKEEN Energy dedicated to liquefied natural (LNG) and liquefied biogas (LBG) solutions. For the NORDLIQ liquefaction plant, KC LNG is responsible for the designing, manufacturing and delivering the technical solution.



Nature Energy a/s oversees the supplies of natural and biogas for the liquefaction plant. As one of Denmark's largest natural gas companies with more than 40 years' experience, Nature Energy has positioned itself as a biogas pioneer working to promote its use and thereby actively contribute to improving sustainability. Moreover, the company's dimensions provide both the financial capacity and the resources to construct, maintain and run biogas plants and refueling points.

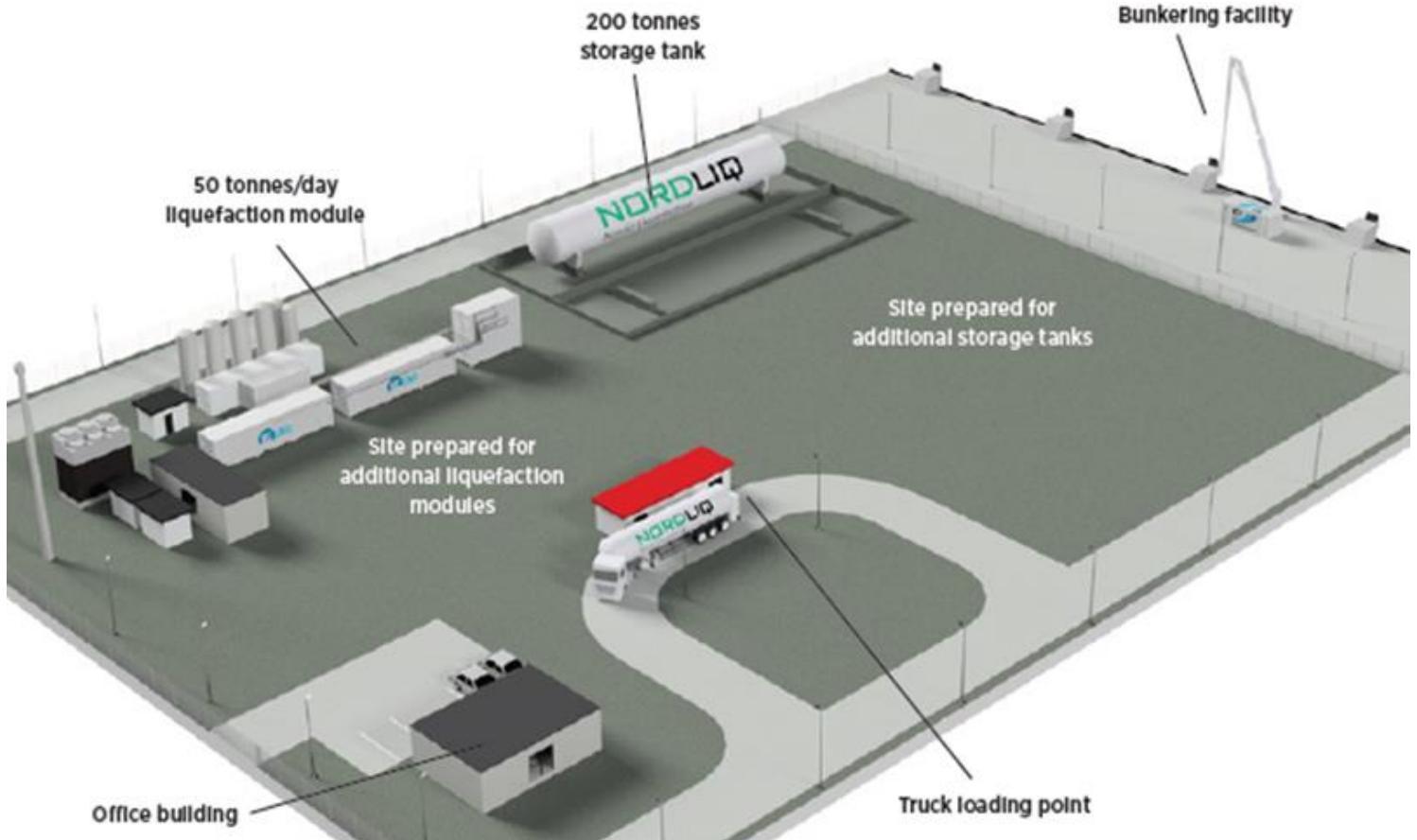
Overview of the market

Map from Gas Infrastructure Europe (GIE.eu)



The Liquefaction Plant

- 60 tons/day capacity
- LNG/LBG storage
- Truck loading
- Direct bunkering via pipeline
- Natural gas grid balancing
- Site prepared for expansion

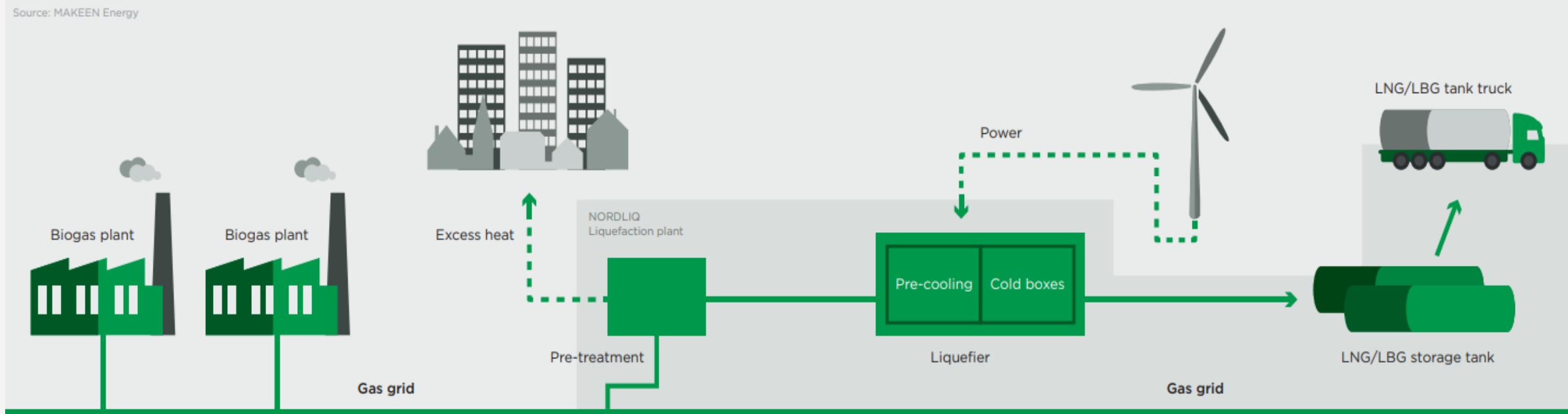


Location



Liquifaction technology

- Connected to gas grid
 - Pre-treatment (H_2O /TNT removal, CO_2 reduction)
 - Pre-cooling/cold box
 - Storage
 - Loading (trucks or ships)
-
- 24/7 operation
 - Start/stop in 30 min
 - Fully automated



Project status

FID

- Completed end September 2021

Start civil works

- October/November 2021

Expected production start

- Q2 2023



Future expansion

- 300 tons/d - 100,000 tons/y production capacity
- Additional 1200 ton storage
- Step-wise approach

