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UNECE Meeting

Electrolysers- unlocking the potential  
for renewable energy

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# Leading pure play hydrogen technology company with a global footprint



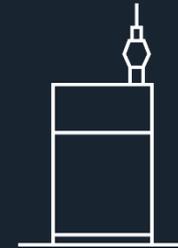
Pure play hydrogen technology company listed on Oslo Stock Exchange (NEL.OSE)



Manufacturing facilities in Norway, Denmark, and U.S., and a global sales network

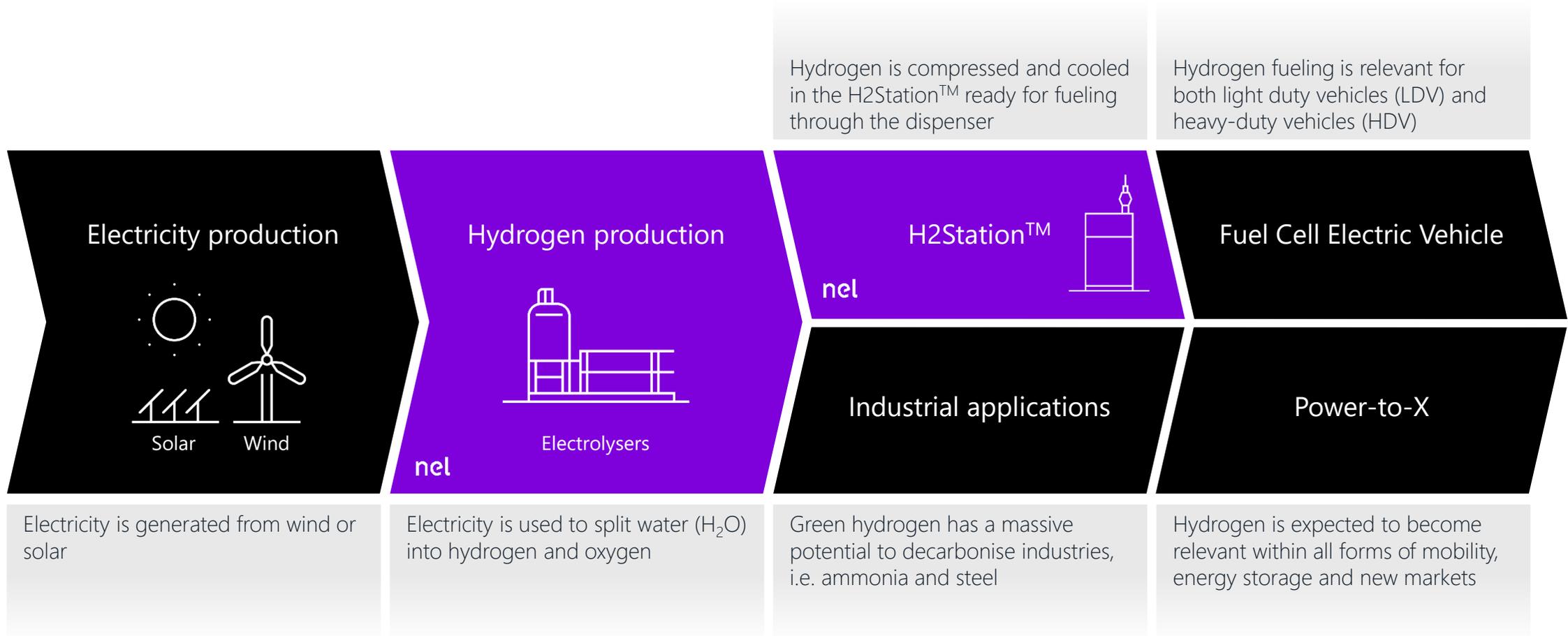


World's largest electrolyser manufacturer, with >3,500 units delivered in 80+ countries since 1927



