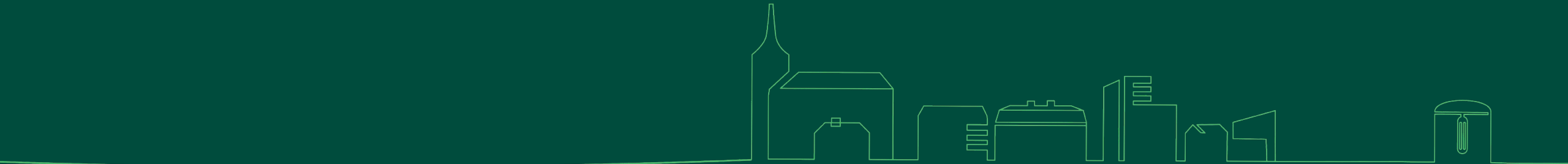


# Fortum New Nuclear

Montel Swedish Energy Day 2024, 29 May 2024, Stockholm

Jesper Marklund, Manager New Nuclear Development Sweden



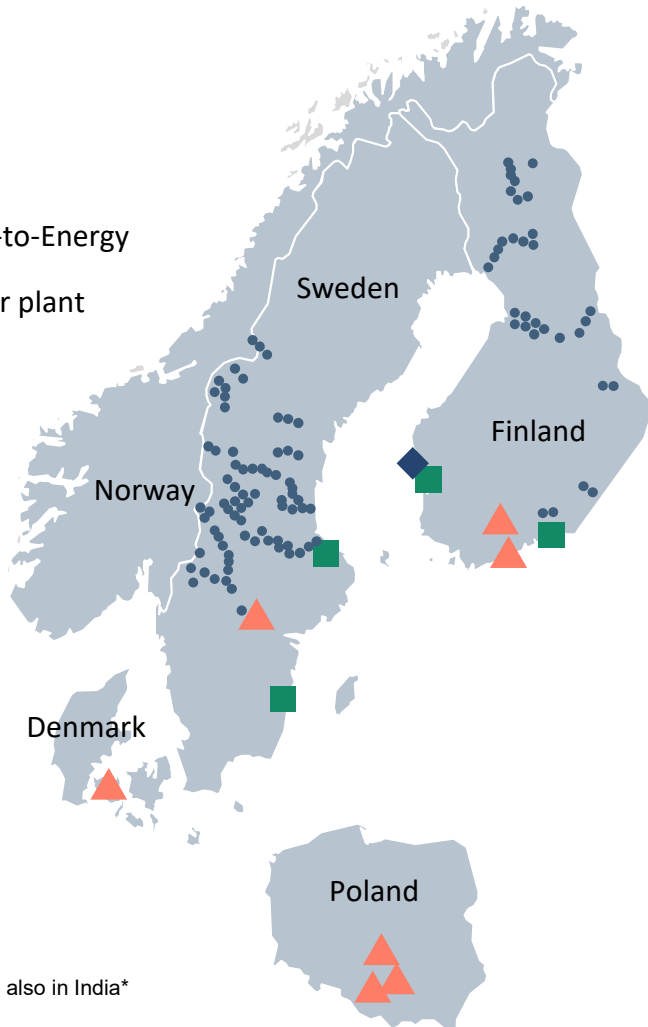
# Agenda

1. Fortum in general
2. Feasibility study for new nuclear
3. First conclusions and next steps



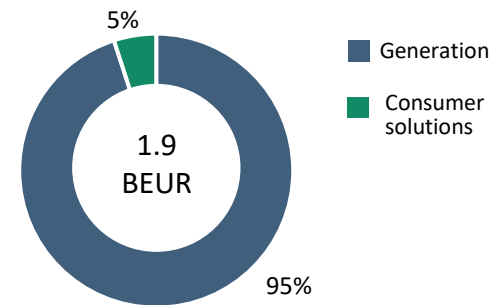
# Fortum today: We are one of the cleanest power generators in Europe – with a strong Nordic focus

- Hydro
- Nuclear
- ▲ CHP and Waste-to-Energy
- ◆ Coal-fired power plant
- ✕ Wind
- Solar\*

