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Nel Hydrogen:
Electrolyser Solutions for Large Scale Hydrogen Production

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VISION

Empowering generations with clean energy forever

MISSION

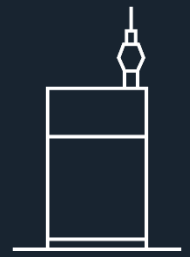
We deliver optimal solutions to produce, store, and distribute hydrogen from renewable energy

Nel Hydrogen: A well capitalized 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

Nel's place in the green hydrogen value chain…

Hydrogen is compressed and cooled in the H2Station™ ready for fueling through the dispenser

Hydrogen fueling is relevant for both light duty vehicles (LDV) and heavy-duty vehicles (HDV)

Electricity production

Electricity is generated from wind or solar

Hydrogen production

Electricity is used to split water (H_2O) into hydrogen and oxygen

H2Station™

Green hydrogen has a massive potential to decarbonise industries, i.e. ammonia and steel

Fuel Cell Electric Vehicle

Industrial applications

Power-to-X

Hydrogen is expected to become relevant within all forms of industry, energy storage, heating, energy export and new applications

Hydrogen technology solutions, commercialized and market ready…

Alkaline and PEM electrolysers

Converting water and electricity to hydrogen and oxygen – for **industry, mobility** and **energy purposes**

Compact hydrogen fueling station

World's most compact fueling stations, capable of **fueling any kind of vehicle** and simple to integrate with other fuels

Strong field know-how and manufacturing capacity “at scale”…

PEM electrolysers

Wallingford, CT USA

Systems delivered: **2,700+**

Production capacity: **>50 MW/year**

History: **25 years**

Alkaline electrolysers

Notodden/Herøya, Norway

Systems delivered: **800+**

Production capacity:
500 MW/year → > 2 GW/year

History: **94 years**

Hydrogen refueling stations

Herning, Denmark

Stations delivered: **110+**

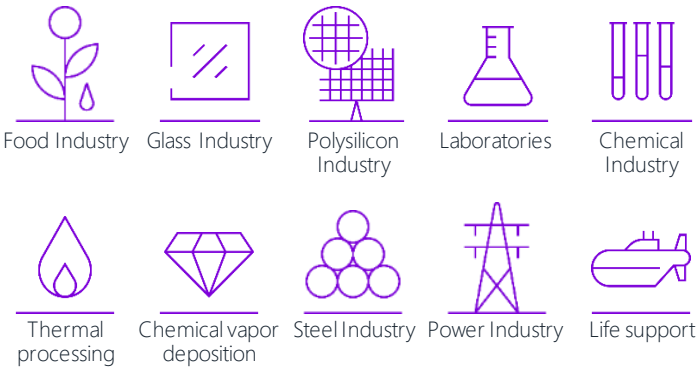
Production capacity: **300 HRS/year**

History: **16 years**

The hydrogen opportunity

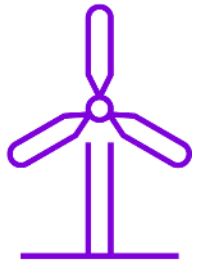
Hydrogen is expanding its areas of application

Industrial applications



- Niche industrial applications represents "traditional" hydrogen markets
- Steady demand for hydrogen

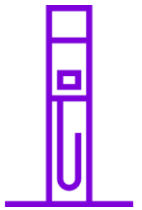
Power-to-X



Renewable hydrogen

- Decreasing cost of renewables and electrolysers is accelerating market
- Vast opportunities within existing & new sectors

Mobility



Transportation

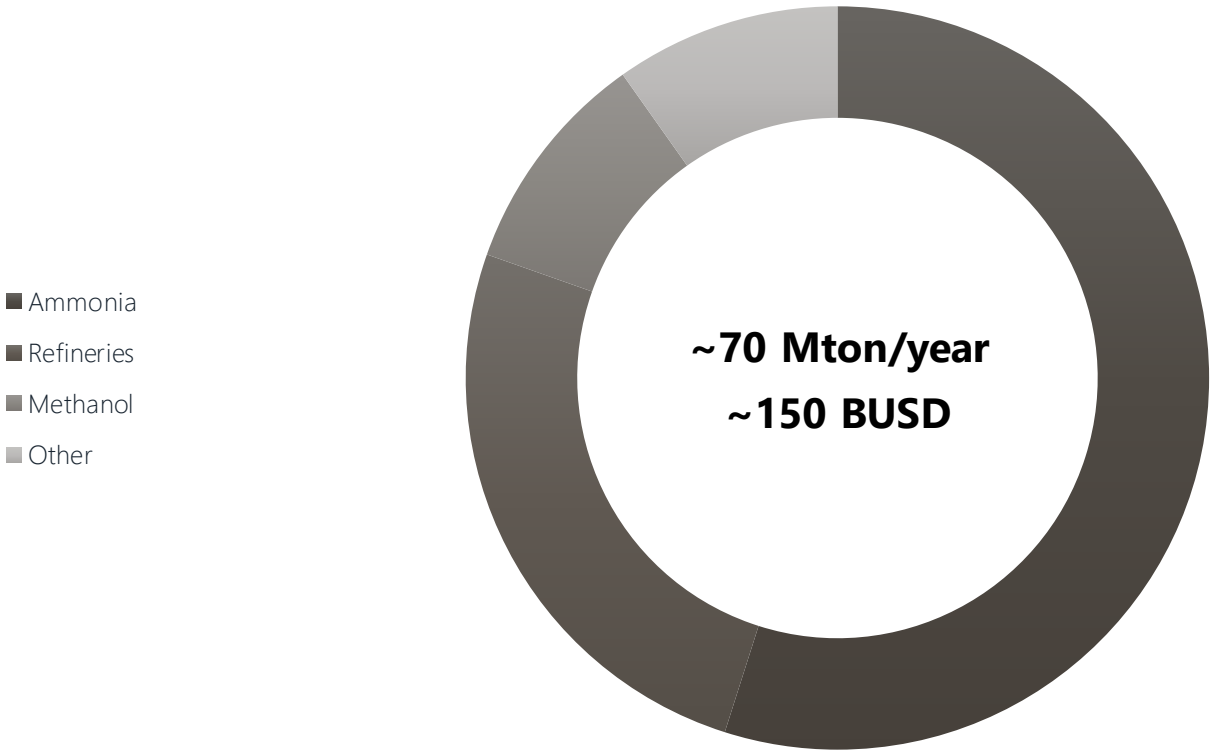
- Key market going forward – both within hydrogen production and fueling
- Heavy duty sector developing faster than anticipated – hydrogen now relevant fuel for all forms of mobility

