Greenspot Mongstad

Summary Business Plan

June 2020

Greenspot background

- Norway is a major energy nation in Europe blessed with a unique mix of resources: plentiful hydropower, offshore petroleum and the potential to further harness renewable energy sources such as wind and biomass.
- Norway has only one percent of Europe's population, but 20 percent of the hydropower resources, 50 percent of its water magazines (stored water for hydropower production), 40 percent of the gas resources and 60 percent of the oil resources.
- Norway's oil and gas industry is the most important driver of innovation and technology development in Norwegian society. These innovations are also being transferred on a large scale to other industries and business sectors such as aquaculture.
- MIP business partners are committed to investing in new sustainable technologies to meet future global energy demand and improve energy efficiencies in operations, based on the current know-how and technologies from Norway's leading high-tech oil and gas industry.
- MIP is also at the forefront of creating the next-generation of large-scale offshore wind; developing and advancing renewable technologies from pilot project to scale.
- Greenspot Mongstad is a new strategic initiative to develop MIP into a diversified green industrial park. It is a joint initiative involving several stakeholders from multiple industries and sectors.
- The common goal is to facilitate new growth and increase Mongstad Industrial Parks competitiveness based on current industries present at Mongstad, as well as CCS, renewable energy, low carbon fuels, aquaculture and other maritime industries.

Key figures for Mongstad Industrial Park

59 companies

(2020)

2400 jobs

(2020)

2400 ship arrivals p.a.

(2019)

43% of the supply base activity in Norway

(2019)

105 200 sqm of floor space

(2020)

4 900 000 sqm of available land

(2020)

5-10 MW available electrical power (continuous)

(2020)

Available capacity:
Industry water = 0 m³/h
Drinking water = sanitary use for new industry

(2020)

Greenspot is a great opportunity to reshape the existing business portfolio and create new growth @Mongstad Industrial Park

Vision	*Transform Mongstad Industrial Park into the "green spot" of Norway by offering favorable conditions for sustainable business models*
Ambition	Ensure a more diversified industrial mix
Ambition	Increase "green" investments @ the industrial park
Ambition	Create ripple effects and new attractive jobs
Ambition	Increase focus on industrial circular processes to create favorable conditions for new business entrants

Strategic Game plan – Short briefing

Ambition

- ✓ Mongstad Industrial Park has been an energy hub for 40 years and will be an energy hub for at least the next 30 years, however the input and output mix will be different. The key success factor is to get the macro picture and megatrends of decarbonization aligned with the micro picture of profitable and sustainable business development @MIP.
- ✓ The oil & gas industrial activities @MIP will continue in the next decade be the key drivers of activity @MIP, but in addition we see a huge potential for MIP taking a leading role in the Hydrogen Economy.
- ✓ The Hydrogen Economy will boost a lot of other business opportunities. When combined with the existing industrial clusters competence, infrastructure and the strategic location close to offshore/maritime markets, MIP is well positioned to be the Norwegian Hydrogen Hub going forward.
- ✓ The Green Hydrogen pilot-e project decision to localize @MIP is a potential game changer and will create many possibilities if the demo project is profitable, scalable and providing demand continues to develop. A long-term vision building on these possibilities has been included in the vision 2030.
- ✓ In a 3-5 year scenario we need to be realistic and take smart decisions also in line with the philosophy of Nordhordlands status as a UN Biosphere Reserve. The business opportunities planned for the 3-5 year scenario are all considered attractive based on contribution to the green shift, profitability and the needed diversification @MIP. In addition; none of these opportunities will create hurdles for future larger scale opportunities.

Short-term plan

- ✓ Establish industrial onshore wind
  - ✓ Target production start 2025
- ✓ Establish production plant and supply system for green liquid hydrogen
  - ✓ Target production start 2024
- ✓ Attracting the Aquaculture industry
  - ✓ 2 cases – target production start 2024
- ✓ Maritime Battery production plant
  - ✓ (go/no go opportunity in current pipe)

Vision 2030

2024 - Step 1 - Demo: Hydrogen production 30 MWe

- ✓ Producing liquid hydrogen for maritime sector – Pilot-E project (~4000 tonnes H_2/ year)

2027 - Step 2 - Scaling up : Hydrogen production >100 MW

- ✓ Producing Ammonia, e-fuel-pilot ~10 000t/year, etc.

