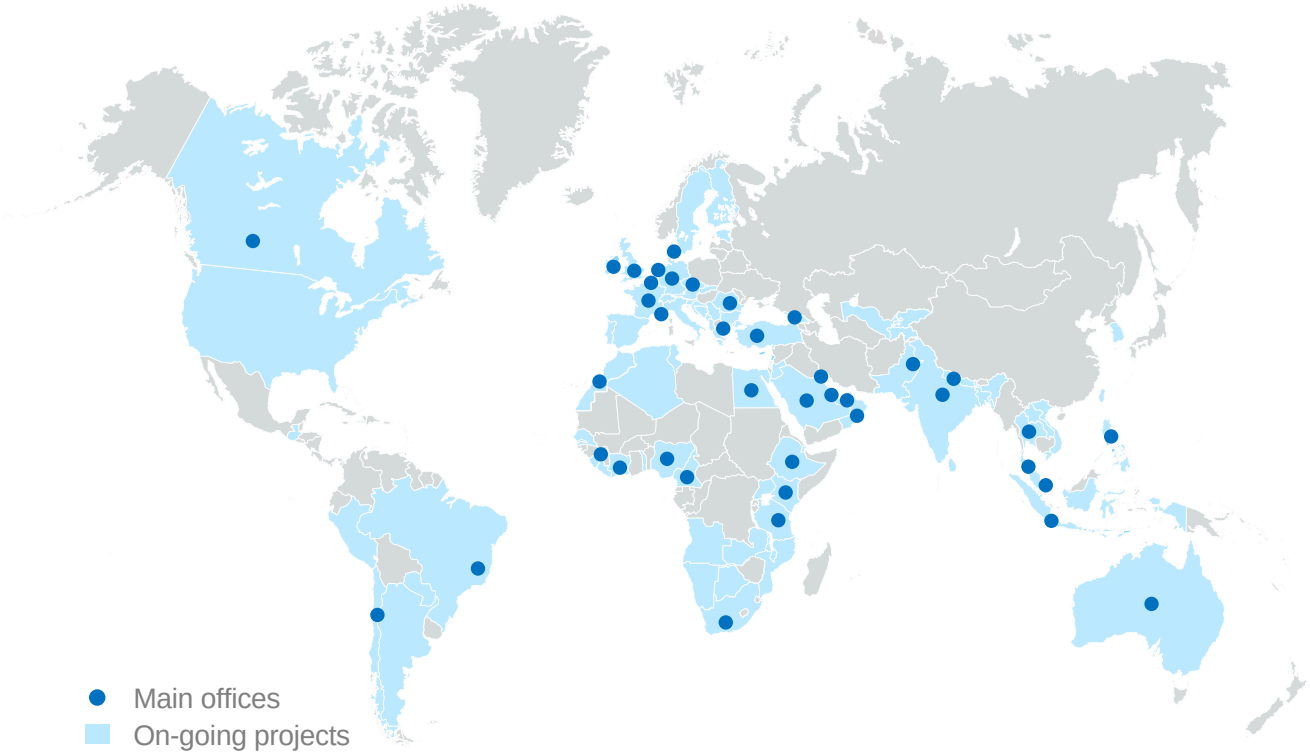
How can nuclear power help reduce the industry's carbon footprint?

28 February 2024

Who is Tractebel?