Steady growing market

Markets expected to see fast growth going forward

Large opportunities for electrolysis within existing hydrogen market

Global hydrogen market by end use



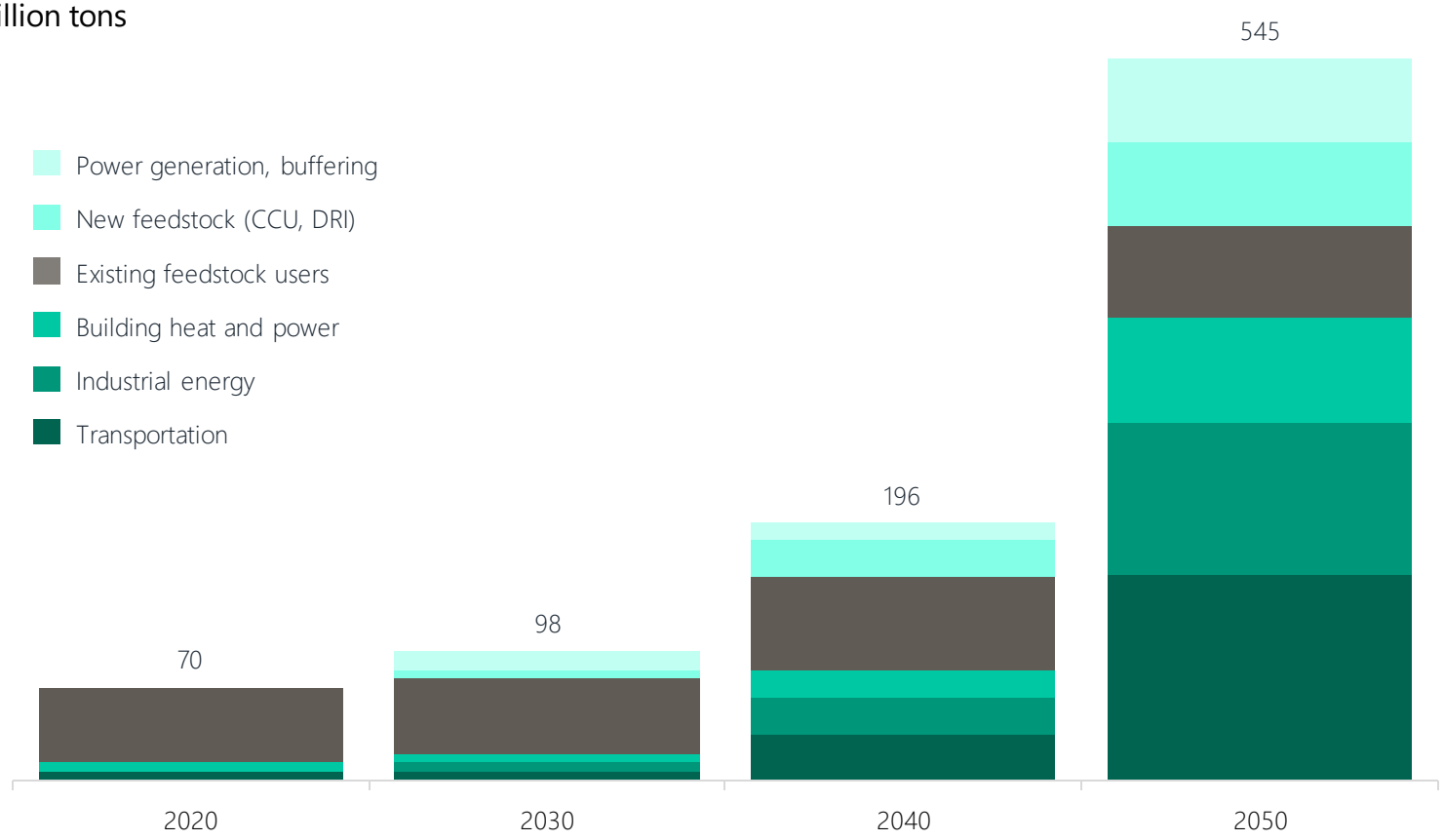
- Currently only 1% from water electrolysis
- Large growth potential driven by increasing focus on climate and renewable energy, decreasing both electricity prices and electrolyser capex
- Focus on renewable hydrogen for refineries and ammonia, accounting for ~80% of market
- Electrolysis set to take larger share of overall hydrogen market. Annual electrolyser market potential of >$20 billion/year within existing hydrogen market alone

Source: 2020 estimates by Hydrogen Council (2017)

Overall hydrogen market set to grow by 8x

Global energy demand supplied with hydrogen

Million tons



Growing hydrogen demand primarily driven by:

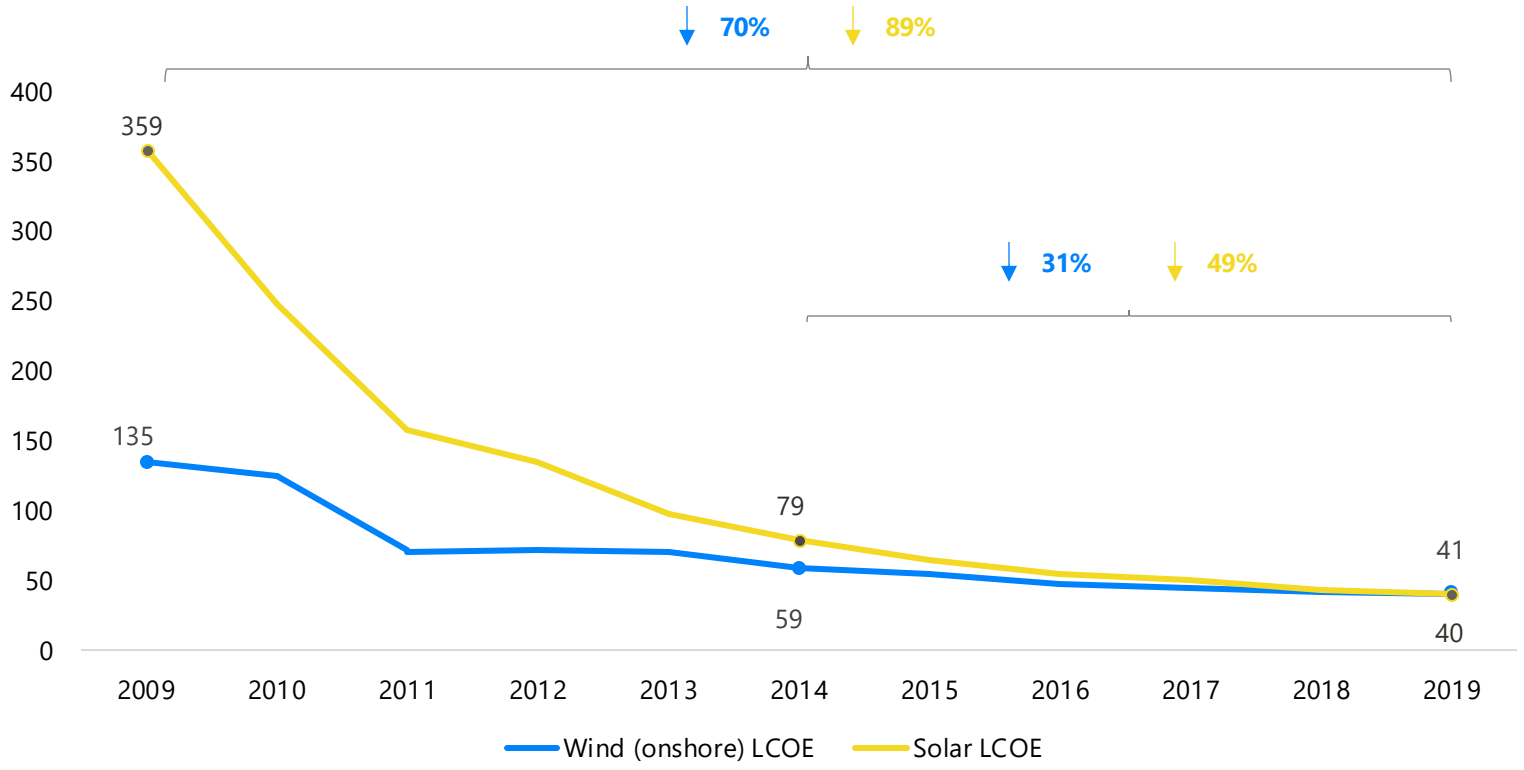
- Regulations to lower surplus demand for fuel
- Decreased crude quality – requires more hydrogen for processing
- Electrification of transport sector
- Move from coal to hydrogen for various industries
- As electrolysers start from a small base, this market potential will grow by >800x

