THE ROLE OF HYDROGEN IN GETTING TO NET ZERO

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Shell Plc

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Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, Shell's operating plans, outlooks, budgets and pricing assumptions do not reflect our net-zero emissions target. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans, outlooks, budgets and pricing assumptions to reflect this movement.

Also, in this presentation we may refer to Shell's "Net Carbon Footprint", which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions. The use of the term Shell's "Net Carbon Footprint" is for convenience only and not intended to suggest these emissions are those of Shell or its subsidiaries.

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OUR **PURPOSE**

To power progress together by providing more and cleaner energy solutions

GENERATING **SHAREHOLDER VALUE**

Growing value through a dynamic portfolio and disciplined capital allocation

RESPECTING **NATURE**

Protecting the environment, reducing waste and making a positive contribution to biodiversity

POWERING **PROGRESS**

Our strategy to accelerate the transition to net-zero emissions, purposefully and profitably

POWERING **LIVES**

Powering lives through our products and activities, and by supporting an inclusive society

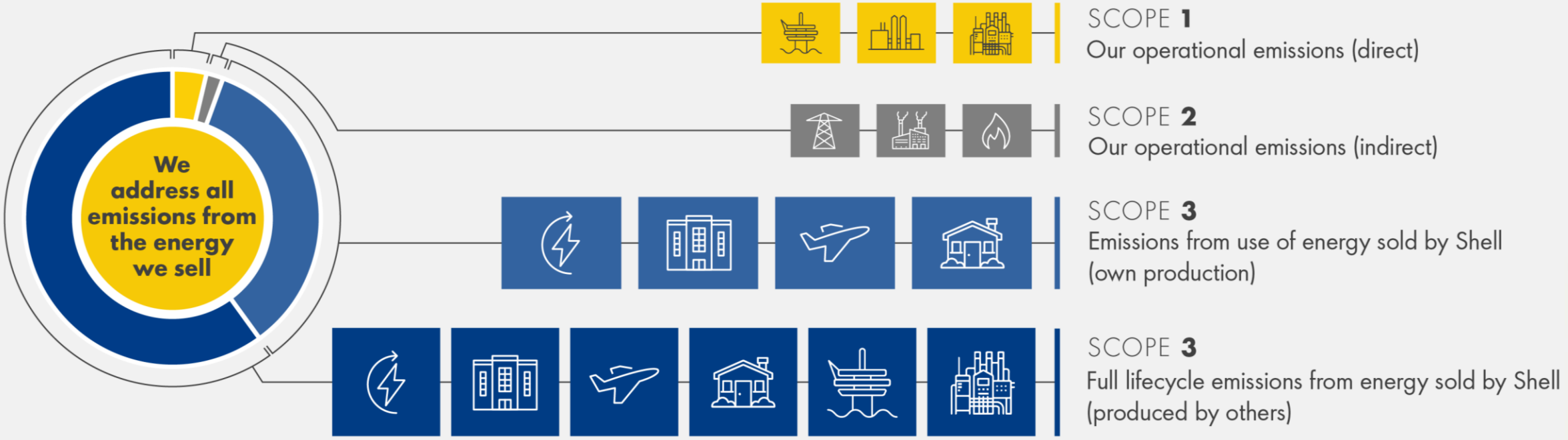
ACHIEVING **NET-ZERO EMISSIONS**

Working with our customers and across sectors to accelerate the transition to net-zero emissions

UNDERPINNED BY OUR **CORE VALUES** AND OUR FOCUS ON **SAFETY**

Shell's climate target

Shell's target is to become a net-zero emissions energy business by 2050.

