Nel Hydrogen

DNB's 14th Annual Small & Medium Conference

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CHIEF EXECUTIVE OFFICER
90 years of hydrogen technology experience and excellence
Nel ASA

• Global, listed, pure-play hydrogen company – facilities in Norway, Denmark and the U.S.
  • Significant foothold in fast-growing markets & a solid backlog

• World-leading on hydrogen electrolyzers and fueling equipment – unrivalled performance and track-record
  • Complete range of products optimally positioned for large market opportunities

• Capable of delivering solutions to produce, store and distribute hydrogen from renewable energy – serving industry, energy and gas companies
  • >3500 hydrogen solutions delivered in ~80 countries world wide since 1927

Three business segments

- Hydrogen Electrolysers
- Hydrogen Fueling
- Hydrogen Solutions
Significant increase in hydrogen market activities

- Total value of offers amounted to ~10 BNOK in 2017
- Often long lead times between offer and order
  - From a few quarters to...
  - ...a few years
- Continued good lead generation is key to continued commercial success
Nel Hydrogen Electrolyser
Production and installation of water electrolysis for hydrogen production

- Global leader in electrolysis based hydrogen production plants
  - highest uptime, lowest conversion cost, robust and reliable
- Unrivalled track-record with >3500 hydrogen solutions delivered in >80 countries worldwide since 1927
- Scalable production capacity for industrial and energy/transport applications – small scale to large scale solutions

Containerized solutions
Up to 1000kg/day

Alkaline and PEM electrolyzers
Scalable and modular

Large scale plant solutions
Up to any capacity
Nel Hydrogen Fueling

Production of hydrogen fueling stations for cars, buses, trucks, forklifts and other applications

- Global leader within hydrogen fueling solutions for vehicles, adapted to latest fueling standards
- Delivered >30 stations in 8 countries across Europe since 2003, expanding into US & Asia
- Highest reported availability and innovative, in-house developed technologies
Nel Hydrogen Solutions
Utilizing market opportunities across the Nel group and offers complete solutions to customers

- Unified delivery of complex renewable hydrogen solutions, efficient system integration, project development and sales across segments

- Sole provider of integrated solutions along the entire value chain:
  1. Fueling Networks
  2. Renewable Hydrogen & Storage Solutions
Fossil parity - renewable hydrogen from electrolysis reaching a tipping point
Global hydrogen market
General market update

Large opportunities for electrolysis within existing hydrogen market

- ~55 million ton/year market (~150 BUSD)
  - 15% merchant market (5 – 15 $/kg)
  - 85% on-site (~2$/kg)
- Only 1% from water electrolysis today, rest from SMR/gasification
- Large potential for growth, driven by increasing focus on:
  - climate and renewable energy
  - decreasing electricity prices
  - decreasing electrolyser CAPEX
- Special focus on refineries and green ammonia
  - Account for ~80% of market
- Assuming that total market is supplied by electrolysis, annual market potential would be >20 B$/year
Overall hydrogen market set to grow 10x by 2050

General market update

If high share of renewables, electrolysis market can potentially grow >1000x...

... and an IEA study confirms the competitiveness of renewable hydrogen

Enable the renewable energy system ▶️ Decarbonize end uses

Enable large-scale renewables integration and power generation
Distribute energy across sectors and regions
Act as a buffer to increase system resilience
Help decarbonize transportation
Help decarbonize industrial energy use
Help decarbonize building heat and power
Serve as renewable feedstock

Clean $H_2$: electrolysis of water

Report authored by the Hydrogen Council, consisting of senior executives of 18 companies in different industries, supported by McKinsey & Co

Source:
Electrolysers outcompeting fossil alternatives

General market update

**CapEx:** Electrolysers from Nel - becoming competitive with SMR

**OpEx:** Renewable energy already enables fossil parity for hydrogen

![Cost split of H₂/Kg diagram](image)

* incl. service, maintenance & operation
**electricity

Source: Pareto Securities

EUR/USD: 1:1.2

*SMR – CapEx range
Current markets served by electrolyzers

General market update

- Food Industry
- Glass Industry
- Polysilicon Industry
- Laboratories
- Transport Sector
- Chemical Industry
- Steel Industry
- Power Industry
- Life support
- Power-To-X (renewable hydrogen)

Historical market

New markets
New markets, Power-To-X
General market update

Unparalleled position of electrolysis in producing other green energy forms

- Hydrogen from electrolysis will be key in producing large quantities of sustainable energy in various forms
- Ability to adapt to diverse and intermittent renewable energy sources becoming increasingly important

POWER-TO-PIPELINE (GAS)
POWER-TO-FUEL (TRANSPORT)
POWER-TO-POWER (ENERGY STORAGE)
POWER-TO-LIQUID (BIOFUEL)
POWER-TO-NH₃ (GREEN AMMONIA)
POWER-TO-CH₃OH (GREEN METHANOL)
POWER-TO-CH₄ (GREEN METHANE)
POWER-TO-STEEL/TITANIUM (CO₂ FREE)
POWER-TO-REFINERIES

Hydrogen from electrolysis will be key in producing large quantities of sustainable energy in various forms.