Source: Hydrogen Council

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

Global average cost USD

Unsubsidised levelized cost of energy ($/MWh)[2]



- With falling LCOE[1] 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[3,4]
- Prices expected to drop further, LCOE of solar PV and onshore wind expected to fall by 71% and 58% respectively[5]
- Renewable hydrogen competitive with fossil fuels at $50/MWh – competitive in most markets at $30/MWh

Sources: [1] LCOE = Levelised cost of energy (total production cost of building and operating electricity-generating plant, [2] Lazard; Renewables Now, [3] PV magazine, [4] IRENA (International Renewable Energy Agency, [5] BloombergNEF New Energy Outlook 2018

1.5 $/kg

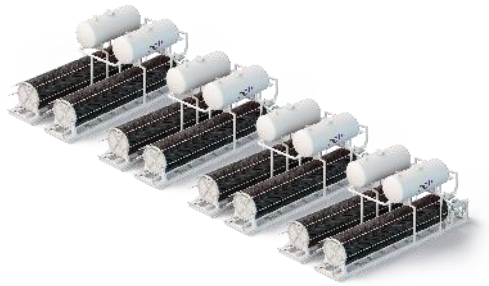
Nel green hydrogen cost target by 2025

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

Market drive towards large Nel alkaline plants

SOLAR WIND HYDRO

A485 (2.2 MW)



4.4 – 60 MW

100 MW – 2 GW
Nel alkaline target market segment

Market need **Medium term** **Long term**

ELECTRODE PRODUCTION AT HERØYA

Capacity expansion at Herøya

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

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

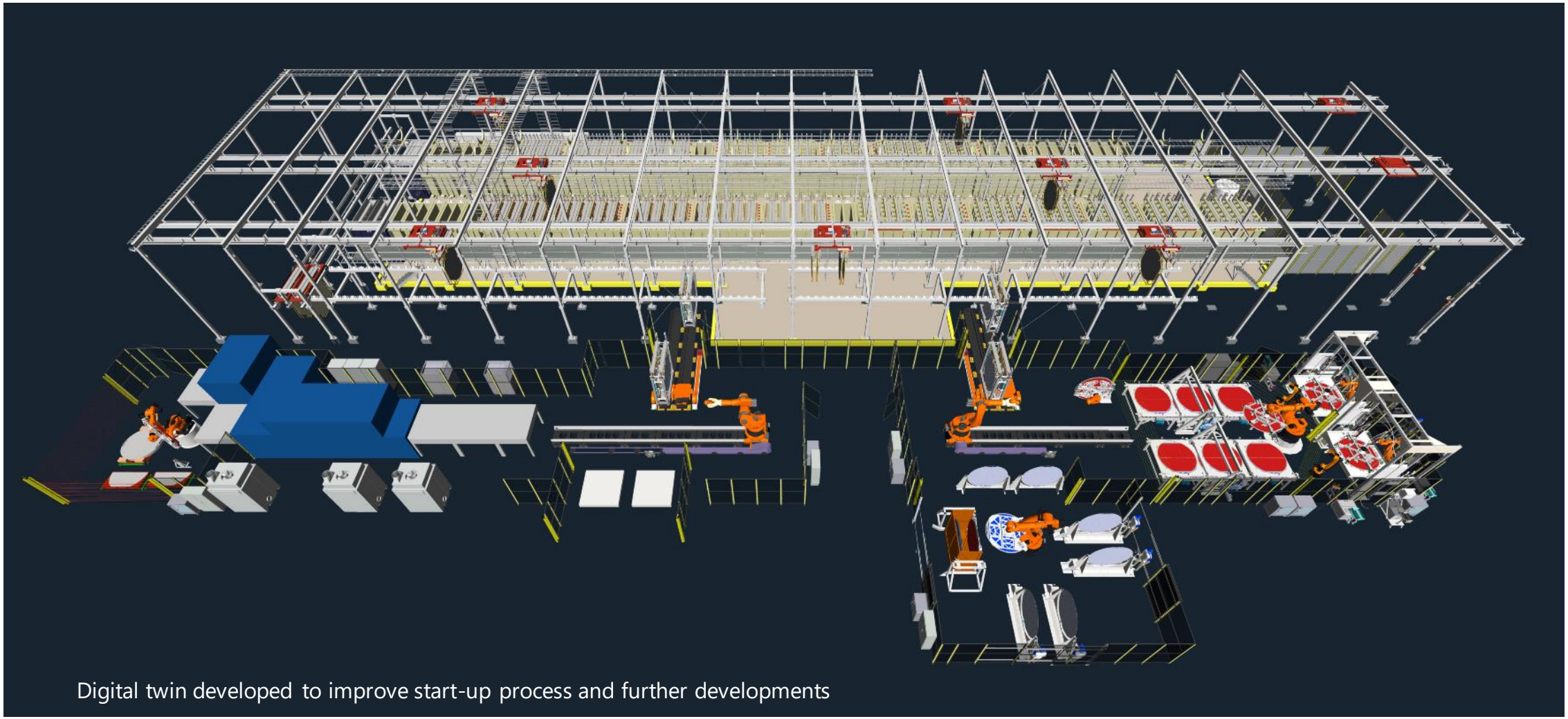
Large scale production line improvements identified, name plate capacity up **from ~360 to ~500 MW**

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

CO_2 reduction potential in line 1 (pilot) of **1.000,000 ton** – with 2 GW, **4-5 million ton**