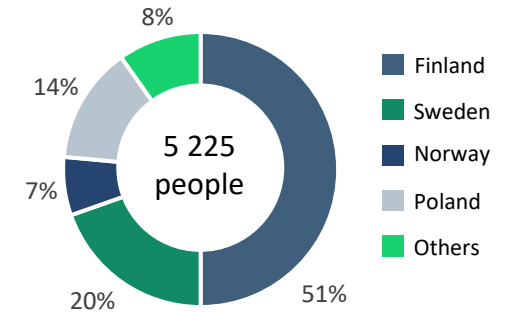


Operations also in India\*

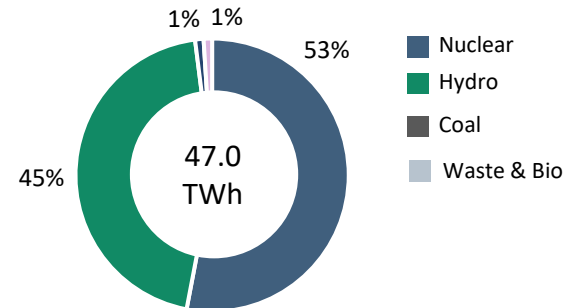
Comparable EBITDA



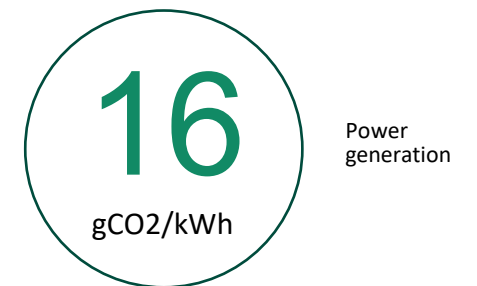
Personnel



Power generation



Specific emissions



# Fortum is a strong Nordic nuclear operator

## Key figures 2023

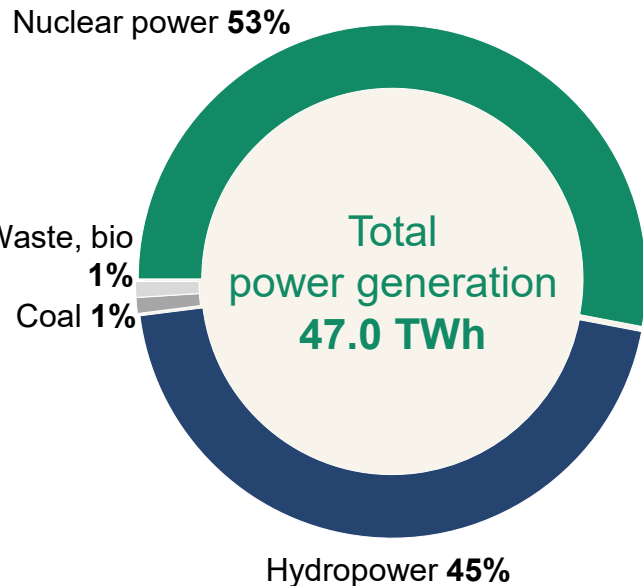
Nuclear generation **24.8 TWh**  
 Total nuclear capacity **3.2 GW**  
 Share of Fortum's total power generation **53%**  
 Nuclear professionals **~750**

**We have 40+ years' track record of safe nuclear operations and we are forerunners in responsible waste management**

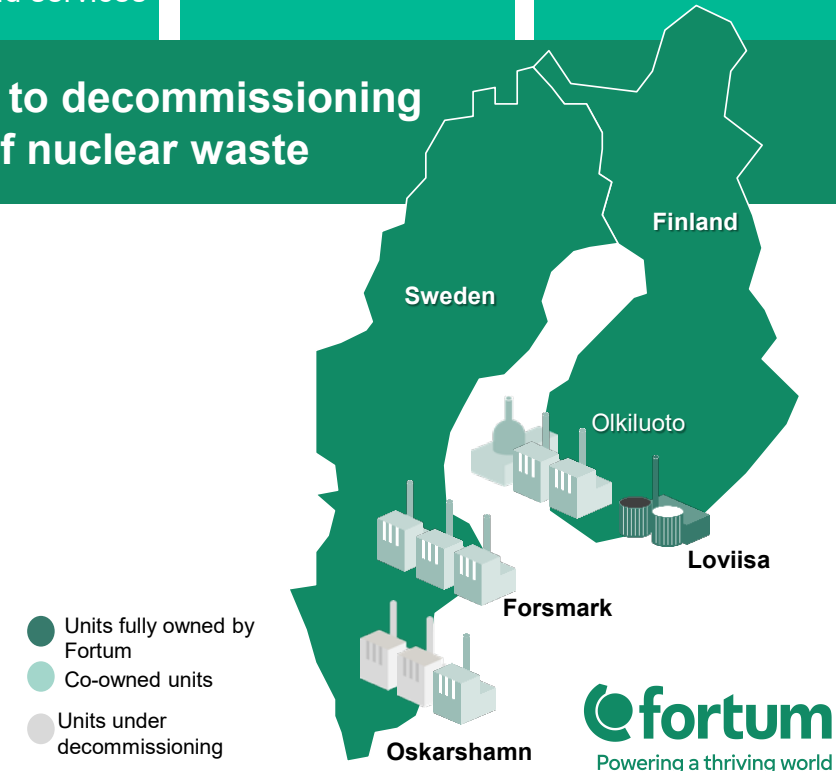
- Fully-owned nuclear power plant in Loviisa, Finland
- Co-owned nuclear power plants in Finland and Sweden
- Nuclear services provider with innovative products and services
- New Nuclear Feasibility Study in Finland and Sweden
- In-house engineering and project competences

