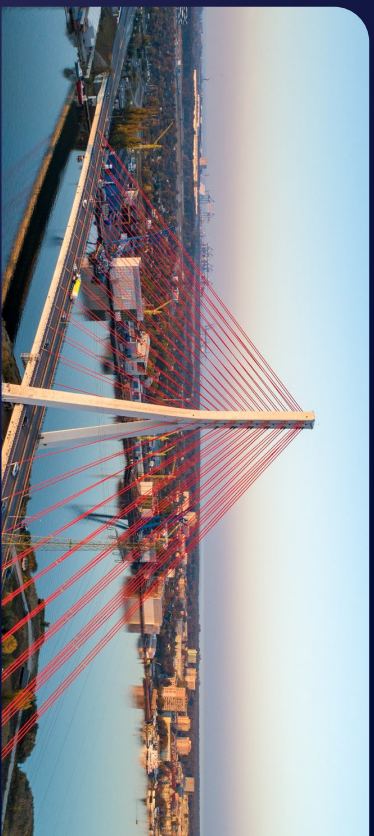


# ORLEN Group Hydrogen Strategy 2030

FEBRUARY 2022



# Our aspirations



Our aspirations

Hydrogen potential

Our strategy

Capital expenditure


# The ORLEN Group Strategy 2030 seeks to build a sustainable portfolio of businesses. Hydrogen is part of the plan to invest in the future