Test production in new line **Q2'21**, start of ramp-up Q3'21

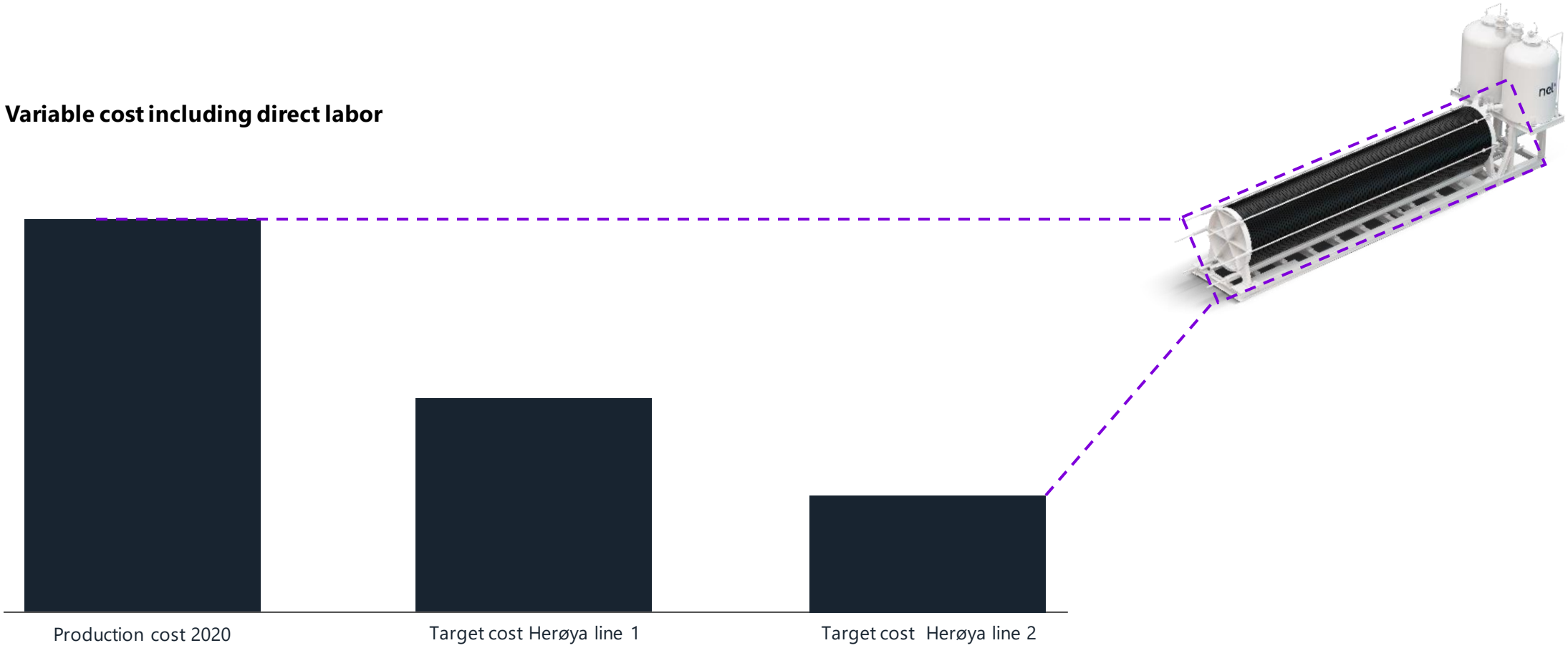
Production line 1 – fully automated



Digital twin developed to improve start-up process and further developments

New plant business case: reducing electrode cost

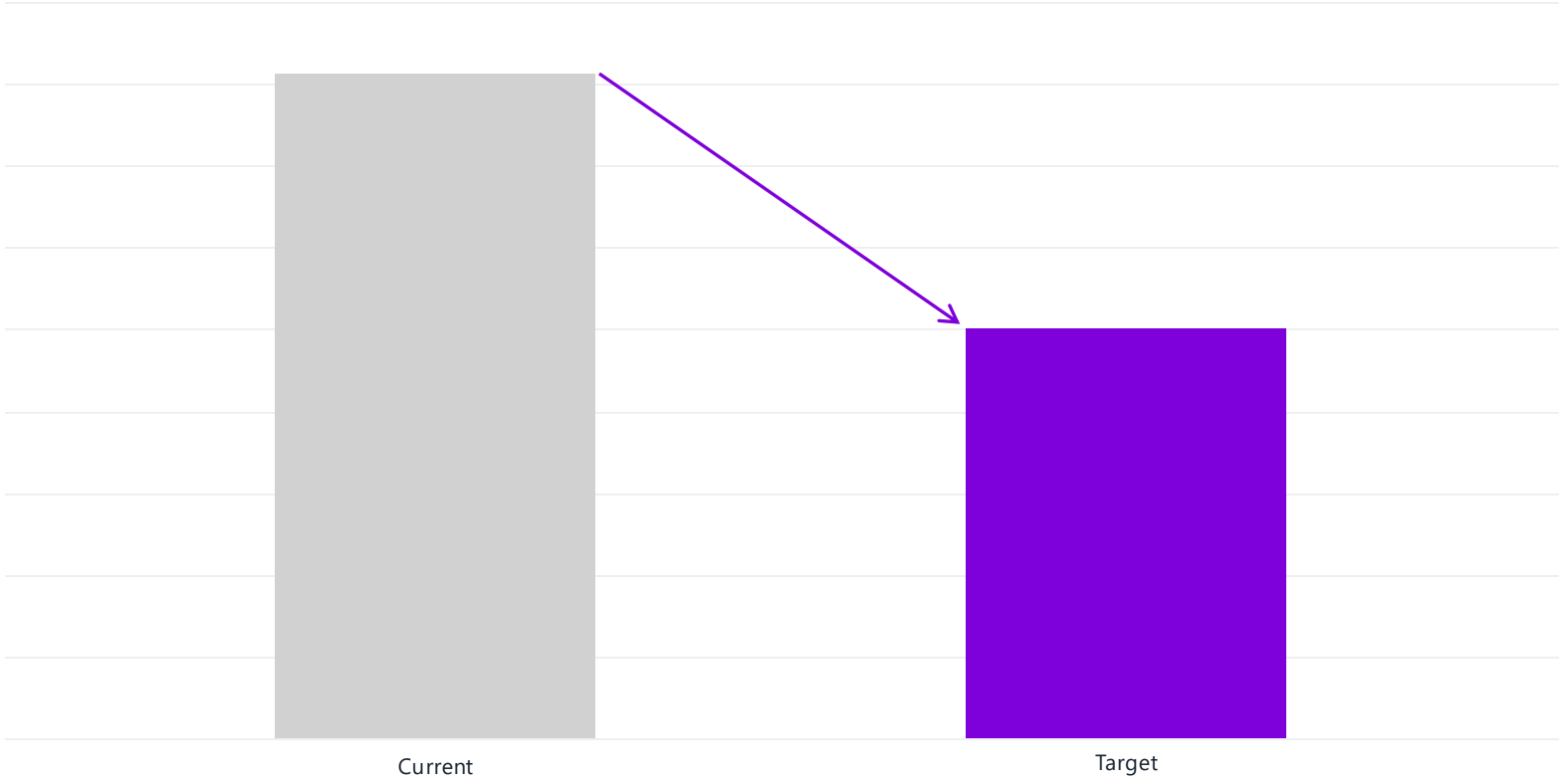
Variable cost including direct labor



The world's most efficient electrolyser becoming even more efficient