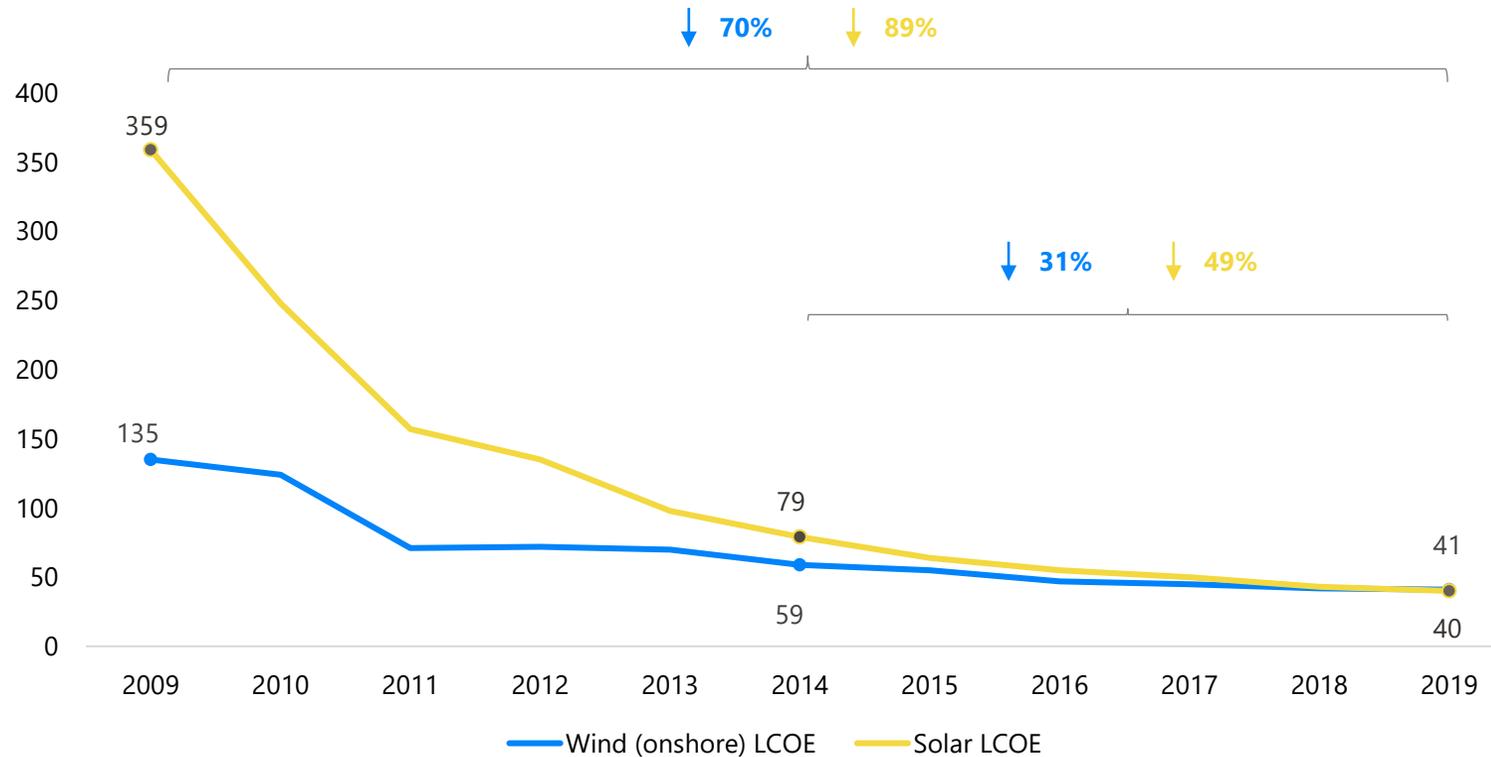
Leading manufacturer of hydrogen fueling stations, with 110+ H2Station™ solutions delivered/in progress to 13 countries

