Herøya opening
April 20, 2022
Positioning Nel for the industry take-off

ANDERS SØRENG
CHIEF TECHNOLOGY OFFICER
Hydrogen will play an important role in the world’s transition to green energy solutions
$1.5/kg

Nel green hydrogen cost target by 2025

Assumptions: Nel analysis based on electricity of $20/MWh, >8% cost of capital, cost of land, civil works, installation, commissioning, building water etc., lifetime 20 years incl. O&M cost, at 30 bar
Enablers for success

Organizational development

Never compromise on safety

Technology strategy driving industry leadership
Enablers for success

The Nel Business System

- Technology and processes
- People
- Continuous improvements and stability
- HSE, quality and ethics
- NBS principles
- Nel values

Simplicity is key

Customer satisfaction
Green transition

We do what we say

Better every day

Organizational development
Enablers for success

Nel safety culture

Never compromise on safety

Commitment

Product safety

Workplace safety

Stakeholder safety

Compliance
Enablers for success

Nel technology strategy

- Ensure world-class organization and facilities
- Develop modular designs for large-scale deployment
- Further enhance bankability
- Further reduce product TCO
- Timely introduce technologies with predictable performance and lifetimes
Enablers for success

Investing in technology

- ALKALINE ELECTROLYSERS
- PEM ELECTROLYSERS
- HYDROGEN FUELING

- 200 engineers
- 10-20% R&D net investment/turnover

R&D investment to follow industry development

R&D investment to follow industry development

People

Activities

Infrastructure
Aligning with industry and customer expectations

ENABLERS FOR SUCCESS

- Increase in manufacturing capacity
- Current products - Improved quality and cost
- Current products – Large scale system optimization
- New products – Step-change in cost and performance
- Meeting market and customer requirements

Strategy, market and customer input
NEL’S HISTORY WITHIN WATER ELECTROLYSIS

....unmatched!

1930-1990's

World’s two largest hydrogen production plants

2022

World’s largest electrolyser equipment production plant

2022 →

• Further development of Nel’s workhorse
• Among industry lowest TCO
• Based on past and present knowledge and capabilities
Further product development – improving efficiency and capacity of cell stack

Targeting CAPEX and OPEX reductions beyond original roadmap in current manufacturing line

**CURRENT PRODUCTS – IMPROVED QUALITY AND COST**

- **Electrode design**
- **Stack design**

For illustration only

TCO $/kg

- **Current Herøya**: 4-5MW
- **Future Herøya**: 8-10MW
High volume production and product standardization reducing *system* cost to enable $1.5/kg
Building blocks that enable scalable solutions to meet customers’ need for larger hydrogen production plants

- Completed design for 800 MW green hydrogen plant
- 200 MW building blocks
- Safety in design
- Consolidated balance of plant elements to optimize CAPEX
- Realizing synergies to reduce cost
- Nel is the only company with a large-scale track record
  - Bankable, proven technology with performance guarantees
CURRENT PRODUCTS – IMPROVED QUALITY AND COST

Safe, cost-efficient and hassle-free installation

- Pre-assembled pipes, stacks and separators - ensures hassle-free installation in a safer and more efficient way
- Reduces time and cost for customers
- Produced by pre-qualified contract manufacturing partners
CURRENT PRODUCTS – IMPROVED QUALITY AND COST

Safe, cost-efficient and hassle-free installation

• Develop skids for easy transportation
• Easy to unload
• Easy to assemble
• Fully automated stack assembly at Herøya from 2023
• Ensures scalability from 20 to 800 MW plants and beyond

For illustration only
Our products

- High-volume production
- Low-cost solution
- Safe product design
...and now some new stuff

....unique pressurized alkaline electrolyser technology

.....targeting market optimization with both atmospheric and pressurized alkaline technologies
Unique electrolyser design optimised for safe operations, energy efficiency and cost

Unique design targeting the lowest TCO

- Developed for off-grid connection to renewables
- 10-15 bar system output pressure
- Min. 5 MW optimized skid solution fits inside 20 ft. open frame
- Skid-based design for flexibility - scope of supply and plant scalability
- World-class efficiency performance
- Designed for automated manufacturing and low-cost supply chain
- Outdoor classification, no building required
- Thermally insulated to minimise heat loss
- Bankable
“We unlock the potential of renewables and enable global decarbonization”

Nel is on its way to pursue $1.5/kg target in 2025

Nel is positioned to deliver among lowest cost products today

More fun to come!
HERØYA OPENING

Factory tour
Pre-Treatment

Gamechanger event
Pre-Treatment

- Cathode Texturizing
- Surface Treatment
- Nickel plating cathode
- Chemical activation
- Nickel plating support plate & anode
- Chemical activation
- Assembly
- Inspection and packing
Pre-Treatment

Treatment of 3 parts before chemical line:

1) Separation/carrying plate
2) Two x electrode plates for anode
3) Two x electrode plates for cathode
GAME CHANGER – FULLY AUTOMATED

Fully automated line

• High volume
• High repeatability & quality
• Low overall cost including manpower
• Low maintenance
• Simple and green process method
Nel Business System

Customer satisfaction
Green transition

Technology and processes
People
Continuous improvements and stability

HSE, quality and ethics
Nel principles
Nel values
Quality control

**Raw material**
- Inspects all deliveries
- Supplier work on their improvements
- Good quality from supplier needed to make good end product