Roadmap to reduce energy consumption towards theoretical minimum

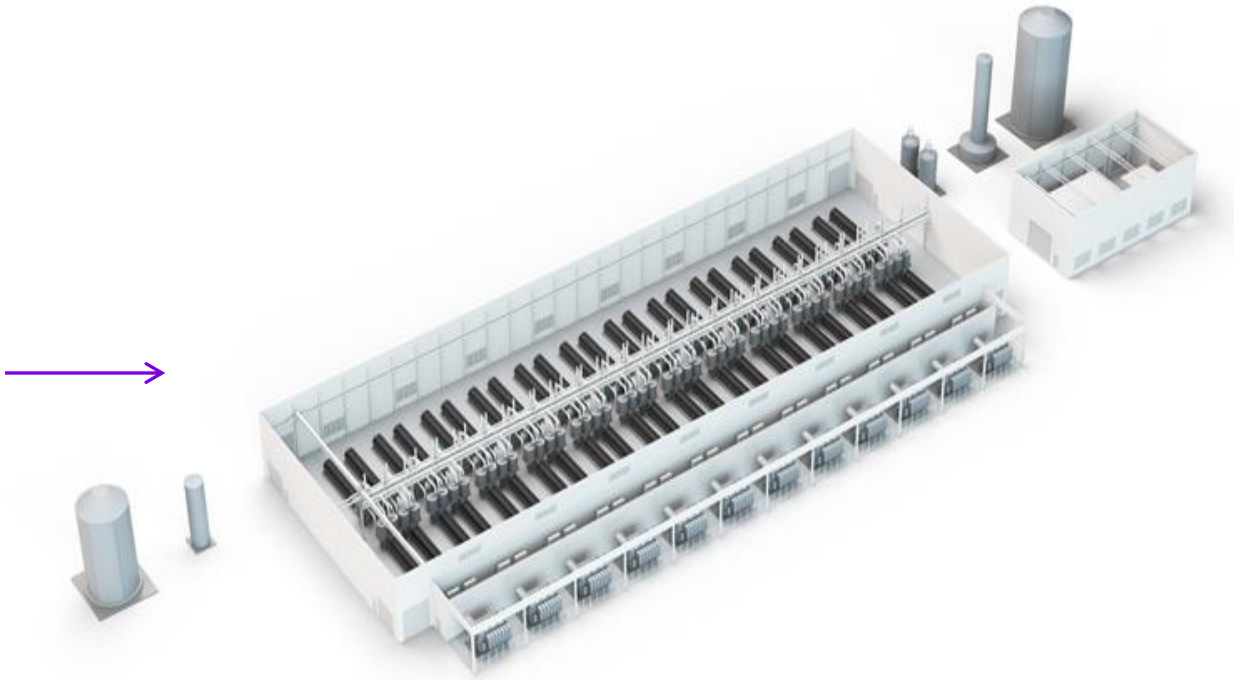
Energy consumption (kWh/Nm^3 H_2)



Main enablers in product and manufacturing process will reduce specific energy consumption by 5 to 10 pct.

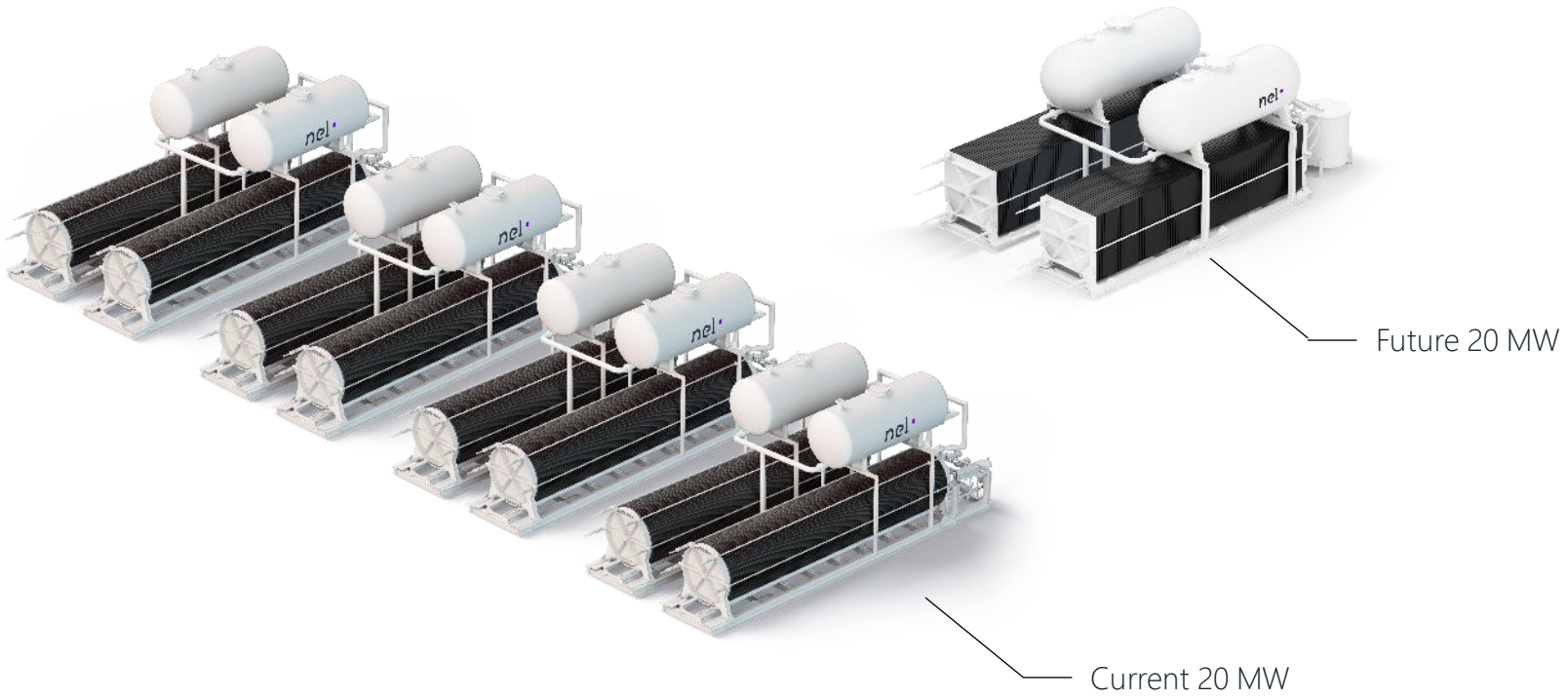
- Zero gap electrodes
- Surface treatment / texturing
- Reduced production variation

Long experience with large-scale renewable energy plants as foundation to design new standard plants