Key figures



654 M€
Turnover (2023)

5,600*
employees

40
presence in
40 countries

>80
projects in over
80 countries

0,3
High safety standard:
frequency rate 0,3

* source: GSR Q4 2023

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ENR Ranking

ENR Engineering News-Record INTERNATIONAL Design Firms 2024

Power
#9

Ports
& Marine
Facilities
#23

Hydro Plants
#2

Nuclear
#5

Wind
#9

Transmission
& Distribution
#16

PUBLIC

Responsible Designer* of the Belgian Nuclear Fleet

Key figures

60+ years
Responsible designer

28
Countries

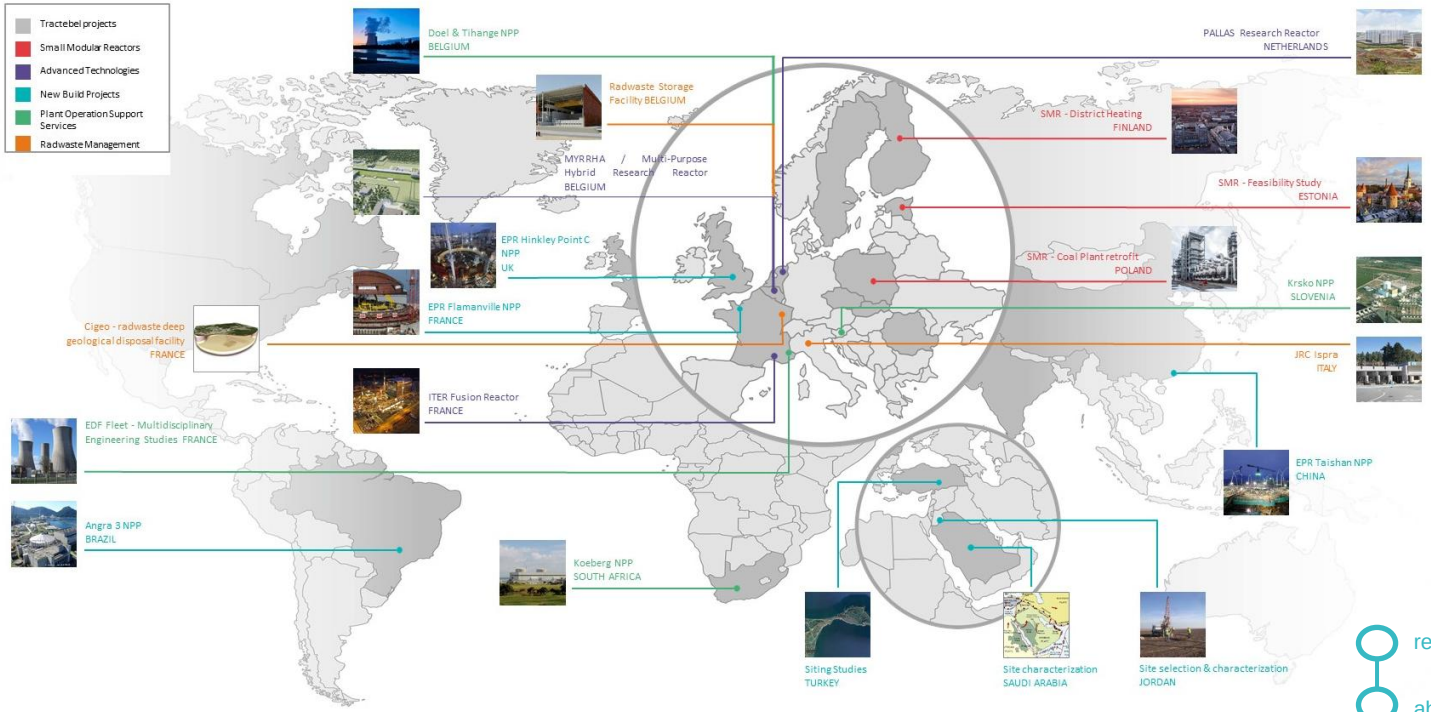
>1,200
Nuclear Experts

€220M
Revenues

*The role of Responsible Designer means that the Conception, Design and Engineering of any modification to the Belgian Nuclear is handled by Tractebel and defended by Tractebel in front of the Safety Authorities

PDoel NPP – Belgium / © ENGIE ELECTRABEL / Rudy De Barse

Worldwide nuclear projects



- recent projects in 28 countries
- about 51 clients worldwide
- nuclear expert teams based In B, F, RSA, UK, NL, RO

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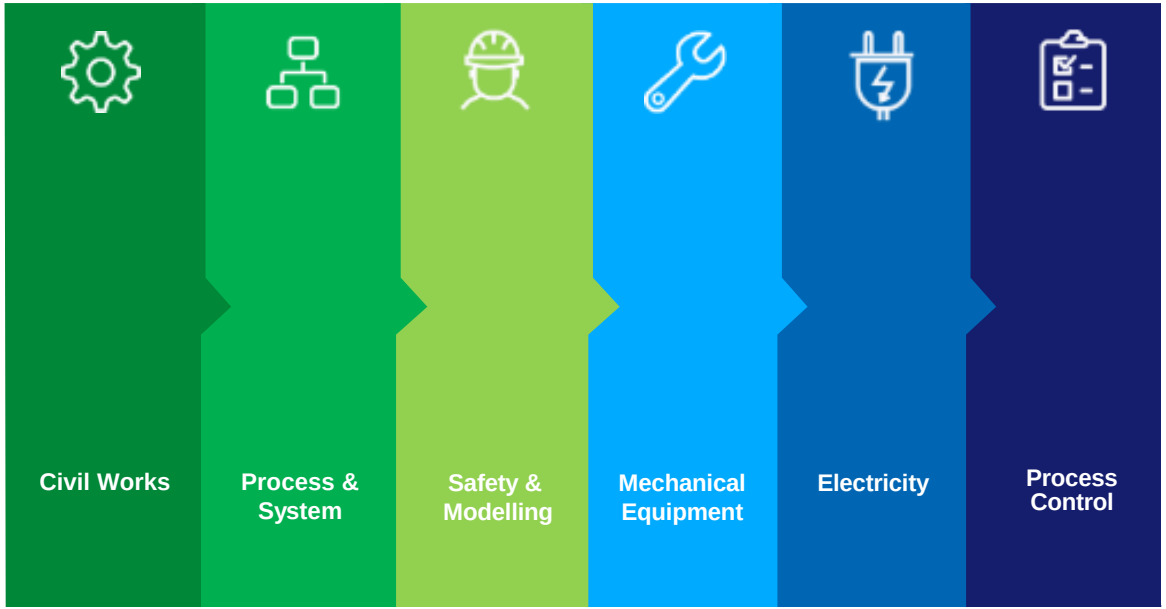
Providing integrated nuclear and non-nuclear solutions

TRACTEBEL ENGIE

PRODUCTS

- NEW BUILD
- SMALL MODULAR REACTORS
- PLANT OPERATION SUPPORT
- FUSION, SPACE, DEFENSE & DIVERSIFICATION
- RADWASTE & DISMANTLING