Business logic of the ORLEN Strategy 2030

Key business segments and areas

Share in total investment


**Maximising performance**



- Upstream
- Refining
- Fuel retail
- Energy/gas distribution

~35-45%

**Strategic development**



- Petrochemicals
- Gas-fired power
- Renewable power
- Non-fuel retail

~45-55%

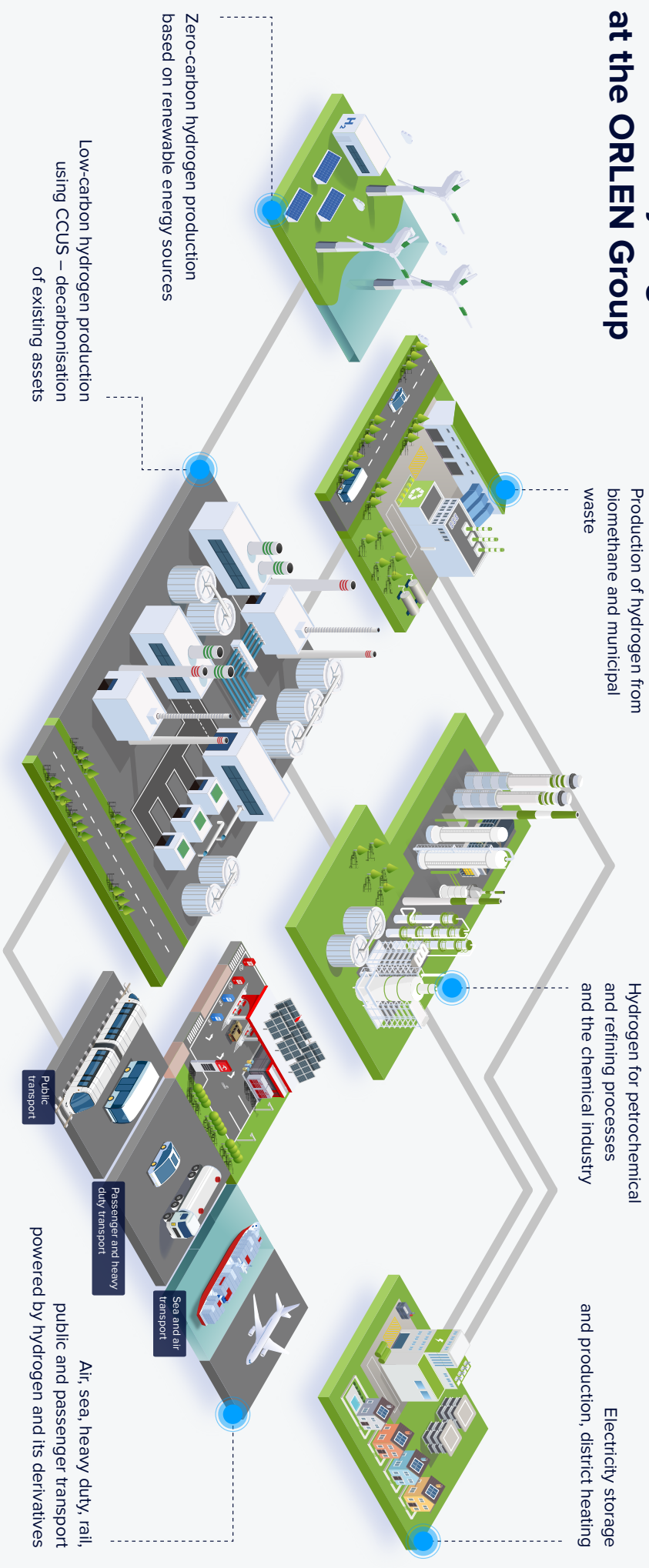
**Investing in the future**



- New mobility
- Hydrogen
- Recycling
- R&D&I and digital transformation

~5-10%

# Vision for the production and use of hydrogen at the ORLEN Group



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# Hydrogen strategy aims to establish the ORLEN Group as a leader of the hydrogen market in Central Europe

Key indicators for the ORLEN Group in 2030



**540 MW**

of new low- and zero-carbon hydrogen capacity, including from water electrolysis powered by renewables and municipal waste. With the ambition to achieve 1 GW in the long term 2030+



**~50%**

of hydrogen produced by the ORLEN Group to be low- or zero-carbon, with an ambition of ~80% in the long term 2030+



**1.6**

**m tonnes**

tonnes less of CO<sub>2</sub> emissions from hydrogen production in 2030, with up to 3m tonnes less in the long term 2030+



**19**

**Kt H<sub>2</sub> / year**

per year of automotive grade hydrogen



**>100**

hydrogen refuelling stations with necessary logistics infrastructure in Poland, the Czech Republic and Slovakia

# Hydrogen potential



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# Energy transition is reshaping our external environment

## Technology advances

Growing cost-effectiveness of renewables

Low-carbon transport and industrial sector decarbonisation

Circular economy with a focus on recycling technologies

Ambitious reduction targets for greenhouse gas emissions

New Green Deal, Fit for 55 package

Ongoing regulatory support

## Regulations

## Environmental concerns

Evolving expectations from providers of goods and services

Proactive and increasingly conscious consumers

# Strategies and roadmaps are vital in areas requiring long-term planning



Ambitious goals for developing a hydrogen economy, supported by public and private funding, are included in both the EU Hydrogen Strategy and Poland Hydrogen Strategy\*.



## 40 GW capacity

Strategies and roadmaps are vital in areas requiring long-term planning in electrolyzers powered by renewables that can produce up to 10m tonnes of green hydrogen in the EU.

A major factor is a demand-side policy creating new sales markets, particularly in industry and transport.



## 2 GW capacity

in facilities producing hydrogen and its derivatives from low-carbon sources, processes and technologies, including electrolysis units.

The primary goal is to create and advance a competitive hydrogen industry to achieve climate neutrality.