2030 - Step 3 - 2030: Preparing large scale infrastructure

- ✓ Full scale e-fuel delivery to Maritime sector, aviation, long haul trucks etc. >100 000 tonnes/ year

Highlight of the competitive advantages – capitalizing on the strengths identified in the SWOT analysis

Strategical positioned for growth in the "sea meets land" industries

Largest industrial energy cluster in Norway

Competent workforce - skilled in process industry, maintenance and logistics

Nordhordland Biosphere Reserve (the only in Norway)

World class port facilities with quayside access to electricity, LNG and bunker oils

Large areas ready for new industrial development, without causing large interventions in nature

Largest refinery in Northern Europe and world leading test center on CCUS

Potential access to:

- Natural gas
- Hot industrial water
- Refinery products
- CO_2

Good road infrastructure on site and links to national main roads

Extensive pipeline system and oil storage facilities

During this project 32 business opportunities were identified and evaluated

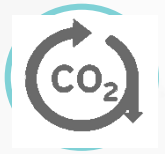

Data centers


Consolidation of oil & gas services


Test center


Decommissioning of offshore oil and gas installations and pipelines


Logistics hub



Carbon Capture and Storage (CCS)


Battery production


Sustainable fuels

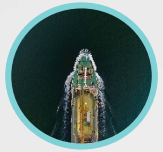
Blue hydrogen production


Offshore Wind

Green hydrogen production


Ammonia production


Purification and recycling of contaminated bulk material


Ship recycling


Concrete recycling


Cement production


Land-based grow-out farming of salmon


Fish processing


Post-smolt salmon production