COMPETENCES



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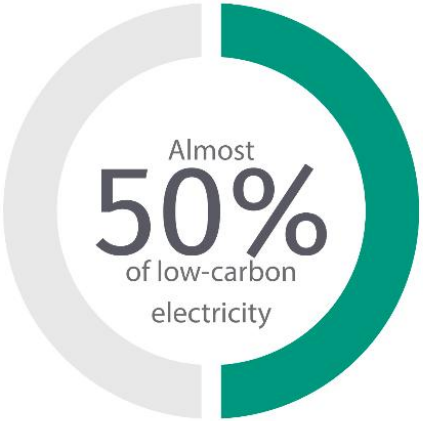
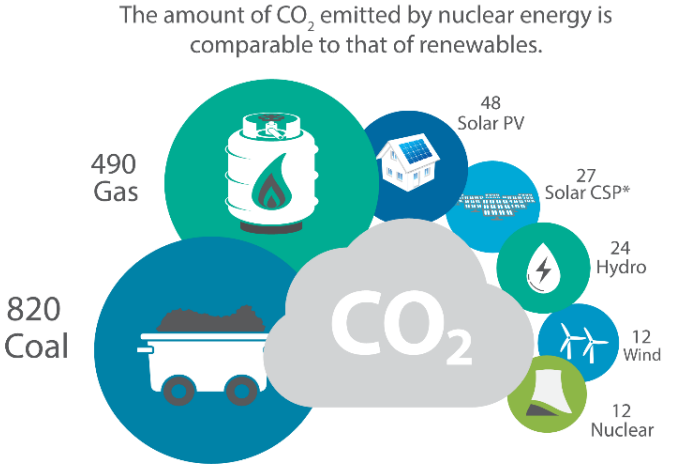
Nuclear’s contribution to Europe’s industry decarbonisation

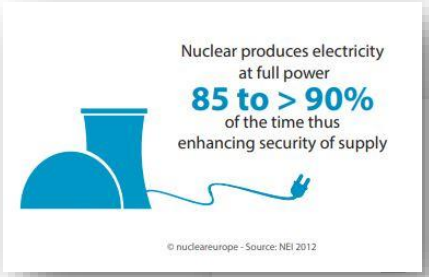
Half of EU's low-carbon electricity

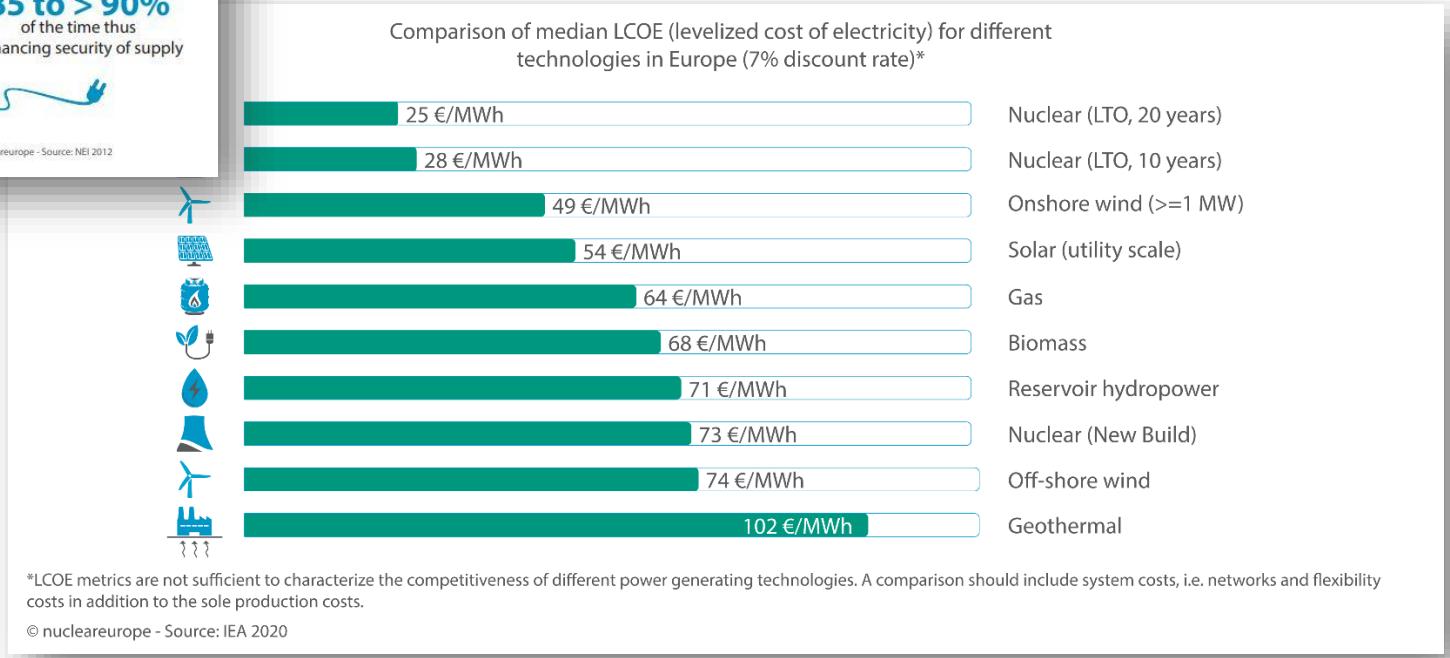




Source: nucleareurope

A reliable & affordable energy





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Pink hydrogen

Hydrogen produced from nuclear is:

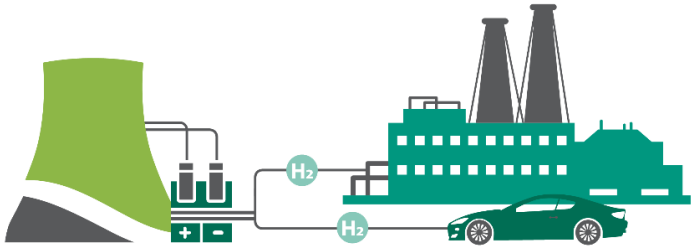
Low-carbon

Affordable
as it can be produced
constantly

Available 24/7
as it is not weather
dependent

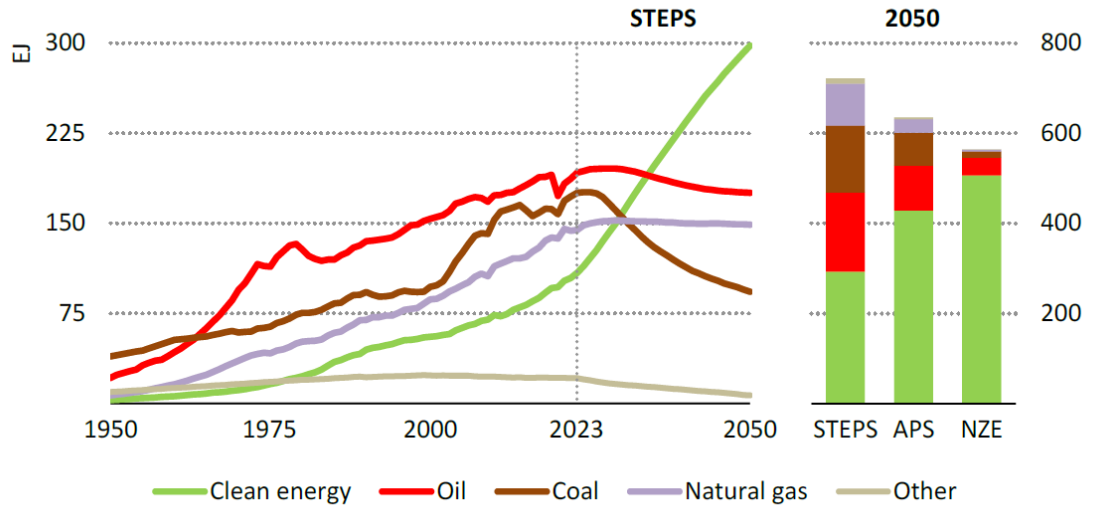
© nucleareurope

Nuclear-based hydrogen can help hard-to-decarbonise sectors reach their decarbonisation goals



IEA's Global Energy Forecast

Figure 1.1 ▷ Global energy mix by scenario to 2050



IEA. CC BY 4.0.