**Ambitious reduction targets for greenhouse gas emissions**

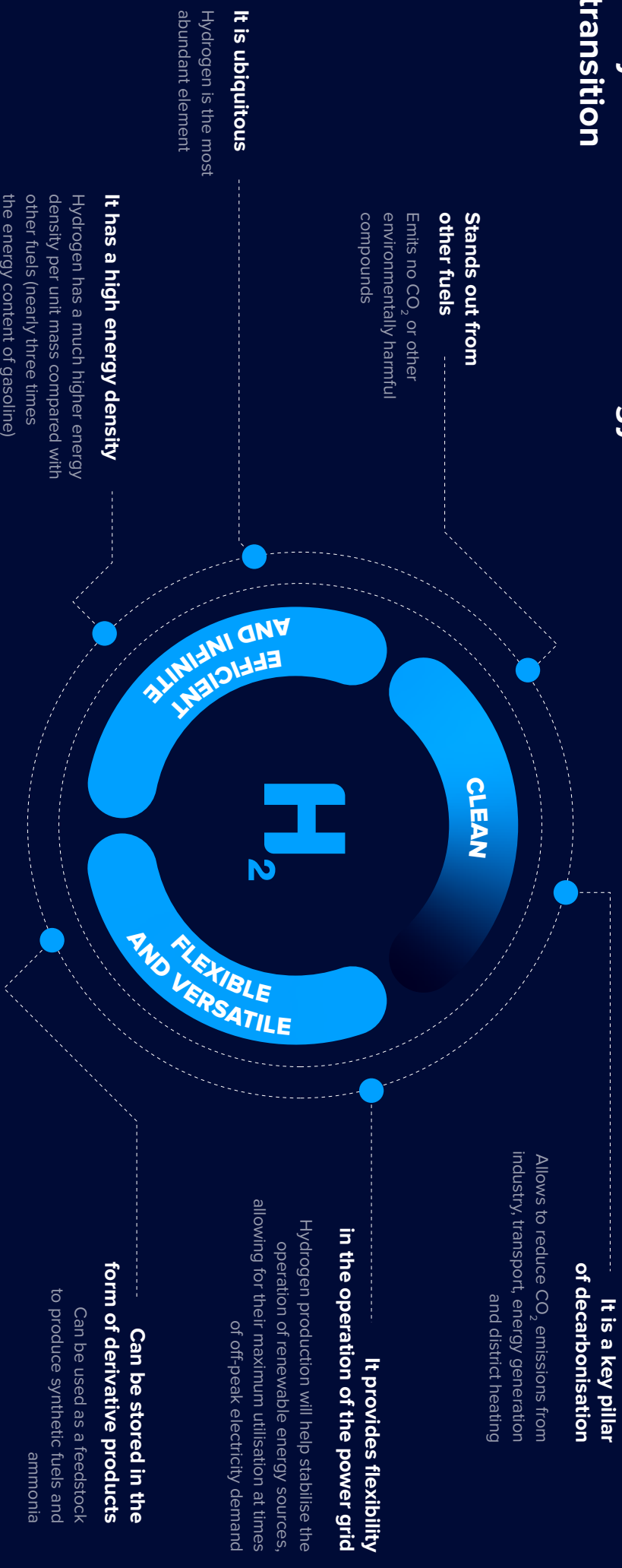
**New Green Deal, Fit for 55 package**

**Ongoing regulatory support**

\* Poland Hydrogen Strategy 2030 with an Outlook to 2040.