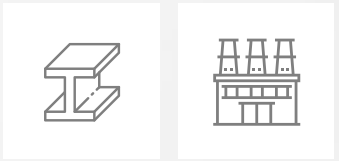


We believe Shell's total carbon emissions from energy sold peaked in 2018 at around 1.7 Gtpa

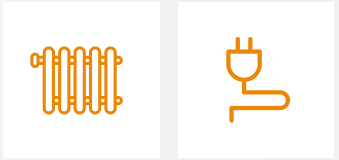
Hydrogen in the future energy system

Decarbonise hard-to-abate end-uses

Decarbonising transportation leveraging higher energy density uses



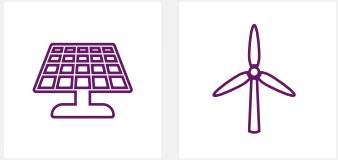
Decarbonising industry energy use replacing coal and other fossil fuels



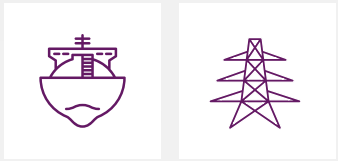
Decarbonising building heat and power leveraging existing gas infrastructure

Decarbonising grey H_2 use in fertiliser, refineries and chemical industries

Enable deep renewables penetration, distribution & system resilience



Enabling large-scale renewables penetration and power generation



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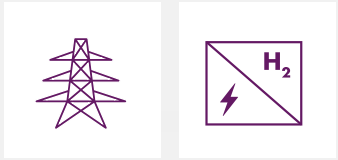


Act as a buffer or storage to increase system resilience

Electrolysers as real-time sinks for an oversupplied renewable system

H2: the ‘Swiss Army Knife’ of the Energy Transition

Bullish outlook on global Hydrogen growth from key analysts

The global addressable market for hydrogen could reach nearly €10trn by 2050E

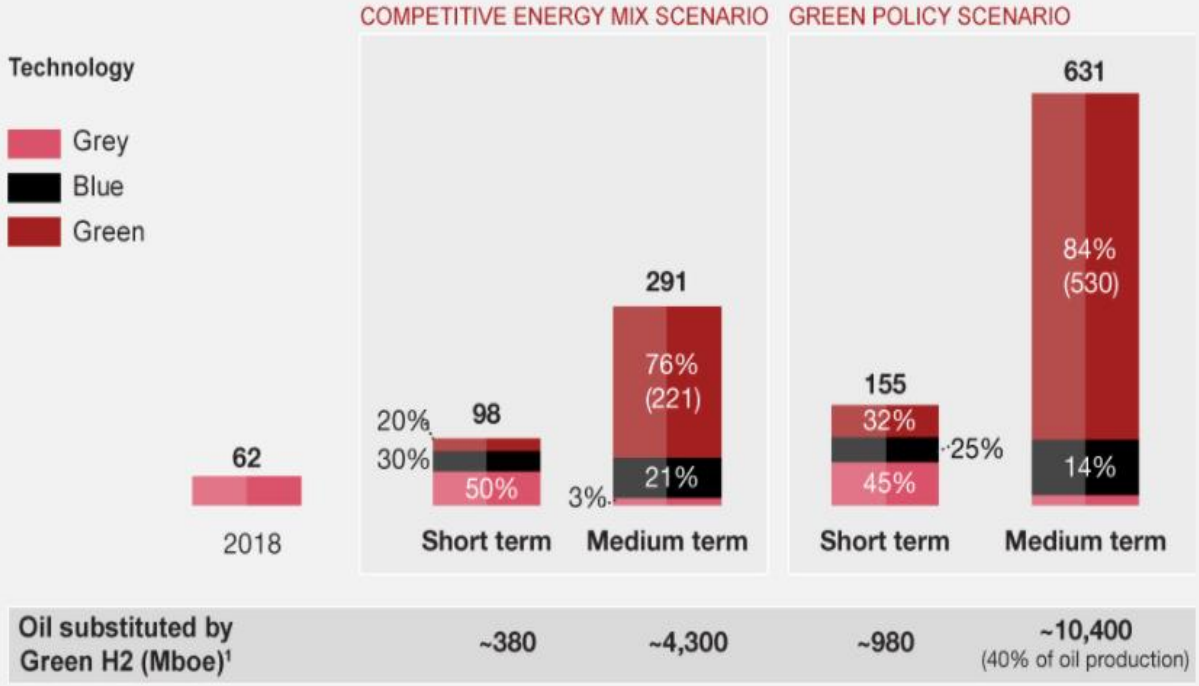
	EU	USA	Asia
Electricity Consumption in PWh	2.9	3.9	10.4
Installed Capacity in GW	1,055	1,095	3,129*
Renewables Capacity in GW	312	144	480
Population in mn	447	327	4,561
GDP current prices in $ trn	15.9	20.6	31.5**
Hydrogen addressable market in €trn	**2.2**	**2.9**	**4.4**