World Energy Outlook 2024, IEA, October 2024

Focus on the industry

Potential for industry repowering in Europe

Source: global energy monitor, 2023

NATURAL GAS

235 GW

COAL

157 GW

Source: IEA, 2020

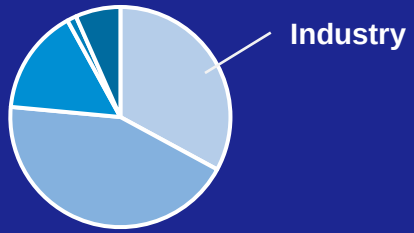
HEAT MARKET

> 60% below 550°C

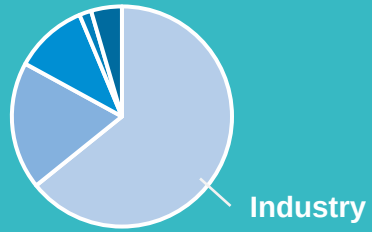
Average 970 TWh_{th}/y

1995 2000 2005 2010 2015 2020

CONSUMPTION SHARE



CONSUMPTION SHARE



Source: IEA, 2020

20-35 Mt H_2/y

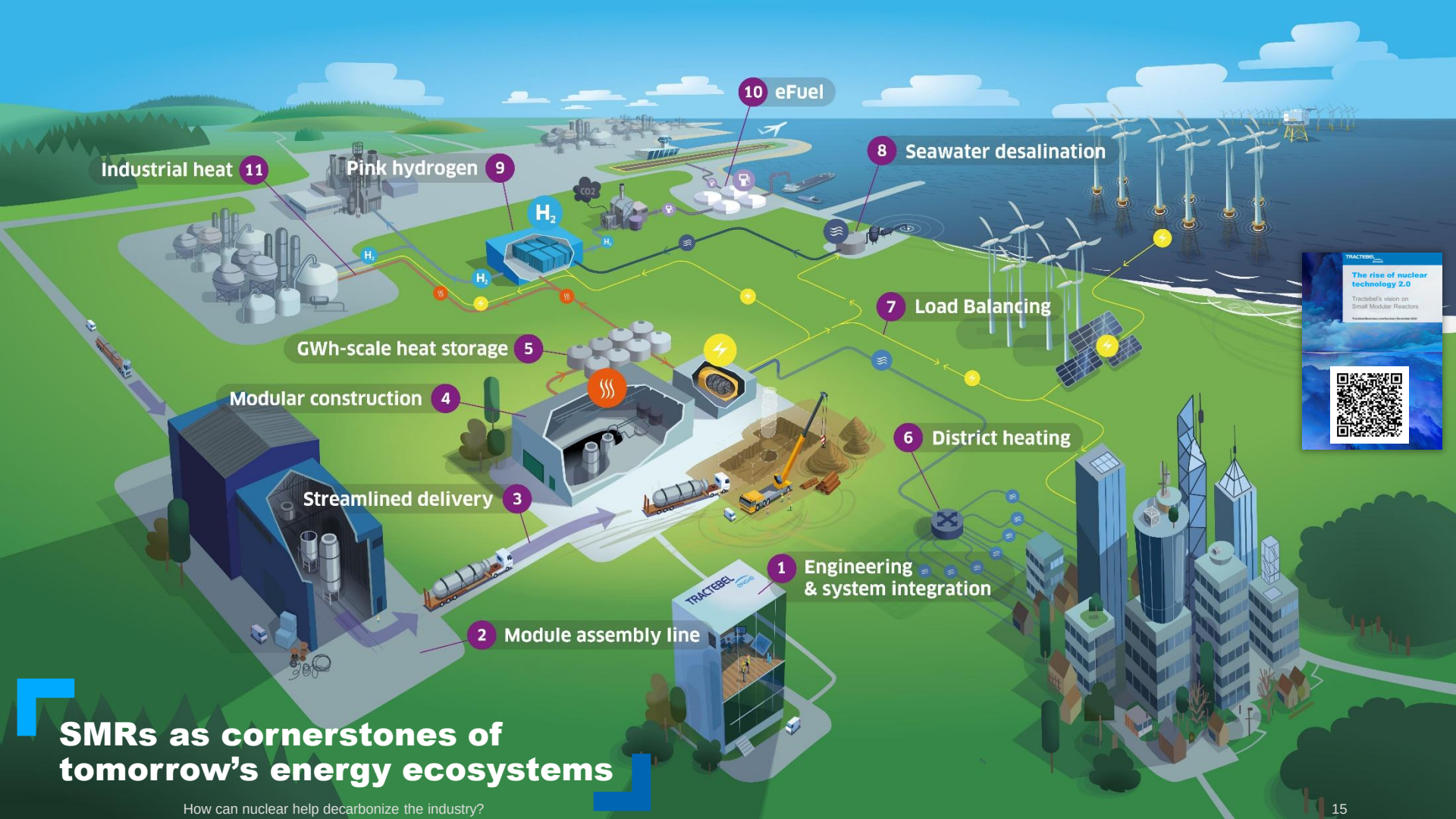
European Domestic production by 2040

> 800 TWh_e/y

Clean electricity demand to produce that hydrogen

Source: IEA – Energy Technology Perspectives 2020

Industrial applications of Nuclear Energy



SMRs as cornerstones of tomorrow's energy ecosystems

How can nuclear help decarbonize the industry?