Further product development – improving efficiency and capacity of cell stack

Current vs. future 20 MW cell stacks



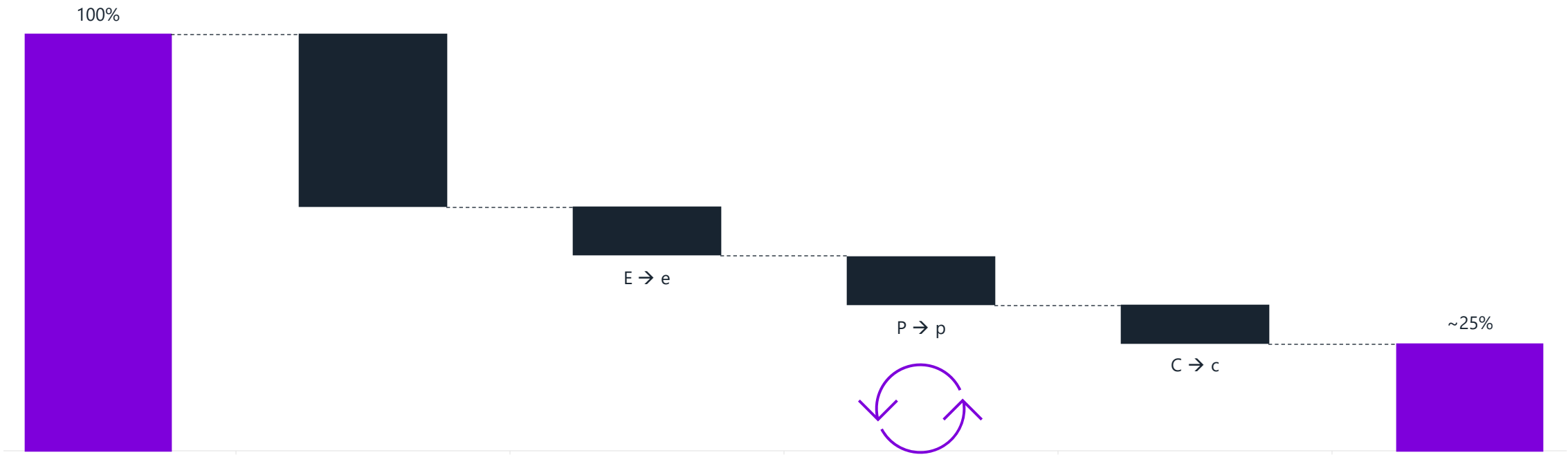
Enablers:

- Electrode size and form improvement
- Increase active electrode area
- Increase current density

Balance of plant on existing platform compatible with future

Scaling technology for a 10X market

Standardization reducing system cost to enable $1.5/kg



Electrolyer system cost today
Excludes Civil/Building

Herøya expansion
Increased capacity with Herøya expansion

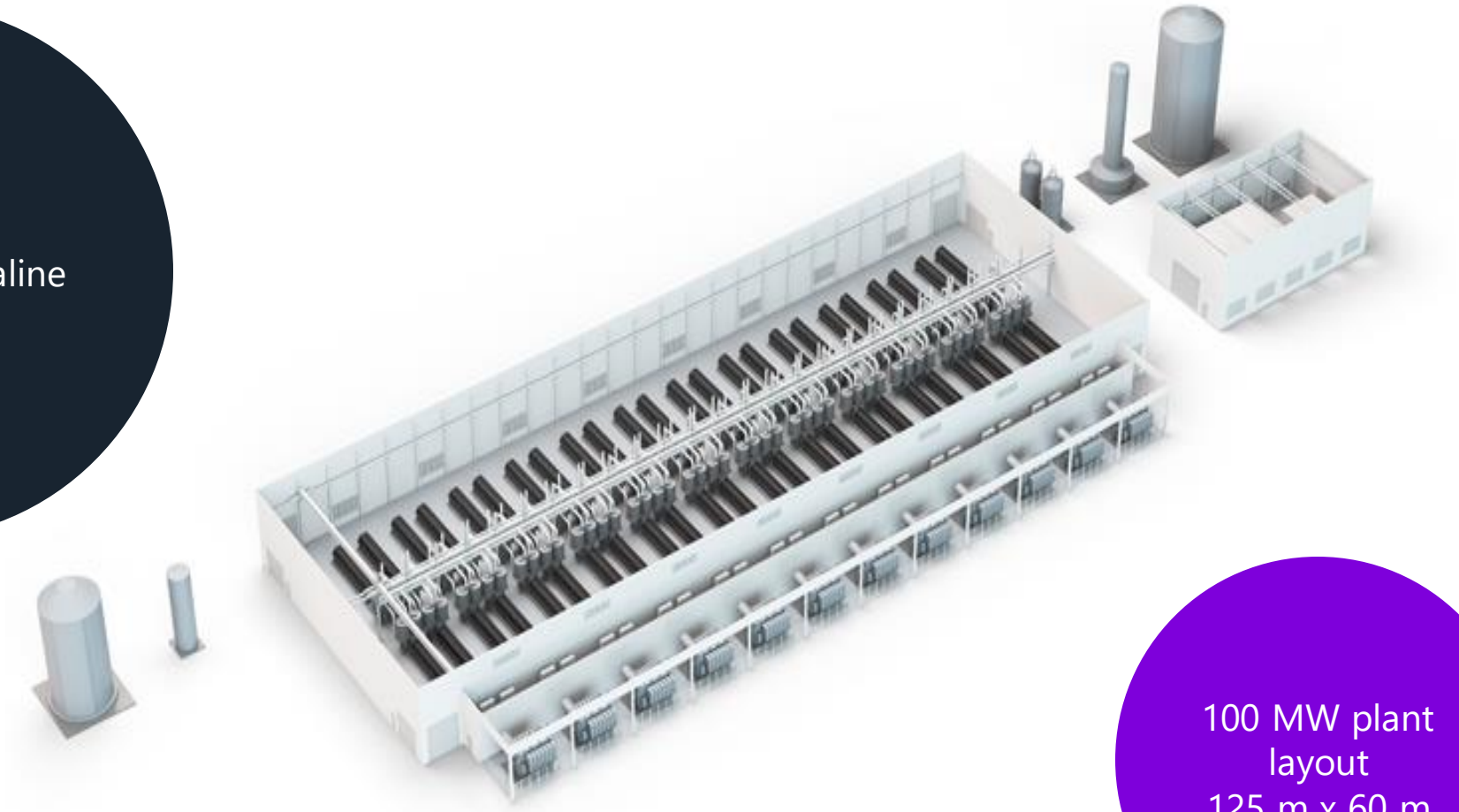
Engineering
Standardizing large-scale offerings: 20 MW, 50 MW, 100 MW, 250 MW

Procurement
Continuous improvement of supply chains and framework agreements

Construction
Standardised design and pre-fabricated skids reduce time and cost for commissioning and installation