**Process**
- All key parameters monitored and controlled
- Actions taken before outside specs
- Good process gives good output

**Treated product**
- Quality is controlled even with good material and process
- Using statistics for analysis of process
- Linked to end product quality for continuous improvements
Chemical line

GAME CHANGER – FULLY AUTOMATED

Cathode → Texturizing → Surface Treatment → Nickel plating cathode → Chemical activation → Assembly → Inspection and packing

Support plate → Nickel plating support plate & anode → Chemical activation → Assembly

Anode
Chemical line functions

The two main functions of the chemical line:

- Nickel plating for corrosion resistance
- Catalytic loading for cell energy efficiency
Chemical line operation

Operation of the chemical line:

- Fully automatic process control
- All process steps can be optimized individually
- Fully automatic care of jigs/racks
- Daily cross-functional monitoring meetings
In Control, Capable and Maintained methodology (ICCM)

Methodology:
- Process understanding
- Process viewpoint – Focus on leading indicators
- Statistical Process Control (SPC)

Outgoing Quality Control:
- Mechanical properties
- Electro-chemical properties
- Layer composition
Assembly and inspection

Gamechanger event
Assembly and inspection packing station

GAME CHANGER – FULLY AUTOMATED
Assembly station

- Significantly improving the HSE for the operator
- High repeatability and quality
- Process control includes torque, rotation and time
- Each electrode has a unique serial number
- Full traceability of all material used and all process parameters
Final Inspection Station

- 4 Inspection stations for manual inspection
- Data from assembly station shown visually
- Final visual inspection of surfaces
- >95% of electrodes approved in final inspection
- Nel Business System utilisation
Unlocking the potential of renewables with Nel’s PEM technology

Filip Smeets
SVP Electrolyser
Manufacturing facility in Wallingford

- Nel has the longest track record in PEM electrolysis with over 25 years of experience
- Originally the PEM units were developed for respiratory oxygen in submarines. Hence our focus on reliability
- Nel PEM skill center is based in the US with an R&D and manufacturing facility in Wallingford, CT.
**HOW PEM UNLOCKS THE POTENTIAL OF RENEWABLES**

**Unique qualities**

<table>
<thead>
<tr>
<th>ALKALINE ELECTROLYSERS</th>
<th>PEM ELECTROLYSERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atmospheric alkaline</strong></td>
<td><strong>Advanced alkaline</strong></td>
</tr>
<tr>
<td>Low cost</td>
<td>Dynamic response</td>
</tr>
<tr>
<td>High efficiency</td>
<td>Intermittent operation</td>
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- Both Alkaline and PEM have unique features, some of the most important strengths of the PEM-technology are:
  - **Fast response time**
  - **Operating flexibility** ideal for pairing up with intermittent renewable power sources
  - **Very small footprint** (size)
Green hydrogen from intermittent power sources

• The PEM platform is perfect for production of green hydrogen from intermittent power sources such as wind and solar

• Ideal for sites where you have little space, such as existing industrial estates, hydrogen refueling stations or for off-shore hydrogen production
HOW PEM UNLOCKS THE POTENTIAL OF RENEWABLES

PosHYdon – Green Hydrogen on offshore installation

- Innovative pilot project 13 kilometer off the coast of Scheveningen, NL
- Green hydrogen to be produced offshore on operational platform
- Investigating the practical aspects of energy systems at sea and producing hydrogen in an offshore environment
Large scale green hydrogen production from offshore floating wind

- To produce large-scale ‘green’ hydrogen from offshore floating wind
- To integrate electrolysis and wind turbine on moored floating sub-structure
- Around 80% of the world’s offshore wind resource potential is in waters deeper than 60 meters
- Concept developed by ERM
Industrializing our PEM platform

• Scaling up and automation will drive down cost
• Reducing overall material usage
• Reducing dependence on exotic materials such as iridium and platinum
Fueling the green transition

Robert Borin
SVP Nel Fueling
OUR AMBITION – FOSSIL PARITY

Make it as easy and to the same price, to fill up a fuel cell electric vehicle compared to vehicles running on petrol or diesel – and, provide comparable driving range
The advantages of hydrogen

<table>
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<tr>
<th>No emissions</th>
<th>Long driving range</th>
<th>Fueling time</th>
<th>Land requirements</th>
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<td>An obvious prerequisite for all modern vehicles, making all fossil fueled vehicles obsolete.</td>
<td>A well-functioning truck must be able to drive 1500 km on one tank.</td>
<td>Where the battery electric vehicle can not compete with a traditional fossil fueled vehicle on charging time, the fuel cell electric vehicle can.</td>
<td>Charging of battery electric vehicles require 15 times more land area than fueling hydrogen vehicles.</td>
</tr>
</tbody>
</table>

*Due to parking need during long charging times.*
The green transition is a reality
So, what does it take?

• User convenience
• Fast fueling
  • HD – less than 12 minutes
  • LD – less than 3 minutes
• Higher volumes
  • HD – more than 80 kg
  • LD – 5 to 10 kg
• Competitive Total Cost of Ownership (LCoH)
• Fossil parity uptime and reliability
HYDROGEN MOBILITY – THE FUTURE

This is only the beginning!
number one by nature