Nuclear deployment

Purpose and technology diversity

SHORT-TERM DEPLOYMENT

DEEP DECARBONIZATION

WATER-COOLED REACTORS

Well-established technologies

Market initiators by the end of 2020s

Heavy industry

Heat and hydrogen production

HIGH-TEMPERATURE REACTORS

NICHE APPLICATIONS

CLOSED FUEL CYCLE

MICRO MODULAR REACTORS

New business models

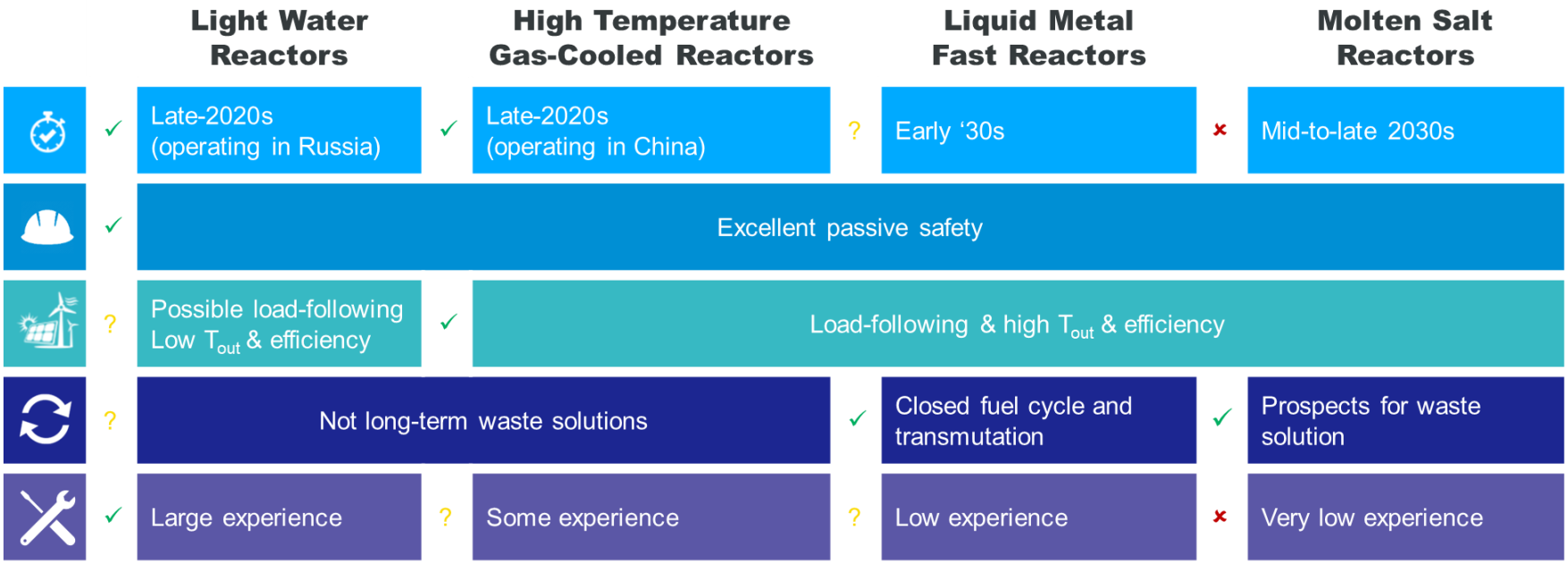
Remote locations, naval propulsion

Reduction of nuclear waste

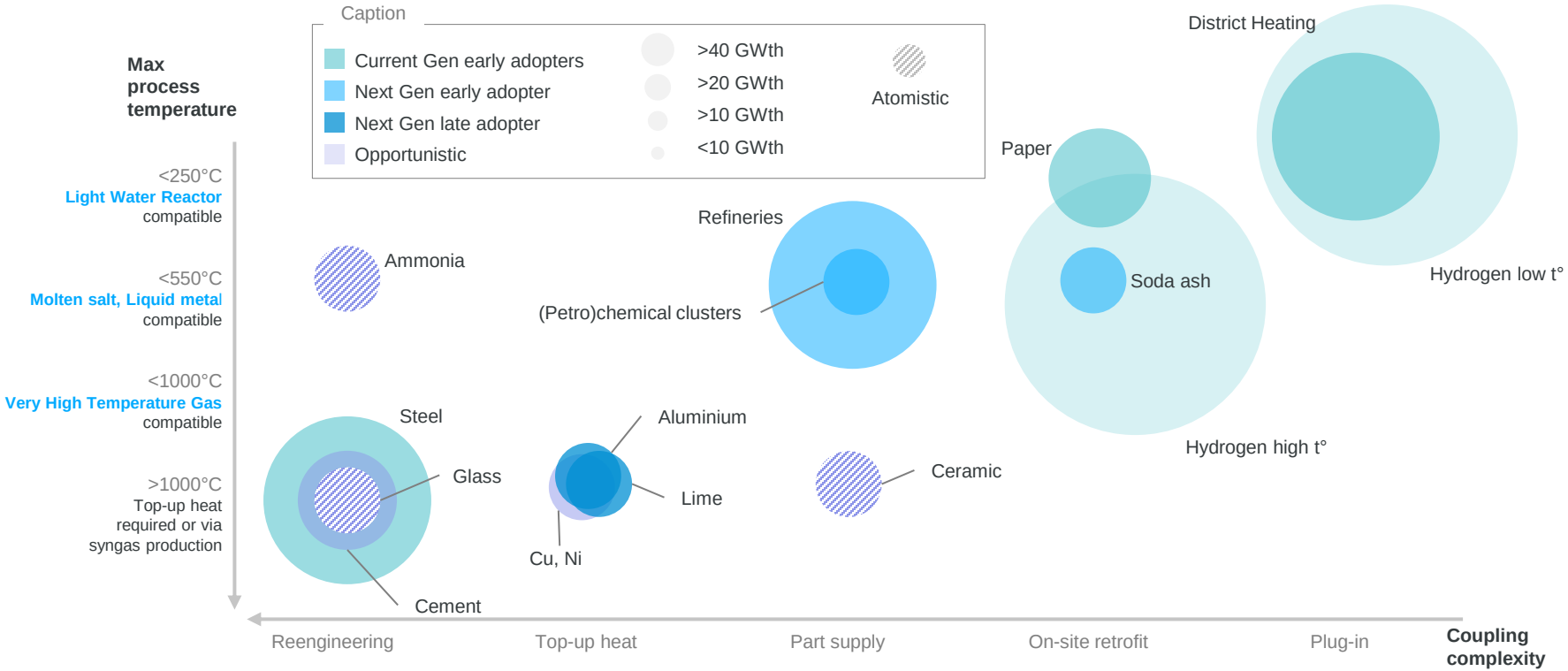
Circularity

FAST REACTORS

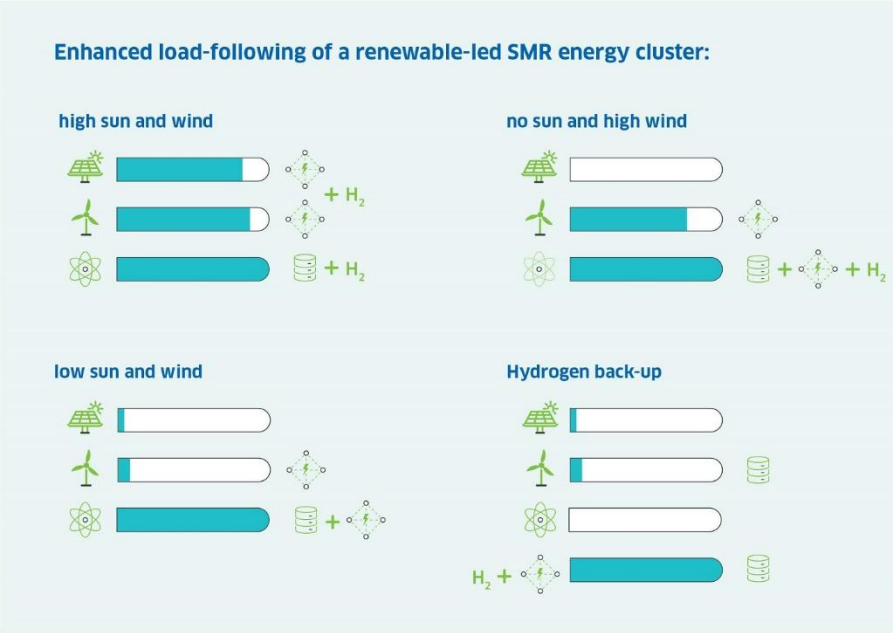
Overview of Nuclear technologies

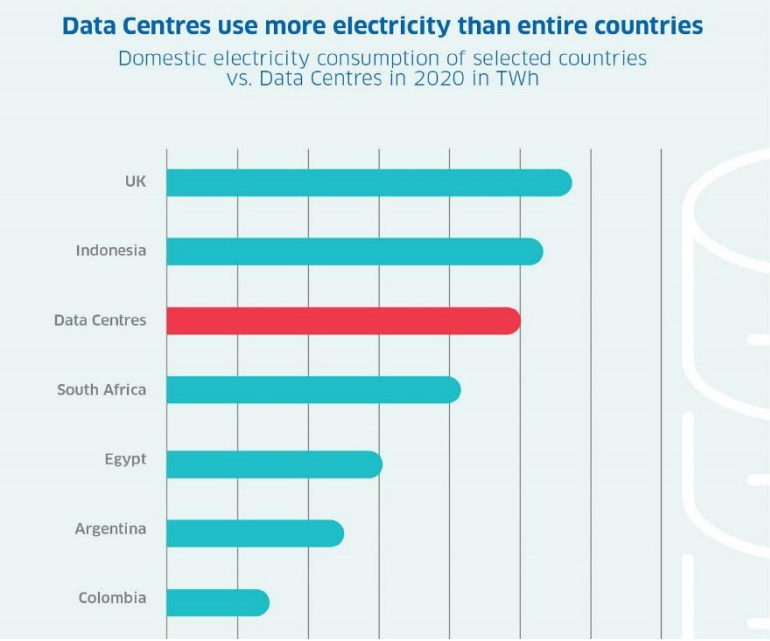


Compatibility of SMRs with industrial heat



Powering data centres with SMRs