# Green hydrogen approaching fossil parity – game-changer across applications and markets



# Cost of wind and solar dropping significantly – green hydrogen to follow

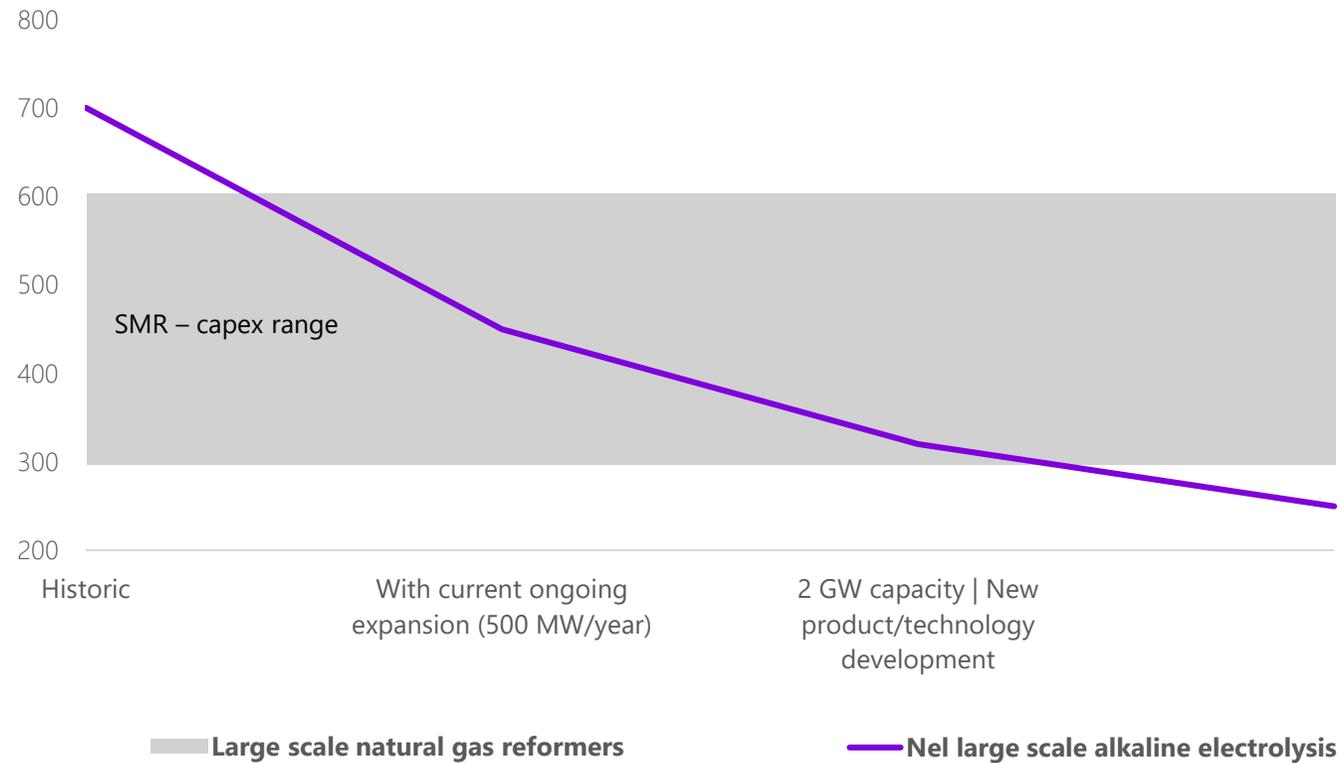
Global average cost USD  
Unsubsidised levelized cost of energy (\$/MWh)<sup>2</sup>



- With falling LCOE<sup>1</sup> of wind and solar prices, renewable hydrogen follows the same path, as electrical power constitutes 70-80% of hydrogen’s total cost
- Record low auction prices for solar PV and wind – prices as low as \$13.5/MWh and \$17.86/MWh respectively<sup>3,4</sup>
- Prices expected to drop further, LCOE of solar PV and onshore wind expected to fall by 71% and 58% respectively<sup>5</sup>
- Renewable hydrogen competitive with fossil fuels at \$50/MWh – competitive in most markets at \$30/MWh

# Growth in renewable hydrogen will accelerate with reduced capex for electrolyzers

Capex of steam methane reformers (SMR) vs. Nel's alkaline electrolyzers  
\$/kW



- Steam methane reforming (SMR) dominates hydrogen production using natural gas and steam
- Nel establishing new manufacturing plant targeting >40% cost reduction – further capex reduction expected due to increased production volume and further size scaling
- Nel targets capex to drop below SMR over time
- Electrolysis expected to be preferred production method if opex (i.e. power prices) is low enough, or at parity, with alternative production methods

# Game-changing expansion at Herøya - on time and on budget



Fully automated and designed according to **lean manufacturing and industry 4.0 principles**



Industrial scale production of most efficient electrolyzers in the market, at a **game-changing cost**



Large scale production line, name plate capacity of **more than 500 MW**



Room to expand to **~2 GW** annually



CO<sub>2</sub> reduction potential in line 1 (pilot) of **1.000,000 tonnes** – with 2 GW, **4-5 million tonnes**



Production for **Nikola and Everfuel** will commence in Q4



# Supplying electrolysers to HYBRIT, the fossil-free steel project in Sweden

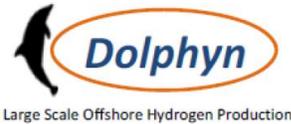
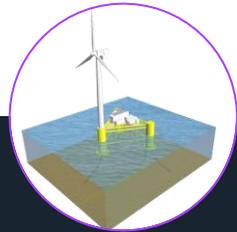


Supplying electrolysers to the currently most advanced fossil-free steel project

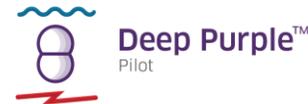
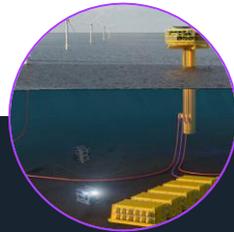
- Nel has received a purchase order for a 4.5 MW alkaline electrolyser which will be used in a pilot plant for fossil free steel production
- Hybrit Development AB (HYBRIT) is a joint venture owned equally by SSAB, LKAB and Vattenfall
- The steel industry accounts for 7% of global and 10% of Swedish CO<sub>2</sub>-emissions
- Pilot plant will operate in Luleå, Sweden from 2021 – 2024, with target of full-scale implementation by 2035