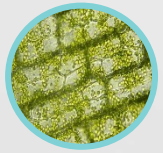

Fish feed production


On-site land-based wind generation


Grey hydrogen production


Deep sea (seabed) mining

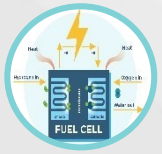

Floating solar


Omega 3 or other specialist substance from algae


Algae biomass production for fish feed


Microorganism culture for feed/human consumption

Biogas and organic fertilizer production



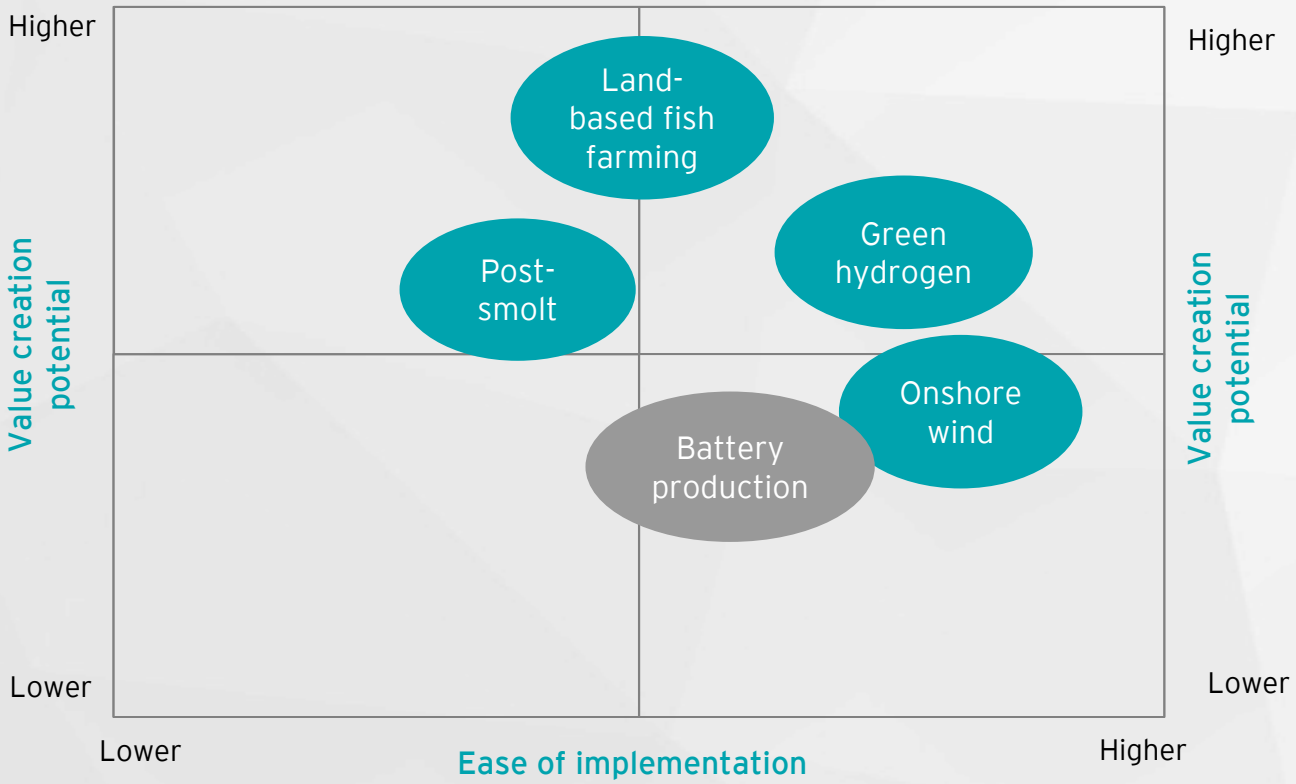
Fuel Cell or electrolyze production


Autonomous warehouse

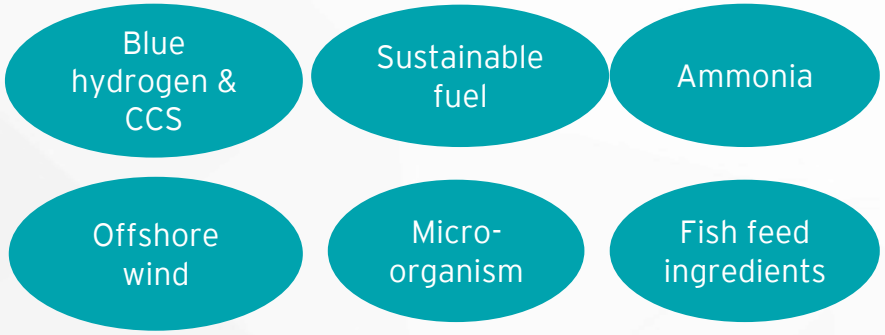

Test center for acute pollution preparedness

The most strategic and commercial attractive business opportunities in a 3-5 year scenario is green hydrogen, onshore wind and aquaculture. The long-term strategy is to position Mongstad Industrial Park as a Hydrogen Hub generating several additional opportunities

SHORT-TERM POSSIBILITIES



LONG-TERM POSSIBILITIES



The long-term possibilities are related to the up-scaling of hydrogen production and spin-off possibilities at scale

Attractive symbioses potential Attractive stand-alone

Renewable energy and hydrogen are key to a green development in accordance with Greenspot Mongstad`s vision

Renewable electricity

+ water

Electrolysis

Hydrogen

+ Oxygen

Hydrogen can be:

- Burnt directly
- Used in transport such as maritime applications

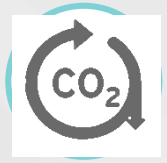
Natural gas

Reforming

Hydrogen

+ Carbon dioxide

CCS

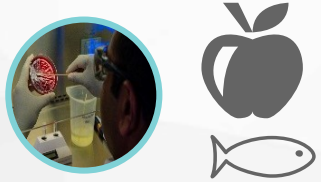


Further processing

Hydrogen based products

Sustainable fuels are chemically the same as fossil fuels and have multiple uses e.g.:

- Fuels for aviation, maritime and road vehicles
- Chemical feedstocks for plastics etc.