Reduced cost

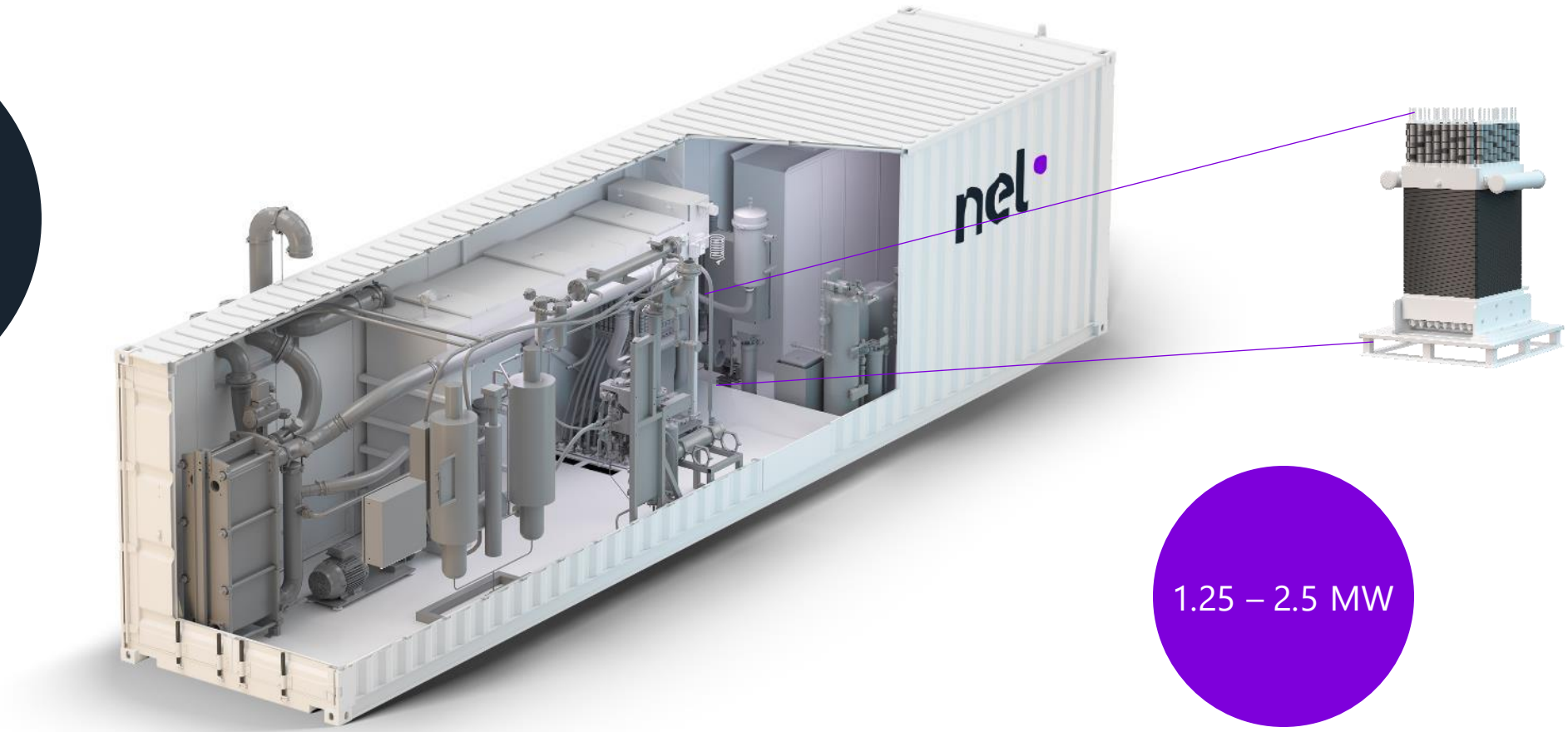
Large-scale alkaline



100 MW plant layout
125 m x 60 m

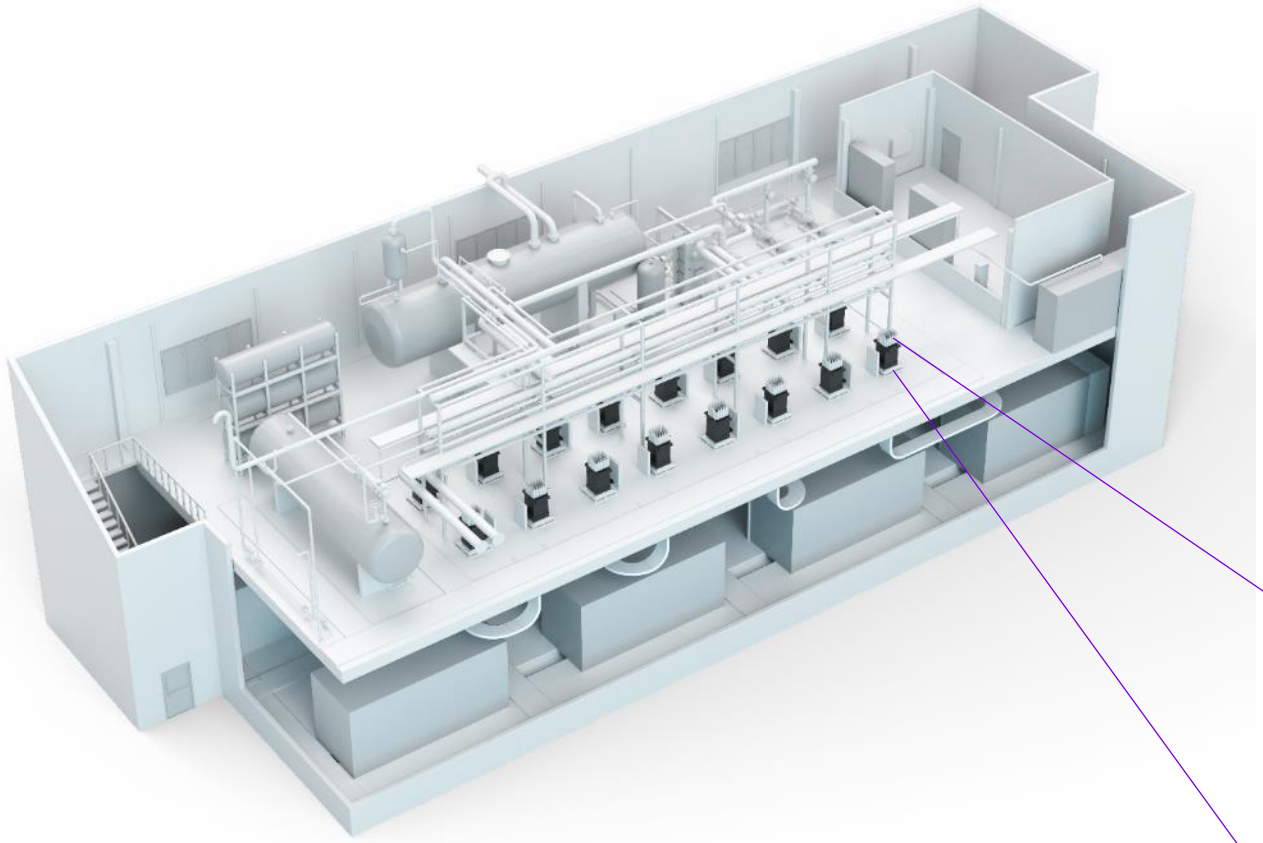
New containerized large-scale PEM electrolysers – MC250 and MC500 Automated MW-class on-site hydrogen generators