# Hydrogen is now considered a key element of the energy transition



# Our strategy



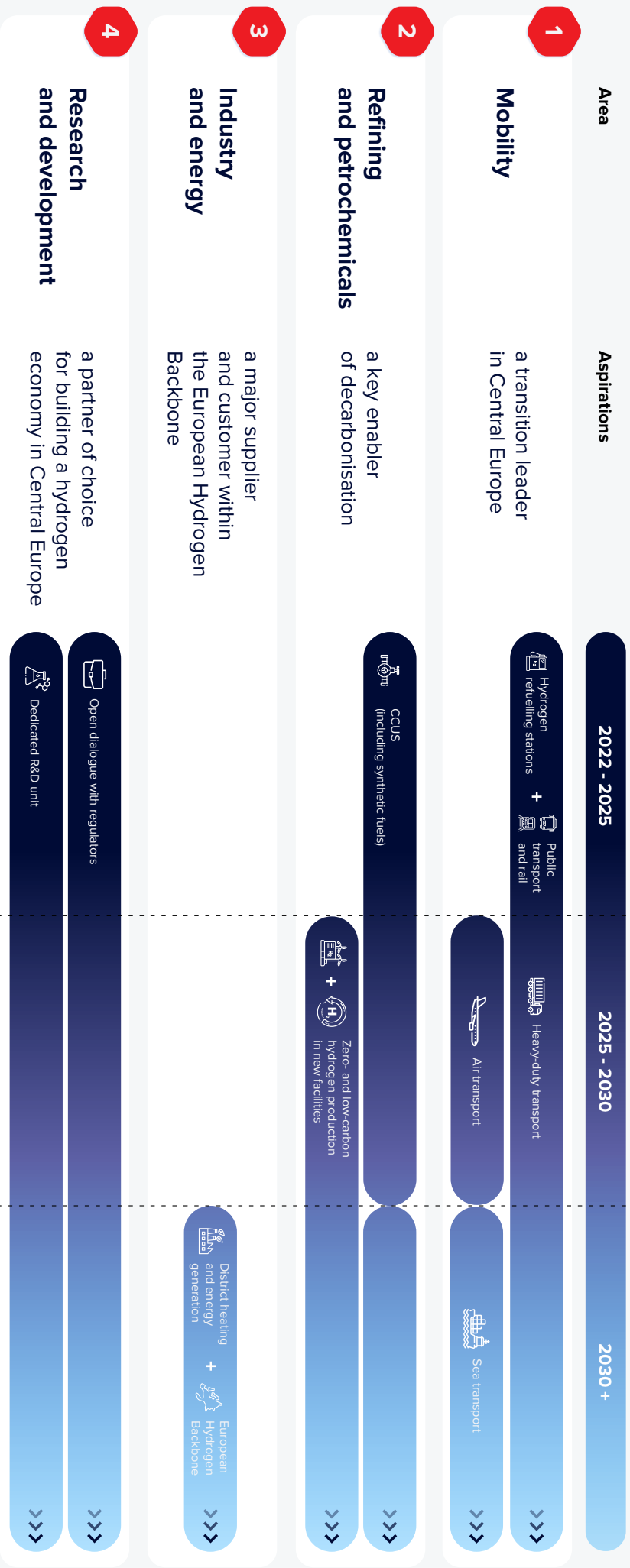
Our aspirations

Hydrogen potential

**Our strategy**

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# Hydrogen economy: our strategy





**Mobility** – hydrogen as a fuel for public and rail transport, and in the long term – also for heavy-duty, air and sea transport

**Aspirations:**

Leader in advancing hydrogen mobility in Central Europe, actively supporting decarbonisation of transport.

- Market development starting with city buses and railway, through long-haul heavy-duty and passenger transport, to synthetic fuels for air and sea transport.
- Network of publicly accessible hydrogen refuelling stations.
- Leveraging existing assets and building new capacities to produce automotive grade hydrogen for transport.

Our aspirations

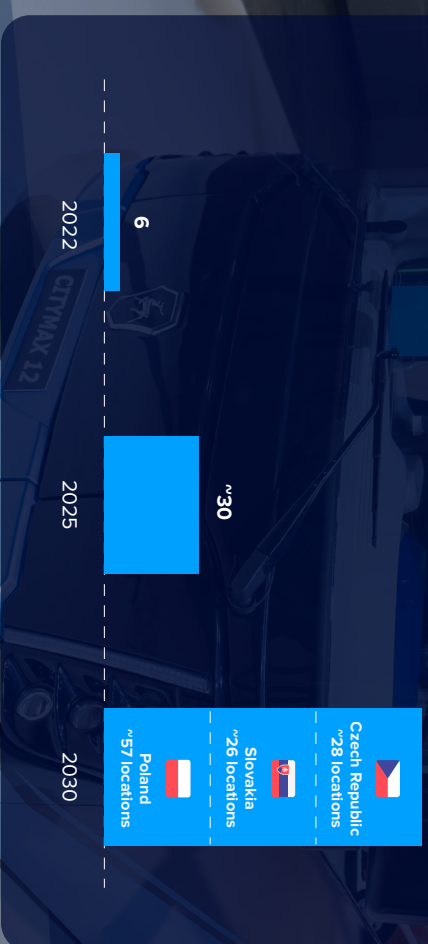
Hydrogen potential

**Our strategy**

Capital expenditure



**ORLEN Group hydrogen refuelling stations**



## 2

**Refining and petrochemicals – hydrogen** as an enabler of decarbonisation. Balanced investment portfolio addressing the needs of existing assets and regulatory challenges

**Aspirations:**

The hydrogen strategy is both an extension of the ORLEN Group's ambitious decarbonisation plan and a response to the rapidly changing market and regulatory environment.