Fermenting bacteria/ algae can produce:

- Food for human consumption
- Feed for animals such as fish

Green ammonia is key for:

- Fertilizer production
- Nitrogen based chemicals
- Fuel

Mongstad by 2025 could have a large number of new businesses established across the site on a number of these plots

Further development by 2030 could make Mongstad the world's most advanced and sustainable industrial park

Legend

Zoned land

Potential land for development

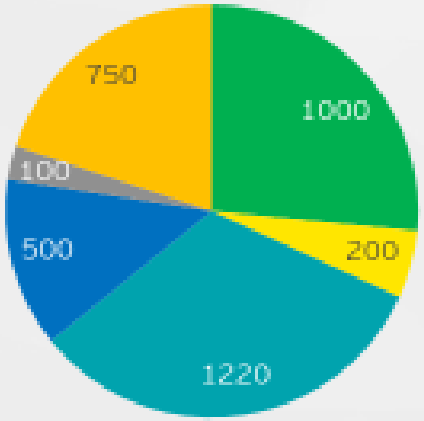
Approx. site & scale of development

Sharing energy and materials throughout the park would allow for optimal resource utilization and sustainable circular growth

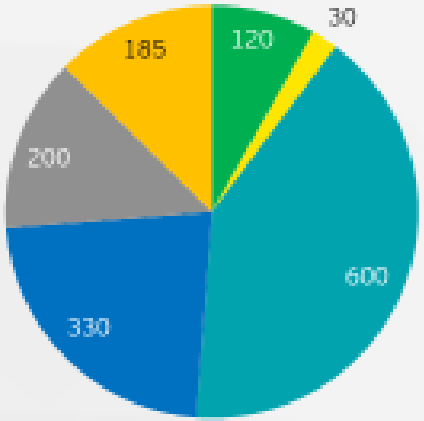
Short-term business concepts can attract significant investments and generate regional value, but could be limited by electricity constraints

- Green hydrogen production
- On-site land-based wind generation
- Land-based grow-out farming of salmon + biogas production
- Post-smolt salmon production + biogas production
- Battery production
- E-fuel (sustainable fuel)

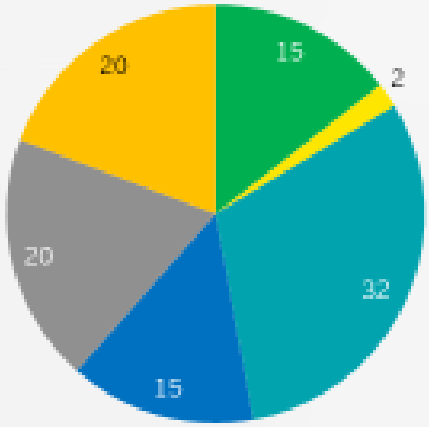
CAPEX (mNOK)



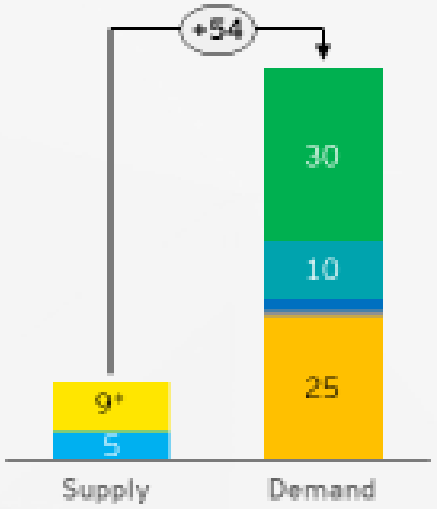
Annual revenue (mNOK)



Number of new jobs



Electricity (MW)