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What does this mean at Belgian level?

From 2035 onward, Belgian energy landscape will require new solutions

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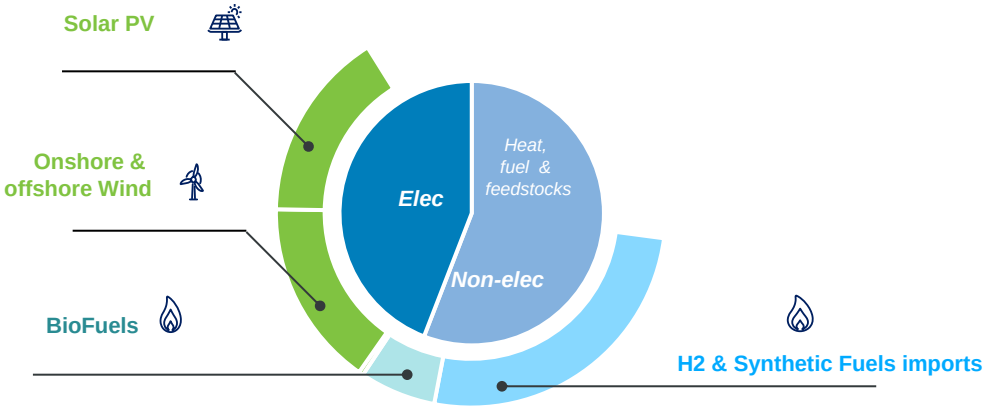
Energy Ville

100 to 150 TWh
Renewables potential

.be Vision and strategy Hydrogen

125 to 200 TWh
Domestic use of H2 by 2050



Electrification

Energy efficiency

Energy management

Building renovation

Development of public transportation

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Vision

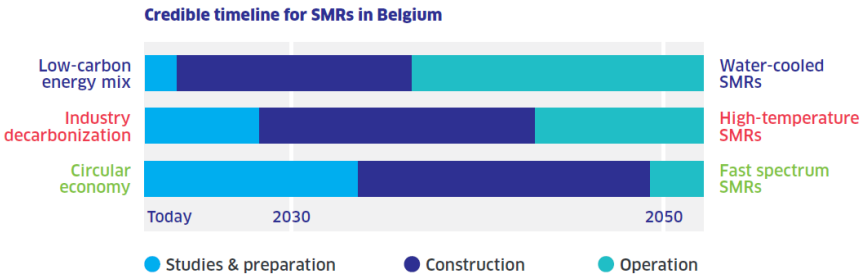
Energy mix objectives and timeframe

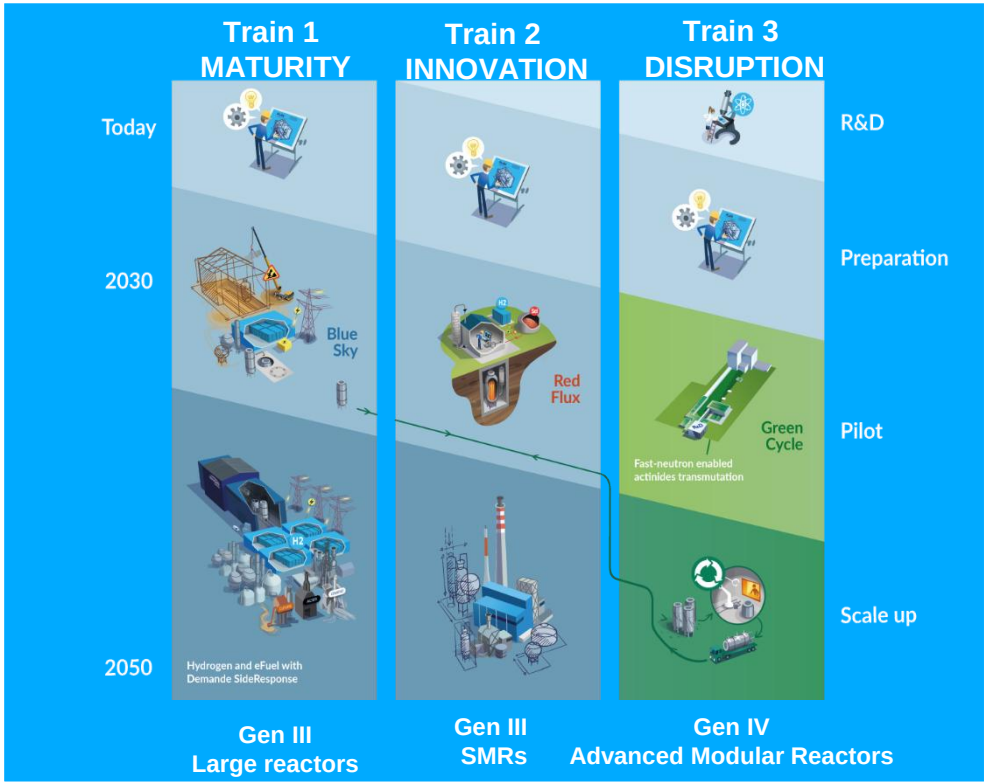
Credible objectives in Belgium:

2037 : 1.2 GW Gen III (SMR / Large scale)

2040 : Start of Gen IV SMR deployment

2050 : 4-8 GW of new nuclear (new Large + SMRs)





Some references

Small Modular Reactor Pre-feasibility for Industrial Applications

Pre-feasibility guidance for SMRs as an option to decarbonize two chemical production assets (US & EU)

CLIENT	**WORLD LEADER IN CHEMICAL INDUSTRY**
LOCATION	**US & EU**
PERIOD	**2021 – ongoing**
KEY TAKEAWAYS	**Possibility for retrofitting existing installation**
	High reliability calls for multi-modules
	Competition with fossil fuels
	Geopolitics playing a major role

Small Modular Reactor Pre-feasibility for Refinery

Pre-feasibility guidance for SMRs as an option to decarbonize all refining processes

CLIENT	**WORLD LEADER IN PETROCHEMICAL SECTOR**
LOCATION	**North America**
PERIOD	**2024**
KEY TAKEAWAYS	**Complex installations requiring a holistic understanding and graded approach**
	Co-location hazards mastered

SMR for data centers

Preliminary assessment of suitability of SMR solution for data centers

CLIENT	**Large multinational corporation**
LOCATION	**Europe**
PERIOD	**2022**
KEY INSIGHTS	**Integration in dedicated micro-grids to guarantee high availability** **Preference for low-maintenance solutions and reduced footprint**

EPR Hinkley Point C

CLIENT	**EDF CNEN**
LOCATION	**United Kingdom**
PERIOD	**2011 – 2020:** **Basic design and optimization studies** **2015 – 2022:** **Detailed design (calculations and drawings)**
SERVICES PROVIDED	**Design studies and structures geometry optimization** **Containment, Inner structures, APC shield building, HL1/4** **Implementation studies** **Pool liner studies** **3D reinforcement drawings with TEKLA software**

EPR Hinkley Point C

The nuclear island is made up of a common raft in which the electrical buildings, the fuel building, the plane hull and the containment are settled. The internal structures of the Reactor Building are based on the raft.

CLIENT	**EDF CNEN**
LOCATION	United Kingdom
PERIOD	**2011 – 2020**: Basic design and optimization studies
	2015 – 2022: Detailed design (calculations and drawings)
SERVICES PROVIDED	Design studies and structures geometry optimization
	Containment, Inner structures, APC shield building, HL1/4
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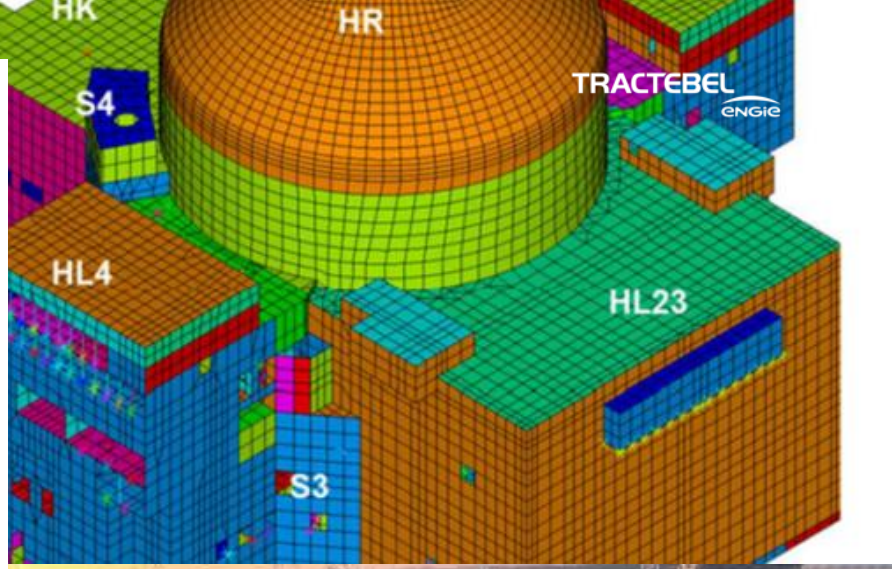

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ENGIE

Thank you for your attention!

We’d love to hear from you

https://forms.office.com/e/NzR4XHjbCy

Dive further into SMRs…

Primary Elbows Replacement for the EDF 900 MW Fleet

As part of the strategy to extend the life of the PWR fleet, EDF must replace a set of sensitive primary pipe components whose mechanical justification is not established beyond the 4th Periodic Safety Review.
Tractebel is part of ENGIE consortium with ENDEL to propose an integrated solution including engineering and site operations.

CLIENT	**EDF**
LOCATION	**France**
PERIOD	**2018 - 2026**
SERVICES PROVIDED	**Site survey and design studies** **Lay-out & shielding studies; calculation of primary loops** **Planification of activities during outages; Tools development** **Qualification of cutting, decontamination, welding & grinding methods**