Process Container



1.25 – 2.5 MW

New PEM electrolyser launched including new stack

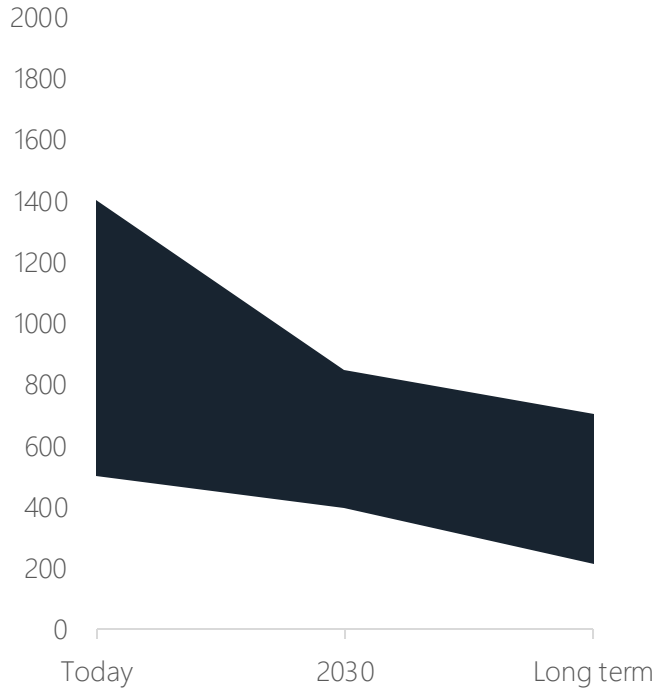


Large-scale PEM

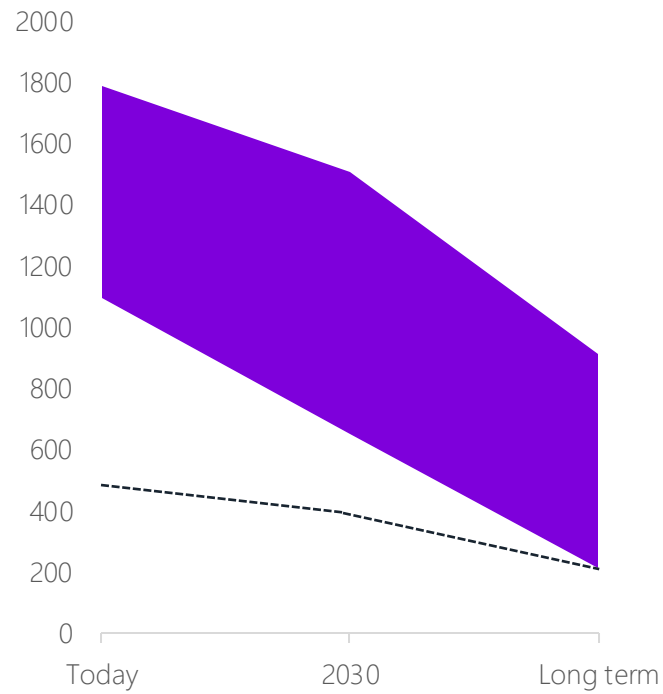
20 MW plant layout
35 m x 15 m

Electrolyser capex evolution

AE CAPEX Evolution
(2010-2030, $ per kW)



PEM CAPEX Evolution
(2010-2030, $ per kW)



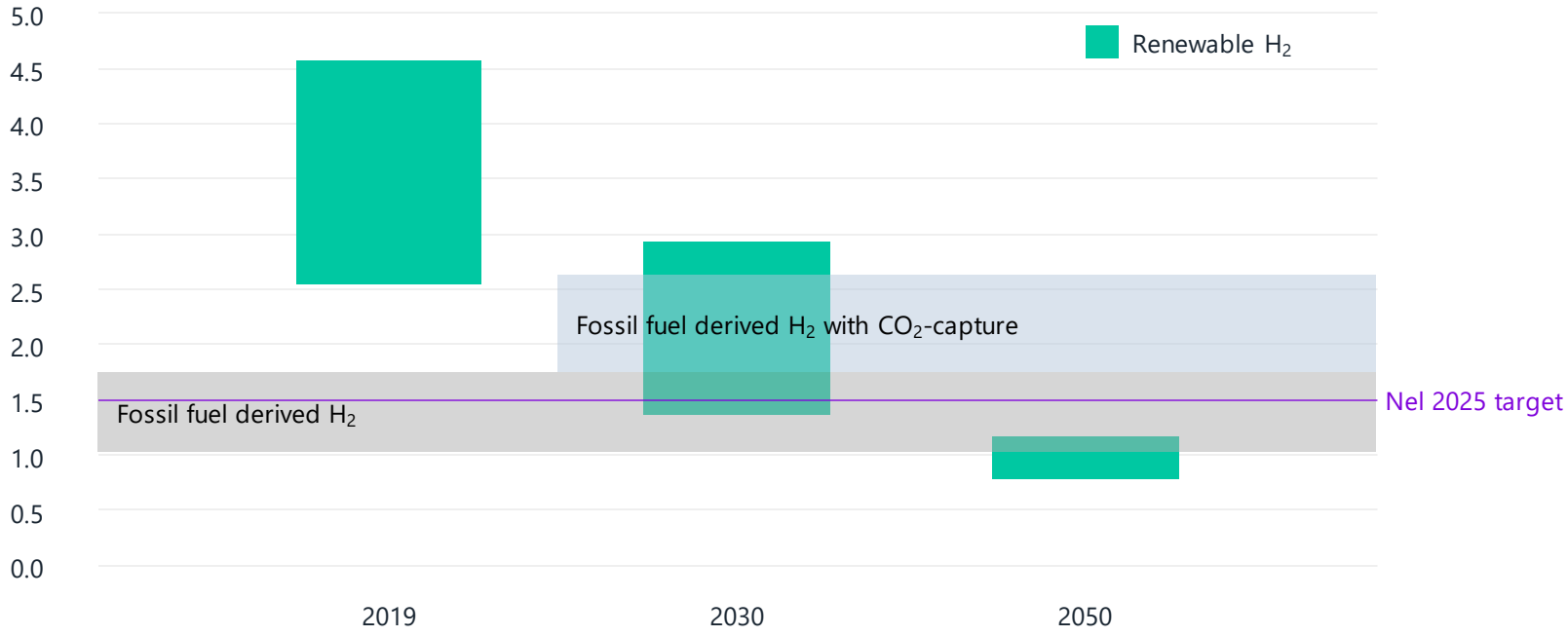
- Capex for electrolyser expected to dramatically decrease by 2030
- PEM trailing alkaline earlier years
- Both converging towards 300$/kW by the end of decade

Sources: IEA

Renewable/green hydrogen is on a trajectory to outcompete grey and blue hydrogen

Forecast global range of levelized cost of hydrogen/TCO production from large projects

2019 $/kg



- Green hydrogen cost expected to decline and close gap with fossil sources by 2030
- IEA expects cost parity by 2030 – Nel expects to reach this target by 2025
- Focus on reduction of capex, increase lifetime, improve efficiency, increasing current density, lowering catalyst, and scaling up system components

Source: BloombergNEF & IEA / conversations with oil & gas majors

number one by nature