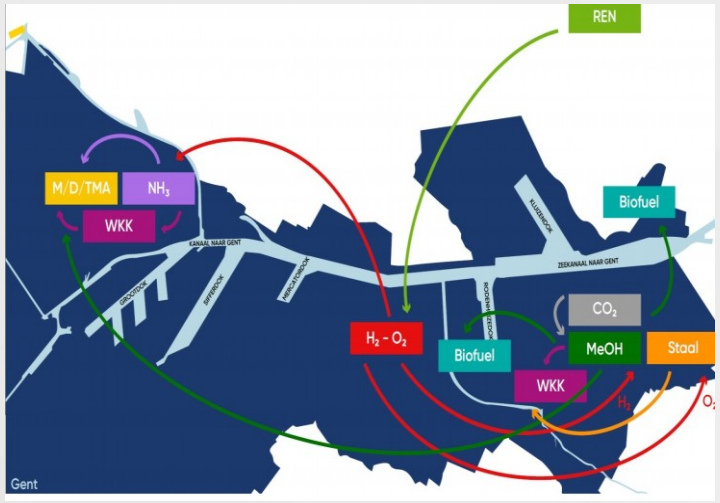


CAPEX	Annual revenue	Number of new jobs	Future electricity demand
~ 3 800 mNOK	~ 1 500 mNOK	~ 100	~ 68 MW
Aggregated number for the short (3-5 year) business concepts.	Aggregated number for the short (3-5 year) business concepts.	Aggregated number of the cases for each business concept. Directly employment effect for daily operation. Employment during construction phase is much larga as is potential and indirect employment during operation.	Aggregated number of the cases for each business concept. The gap is considerable, but several measures are being taken to solve the critical situation.

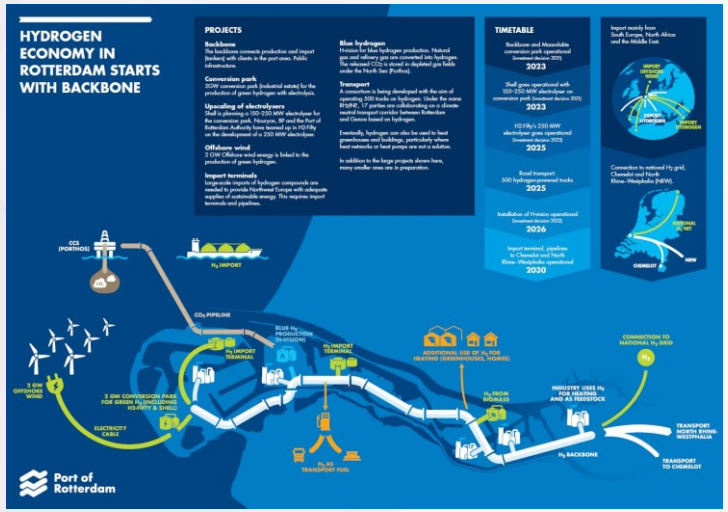
* Based on a 50% capacity factor for wind

If we want to take a leading position in the green transition it is critical to establish new value chains, strategic alliances and green deals now. In EU several new innovation giga-projects is planned and we need to step-up to be capitalize on our competitive advantages…

1 Port of Gent – the CCU hub



2 The H-Vision and Porthos project in Rotterdam



3 Sustainable fuel project in Denmark

Consortium partners

Timeline

2023: Demo
- Estimated CAPEX 80 mEUR

2027: Scaling up
- Estimated CAPEX for Full Scale 500 mEUR

H-Vision concept: Blue & green hydrogen. H2.50-FEED- 250MW electrolyser
Athos: Concept- CCUS project between
Porthos: CCUS Demo 2023, Scaling up 2027. Netherlands has circa 3 GW green & 3 GW blue hydrogen production under consideration

2023: 10 MW Electrolyser – bus and trucks
2027: 250 MW Electrolyser – methanol for maritime transport and jet fuel (e-kerosone)
2030: 1,3 GW Electrolyser – producing 250 000 tonnes of sustainable fuel (circa 30% of Copenhagen airport demand)

For questions about the report, please contact

Vegard Sjursen – Project Manager
Strategy & Business Development
E-mail: Vegard.R.Sjursen@no.ey.com
Mobile: +47 997 66 782

Maria B. Helsengreen
Partner of EY Advisory Bergen
E-mail: Maria.B.Helsengreen@no.ey.com
Mobile: +47 957 42 213

James Higham
Climate Change & Sustainability Services
E-mail: James.Higham@no.ey.com
Mobile: +47 908 30 131

Rina J. Riddervold
E-mail: Rina.J.Riddervold@no.ey.com
Mobile: +47 452 69 216

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