Implementation of numerous projects addressing key challenges facing the ORLEN Group until 2030:

- Reduction of CO<sub>2</sub> emissions from existing hydrogen production facilities of the ORLEN Group using low-carbon technologies – carbon capture, utilisation and/or storage (CCUS).
- Development of new generation sources based on electrolysis units and renewables.
- Implementation of municipal waste to hydrogen technology.



## Industry and energy generation

– promising areas of focus depending on the scale of development and availability of zero-carbon electricity sources

### Aspirations:

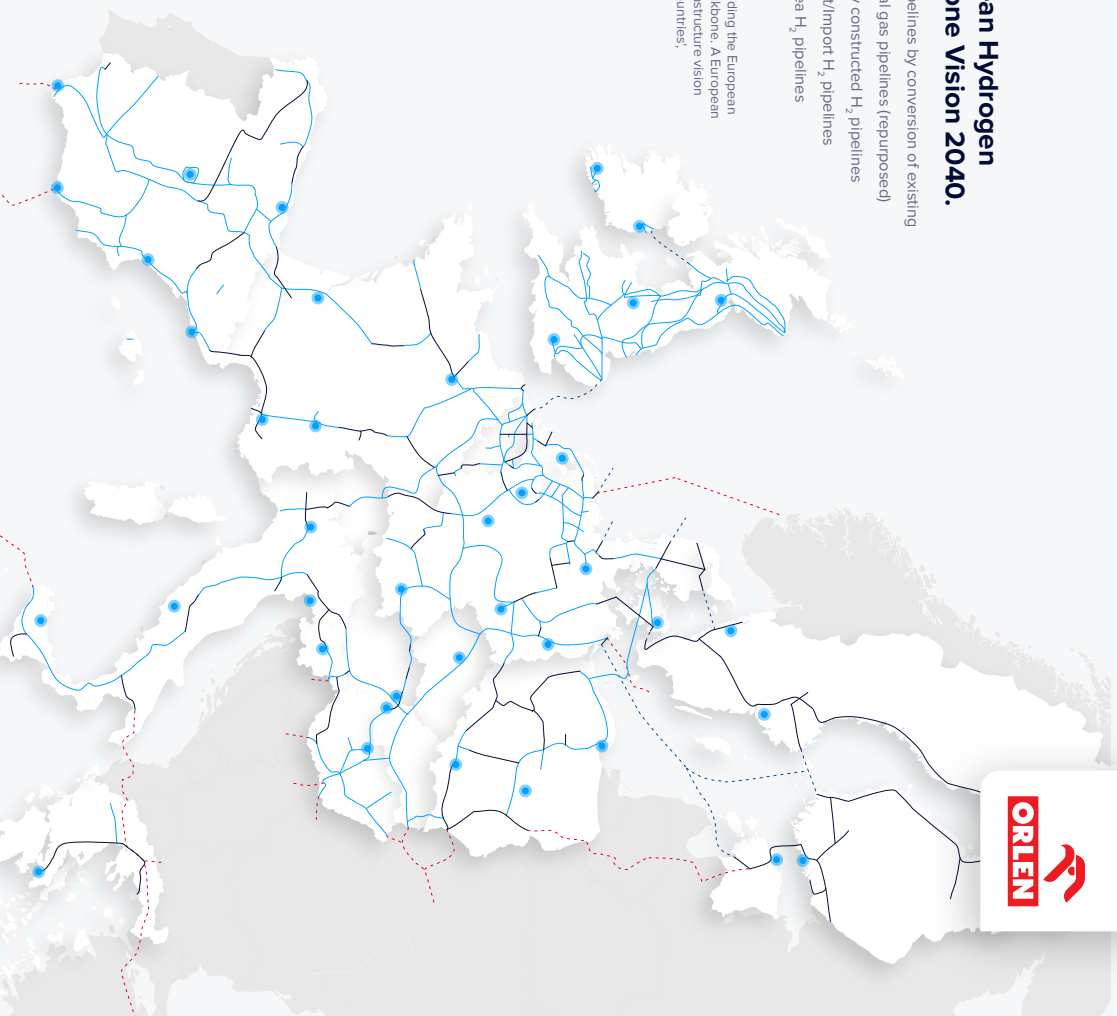
Building a significant position as a supplier and customer to the European Hydrogen Backbone

- Industry and export: after 2030 surplus zero- and low-carbon hydrogen could be directed to meet the needs of other Industries at home and abroad (e.g. within the framework of the European Hydrogen Backbone),
- District heating and power generation as promising applications of low- and zero-carbon hydrogen.
- Grid stabilisation: large-scale utilisation of hydrogen and/or ammonia for energy storage will be possible after 2030 with wind farms in the Baltic Sea when there is a significant periodic surplus of renewable electricity in the grid.
- New CCGT units planned within the ORLEN Group will be able to co-fire hydrogen.