## PROJECT EXAMPLES

# Nel at the forefront of developing solutions for hydrogen production from offshore wind - a potential next step towards hydrogen production at scale



- Production of green hydrogen at floating offshore wind installations
- Project has potential to supply energy to heat more than 1.5 million homes
- Assessment underway for application of a PEM electrolyser from Nel
- Other partners are ERM and Doosan Babcock amongst others
- Funding obtained through the UK Government "Hydrogen Supply Programme"



- Production of green hydrogen offshore combined with subsea storage
- Demonstrate opportunity for stable energy production and supply off-grid, i.e. remote islands, offshore installations
- Consortium is led by Technip FMC and consists of Vattenfall, Repsol, Nel, DNV, SINTEF amongst others
- Funding obtained through Innovation Norway



- Production of green hydrogen from demineralized seawater and offshore wind. Mixed with natural gas to be transported to shore via existing gas pipelines
- Nel to provide 1.25MW containerized PEM electrolyser to pilot project
- Consortium partners include TNO, Neptune Energy, Nel, Gasunie, Noordgastransport amongst others
- Funding obtained through Dutch Government DEI+ scheme

## The Fit for 55 Package manifests Europe's leadership in green hydrogen

- 3000-page report – hydrogen mentioned ~1000 times
- By 2030, half the fossil hydrogen in industry will have to be replaced with renewable hydrogen
- Roll-out of hydrogen fueling stations, minimum one station available every 150km along the Trans-European Transport Network and in every urban node
- EU ETS proposal to include the production of renewable hydrogen under EU emissions trading scheme (eligible for free allowances)

The proposals will be discussed in the European Council's working parties before engaging with the European Parliament for a final adoption of each legislative act



# Delegated Act on Renewable Energy Directive

- We need more renewables!
- One of the greatest challenges to our industry. We need a framework for additionality that is 'workable'.
- Timeline to adopt delegated act: by end of 2021 (indicative).
- Challenges that need to be overcome:
  - The responsibility to prove additionality is currently put on the hydrogen producer.
    - Member States need to do more via National Energy and Climate Plans to account for additional renewable energy. Commission should consider proposing that Member States develop hydrogen outlooks and relevant scenario planning.
    - PPA's can be used to prove additionality.
  - Timing issues:
    - New renewable energy installations can take longer to build than electrolyzers.
    - The leaked delegated act refers to a 12-month period between the time that new renewable energy is made available and the time that it is consumed.
  - Currently no framework to create a business case for curtailed renewable electricity.
    - In 2021, €1,35 billion<sup>3</sup> of renewable electricity was curtailed and ultimately paid by the taxpayer.
  - The leaked delegated act refers to the need to prove the use of renewable electricity in 15-minute intervals.
    - There is currently no technological, practical and legal way of aligning hydrogen production and energy production within a 15-minute interval. In case such means become available, the associated OPEX will drive costs up significantly. Furthermore, the practical consequences for ramping up and down ELY production in tandem with the RES at such intervals may also lead to premature degradation, further increasing the CAPEX of the plant.

## Trans-European Networks for Energy (TEN-E) Regulation

- Annex II - Electrolyser Infrastructure Category
- European Commission proposes that only electrolysers that are at least 100MW should be eligible for EU funds. Council supports this position.
- European Parliament proposes at least 50MW that can be provided by a single electrolyser or by a set of electrolysers. Also 30MW electrolysers proposed for innovative midstream value chains (e.g. maritime routes via LOHC, liquid h<sub>2</sub> or ammonia).
- The largest electrolysers on the European continent today are of 20-25MW.
- Need to compromise between reality and being overly ambitious. Getting from 25MW to 100MW and into the GW will be a journey.

# Key Messages for Fit for 55 Package

- Maintain RFNBO targets in RED: 50% renewable hydrogen in industry and 2.6% sub-target in transport.
- Develop and uphold the principle of “energy system efficiency” along side the principle of energy efficiency first.
- Develop a workable and pragmatic framework for proving additionality.
- Member States should bear responsibility for providing additional renewable electricity (RE) capacity by setting dedicated RE targets to be used for RFNBO production.
- Ensure the existence of a framework to incentivise business cases for producing h2 from curtailed renewable electricity.
- Create a Trackable, Traceable, Tradeable, Transparent[1] & Trustworthy Guarantees of
- Origin (GO) system, with hydrogen as a distinct energy carrier separate from electricity and gas.
- Create a GO system to address international governance of hydrogen imports and exports.

number one by nature

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