Ability to adapt to diverse and intermittent renewable energy sources becoming increasingly important.
Hydrogen is becoming relevant in all forms of transportation

General market update
Recent survey increases the importance of hydrogen as a fuel

**General market update**

KPMG Global Automotive Executive Survey is the compound input from 1000 executives from the automotive industry

Fuel cell electric mobility is now the #1 trend until 2025

“There will not be a single solitary drivetrain technology: Executives project a split by 2040 for BEVs (26%), FCEVs (25%), ICEs (25%) and hybrids (24%).”
Project examples
Establishing hydrogen infrastructure in Norway

20 MNOK support for establishment of 2 additional HRS in Akershus in 2018

- Uno-X Hydrogen received support to establish 2 new hydrogen fueling stations in Ås & Hvam, Akershus
- After installation, JV will operate 5 HRS in Southern Norway
- Currently ~100 FCEVs in Norway, annual sales growth of >2x
- Total of 4 HRS in Norway in 2017, 8 by end of 2018
- JV consists of Uno-X (41%), Nel (39%) and Praxair (20%)
Fueling station for hydrogen trucks in Trondheim, Norway

Project examples

First ever triple-dispenser station

- For ASKO, Norway’s largest grocery wholesaler
- Onsite renewable hydrogen from electrolysis
- Connected to rooftop solar on warehouse
- Containerized turn-key C-150 electrolyser
- H2Station® for trucks, cars and forklifts

Electrolyzer  Hydrogen storage  Station module  Dispensers

- 35MPa
- 35MPa
- 70MPa
Hyon AS, a one-stop-shop for complete hydrogen energy solutions

Project examples

Scandinavian powerhouse on hydrogen

- Joint venture between Nel ASA, Hexagon Composites ASA and PowerCell Sweden AB
- Utilizes each partner’s respective world-leading technologies and competencies to manage and develop projects for effectively integrating and optimize zero-emission power solutions for the customers
- Main, initial focus: maritime sector
  - Strong maritime competence in Hyon, and high focus on zero-emission maritime solutions in Norway
- Also targeting hydrogen energy storage projects
Supplying fueling stations to Shell in California

Project examples

Exclusive framework contract with Shell

- Nel has exclusive framework contract with Shell (in partnership with Toyota and Honda) for supply, construction and maintenance of hydrogen stations San Francisco CA
  - Initial purchase order received Q1’17 with value of NOK ~140 million
  - Received additional purchase order with value of NOK ~50 million during Q3
  - H2Station® modules expected to ship in H1’18
- Shell has issued an RFI for additional 100 hydrogen stations to California
  - Visibility on deliveries will help the industry to reduce costs
PEM electrolyzer and H2Station® for bus fueling in California

**Project examples**

**High capacity station for 25 buses in CA**

- First integrated Nel/Proton product offering
- One M-400 2 MW Proton PEM electrolyzer
- Two H2Station® for buses
- Total contract value of USD >8 million
- Delivery during 2018
Delivering mega-scale hydrogen fueling stations for Nikola

**Project examples**

**Exclusive partnership with Nikola Motor**

- Sole equipment supplier to create the largest hydrogen fueling network in the world
- 16 mega-scale stations covering 2000 miles & up to 450 ton/day
  - Signed PO for first two demo stations
- 14 commercial stations with capacity of up to 32 ton/day
  - Installation during 2019 – 2021
- Contract potential equivalent to ~1,000 MW of electrolysis and >250 hydrogen fueling dispensers
Nikola: Two demo stations with installation start in H2’18, order of 3.6 MUSD

- Reviewing potential demo-route from plant in Arizona, will support Nikola prototype truck fleet
- Equipment for onsite production and fueling of 70MPa
  - 2 Alkaline electrolyzer stacks for hydrogen production – 2 x 1,000kg/day
  - 2 x 70MPa dispensers and 2xH2Station® – 2 x 500 kg/day
    - Possibility to upgrade fueling capacity later
Nikola: 14 commercial stations – from 8 to 32 ton/day at each site

Project examples

Cluster 8-
Electrolyzer

Low pressure Storage

High pressure storage and dispensing
Potential large scale energy storage project in Fredericia, Denmark

Project examples

Multi-value stream project in Denmark

- Potential project of ~20 MW electrolysis
- Renewable hydrogen for multiple purposes:
  - Replace fossil hydrogen used in refinery process
  - Energy storage and power generation
  - Hydrogen used for transportation purposes
- Other value streams:
  - Oxygen used locally within refinery
  - Heat used for city district heating
- Solution relevant for oil refineries across the globe

Shell oil refinery in Fredericia, Denmark
World’s largest power-to-gas project planned for France

Project examples

700 MW electrolyser plant for power-to-gas in Northern France

- H2V PRODUCT (FR) will inject hydrogen into natural gas grid in France
  - In dialogue with French government on incentive scheme to realise the project
- Largest power-to-gas project in history
  - Planned capacity: 700 MW, starting with 200 MW
  - Direct injection of hydrogen and biogas in natural gas grid
- Design is ready & land secured
- Project phase during 2018 – 2025
- Location: Les Hauts and Normandie-regions in France
How to maintain a leading cost position
Evaluating significant capacity increase to maintain leading cost position

How to maintain leading cost position

Scaling up production capacity puts Nel in first-mover/pole position for next growth cycle

- Evaluating up to 10x capacity increase
  - First phase from 25 to 40 MW completed
  - Currently evaluating expansion into nearby building to expand capacity further
- Full production capacity ramp-up reduces production cost by >30%
Number one by nature