### European Hydrogen Backbone Vision 2040.

- H<sub>2</sub> pipelines by conversion of existing natural gas pipelines (repurposed)
- Newly constructed H<sub>2</sub> pipelines
- Export/Import H<sub>2</sub> pipelines
- Subsea H<sub>2</sub> pipelines
- City

Source: 'Extending the European Hydrogen Backbone. A European hydrogen infrastructure vision covering 21 countries', April 2021.



4

**Research and development** – a partner of choice for building a hydrogen economy in Central Europe, focused on innovation and in-house capabilities development

**Aspirations:**

Advancement of research and development activities actively supporting the potential of the ORLEN Group

- Forging and promoting hydrogen partnerships and the hydrogen ecosystem.
- Building in-house capabilities across the hydrogen value chain.
- Setting up a dedicated hydrogen laboratory at the Research and Development Centre in Plock by 2025 to perform tests and conduct research in test facilities on hydrogen production, quality, purification, storage and transport.
- Taking a leading role in the Mazovian Hydrogen Valley, whose main aim is to implement R&D projects that help drive progress in hydrogen technology.

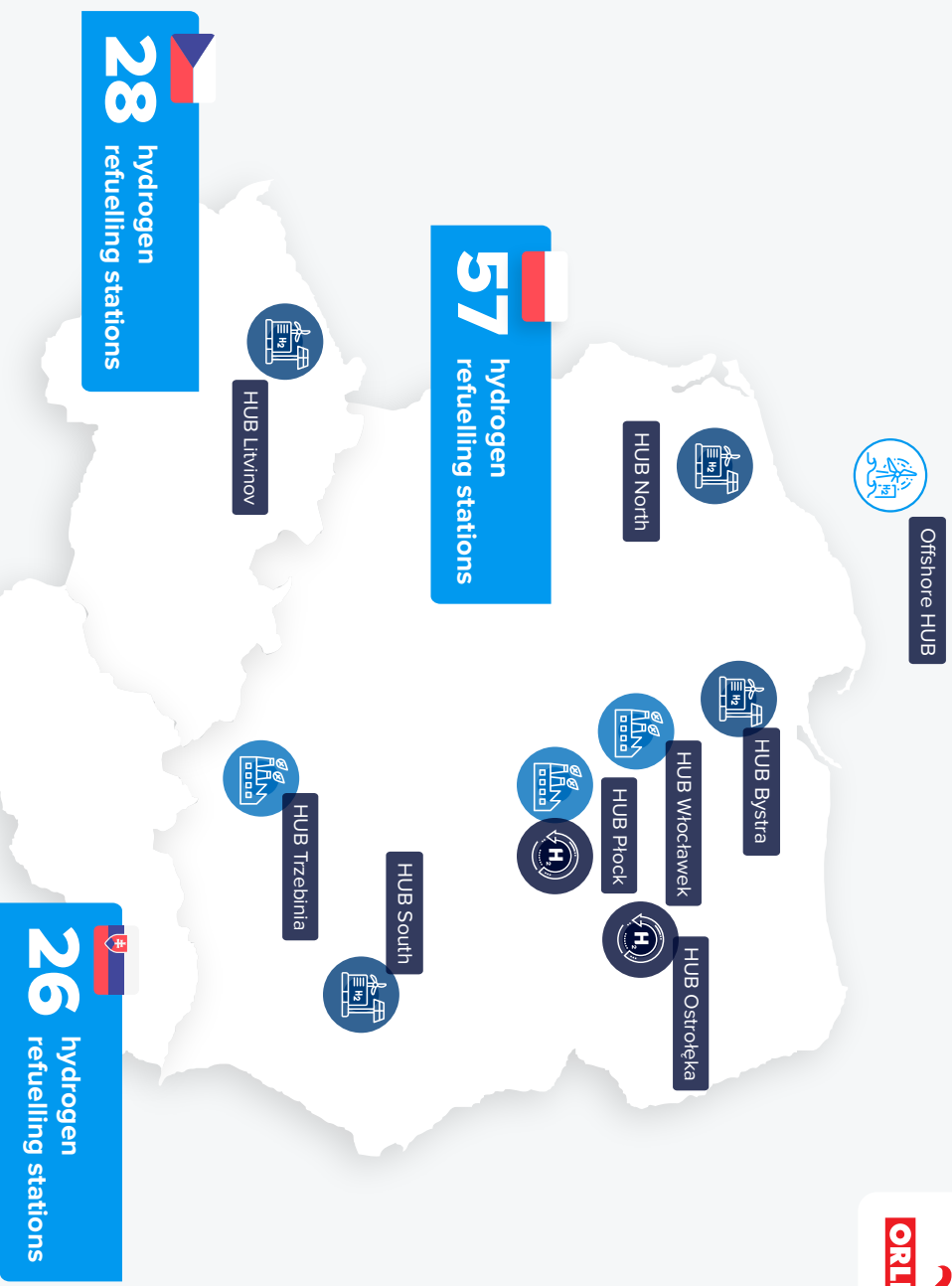


## At the ORLEN Group in 2030

Hydrogen hubs will help supply key sales markets, and hydrogen refuelling stations enable transport on major routes and in major cities

### Hydrogen production sources:

-  Existing sources at plants
-  Offshore electrolyser powered by renewables
-  Onshore electrolyser powered by renewables
-  Conversion of municipal waste into hydrogen





# Hydrogen strategy relies on capabilities of the ORLEN Group companies

## Energy sources



Leader in developing onshore renewable energy segment for zero-carbon hydrogen production



Key player in offshore wind development in the Baltic Sea



Largest operator of agricultural biogas plants in Poland

## Production



Central Europe's first producer of fertilizers based on low- and zero-carbon hydrogen



Central Europe's first refinery relying on low- and zero-carbon hydrogen