Global addressable market → **c. €10trn**

Source: Goldman Sachs "Green Hydrogen The next transformational driver of the Utilities industry" 2020

Green H2 demand is expected to reach ~530 Mt in the medium term, potentially displacing ~10,400 Mboe (40% of production)

Hydrogen demand development by technology (Mt H2)



Source: PwC , "The Dawn of Green Energy"

Two major challenges for the development of the hydrogen economy

Cost

- Decarbonised hydrogen is **not currently cost competitive** with the existing next best alternatives
- As the industry grows in size, **economies of scale** will help reduce cost
- To aid this we need **immediate supportive policy** to enable investment
- **Collaboration** between energy companies, industry players, infrastructure and vehicle manufacturers is also required

Matched supply and demand

- The hydrogen industry will only be able to succeed if **new demand** is established
- New projects need to ensure that **supply and demand are synchronised** as well as aligning with infrastructure development
- This requires **coordination between public and private organisations** at the local, national and international level

CREATING A CLEAN HYDROGEN MARKET BY ORCHESTRATING INTEGRATED HYDROGEN HUBS

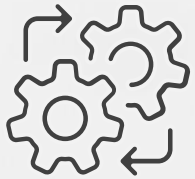
Timeline	Taking a phased approach	Proof points[1]
	Step 0 – Building capability Building on our expertise of handling molecules, established a funnel of clean hydrogen projects and a leading hydrogen retail position	▪ H2 Mobility JV (100 stations), Germany ▪ First California H2 stations, USA ▪ Liquid H2 shipping demo, Japan
2021	**Step 1 – Own use** Focus on serving own assets as anchor demand in hubs. This enables us to build supply positions and gain experience and credibility	▪ RefHyne electrolyser (10 MW with 100 MW expansion in design), Germany ▪ Rotterdam electrolyser (200 MW), NL
	Step 2 – Serving the hubs Expand to serve third-party customers in local hubs. This creates markets and solutions and expands our supply position and hydrogen supply corridors. Through early fuel cell electric vehicle adopters, we prove viability, use case, technology and excellent customer experience for road transportation market	▪ China electrolyser (20 MW) ▪ Hamburg electrolyser (100 MW), Germany ▪ California stations (50 stations) ▪ H2Accelerate - Phase 1, Europe ▪ H-Vision, NL
	Step 3 – Starting the clusters Ready to serve inter-regional and international industrial demand through an expanding hydrogen backbone network, including accelerated roll-out of vehicles and refuelling infrastructure	▪ NorthH2 (4-10 GW), NL ▪ H2Accelerate - Phase 2, Europe
2035	**Step 4 – Fully developed, traded hydrogen market** Facilitated by a wide-spread hydrogen pipeline network, including import. Mass adoption of hydrogen fuel cell electric vehicles for commercial road transport and developing shipping and aviation markets	▪ Rotterdam import ▪ Supplying aviation and marine transport sectors

A Shell hydrogen station in California, USA

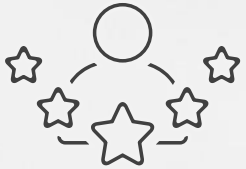
A 10 MW RefHyne electrolyser construction to be completed in mid-2021, Germany

[1]Projects in different stages of development.

Shell has critical capabilities to succeed in the hydrogen business



Leader in process safety



Decades of experience in hydrogen

Continued investments in innovation, research and development

Extensive network of strong partners and customers

Widely recognized for project execution capabilities

Integrated offer from production to supply

Credible partner in a coalition to work with governments

WHAT IS REQUIRED FOR SUCCESS?

Building Cross-sectoral Demand

Supportive policies: Short & Long Term

Clear Definitions & Standards

International Collaboration

“We tend to **overestimate** the effect of a **technology** in the short run and **underestimate** the effect in the long run”

Roy Amara