European leader in developing municipal waste conversion technologies



Central Europe's first large-scale CCU plant operator

## Distribution



Enabler of the Polish hydrogen mobility market. Operator of the largest network of hydrogen refuelling stations and a partner of choice for local governments and companies



Key player in the Czech and Slovak hydrogen mobility market

# Capital expenditure



## Planned capital expenditure

# PLN 7.4bn

with an ambition to increase spending in the long term



\* Including: hydrogen production infrastructure; incl. RES-powered electrolyzers; hydrogen production installations using municipal waste; distribution and storage infrastructure for produced hydrogen and the network of FCV charging points

### Key goals:

- Focus on cost-efficient decarbonisation of existing hydrogen production assets.
- Build new low- and zero-carbon hydrogen production assets.
- Expand hydrogen refuelling and supply logistics networks.
- Address the challenges of green transformation.
- Use non-repayable funding efficiently.

**Majority of key capital projects are scheduled to come online before 2025. Being innovative, comprehensive and cross-border in nature, each project has applied for non-repayable funding to finance 40%–80% of the costs.**



Powering the future.  
Sustainably.



# List of abbreviations, acronyms and units used in the Hydrogen Strategy

Units	Glossary of abbreviations
<b>R&amp;D</b>	Research and development
<b>CAPEX</b>	Capital expenditure
<b>CCGT</b>	Combined Cycle Gas Turbine plants
<b>CCU</b>	Carbon Capture, Utilisation
<b>CCUS</b>	Carbon Capture, Utilisation and Storage
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>Fit for 55</b>	an EU legislation package aiming to reduce greenhouse gas emissions by 55% compared with 1990 levels
<b>GW</b>	Gigawatt
<b>H<sub>2</sub></b>	Hydrogen
<b>Kt H<sub>2</sub></b>	Kilotonne of hydrogen
<b>MW</b>	Megawatt
<b>RES</b>	Renewable energy sources
<b>UE</b>	European Union

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