**Expertise from new build to decommissioning and final disposal of nuclear waste**

## Fortum's power generation in 2023



Unit	Mwe (net)	Fortum Share %
Loviisa 1 Loviisa 2	507 507	100 100
Olkiluoto 1 Olkiluoto 2 Olkiluoto 3	890 890 1600	26.6 26.6 25
Forsmark 1 Forsmark 2 Forsmark 3	988 1120 1172	23.4 23.4 20.1
Oskarshamn 3 Oskarshamn 1 Oskarshamn 2	1400 decom decom	43.4 43.4 43.4



Our purpose is

**TO POWER A WORLD WHERE PEOPLE,  
BUSINESSES AND NATURE THRIVE TOGETHER.**

STRATEGIC PRIORITIES

Deliver reliable  
clean energy

Drive  
decarbonisation  
in industries

Transform  
and develop

We help societies to reach carbon neutrality and our customers to grow and decarbonise their processes in a reliable and profitable way, in balance with nature.

# Firm and clean nuclear power is needed

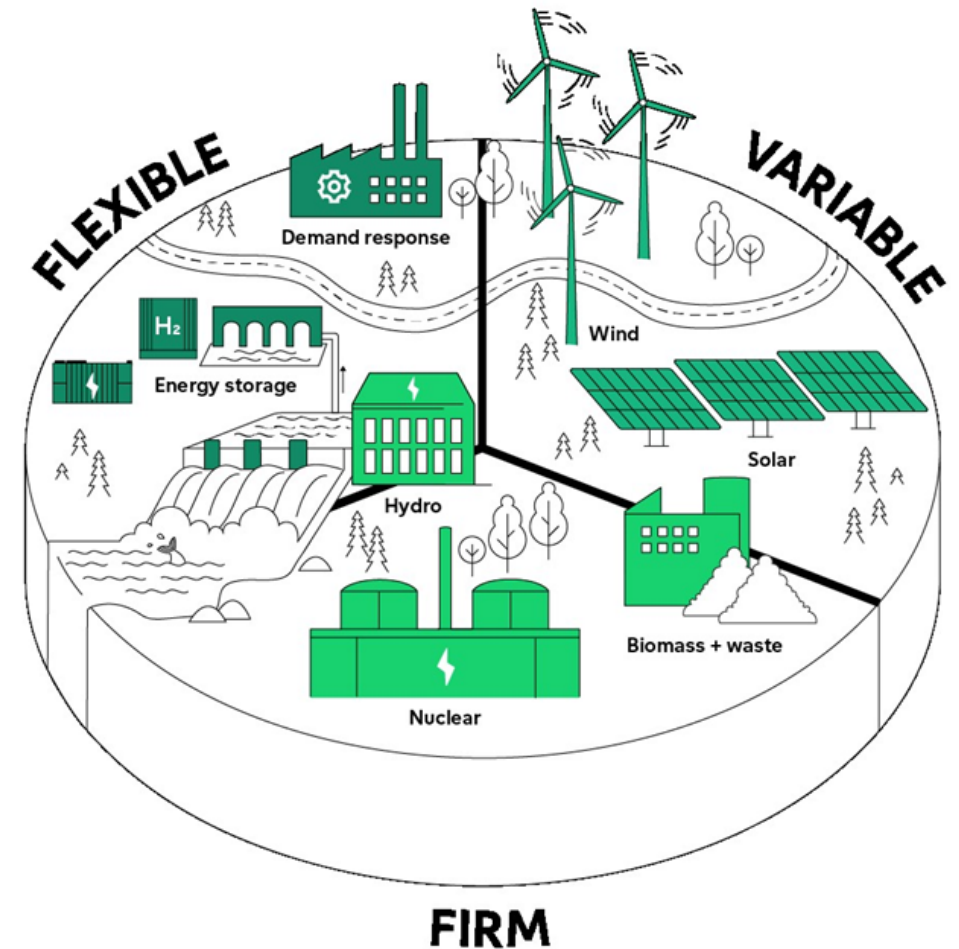
To reach our climate targets, nuclear power provides **CO<sub>2</sub>-free electricity** power production at scale

Nuclear power provides **national security of supply**, given a sufficiently diversified fuel supply

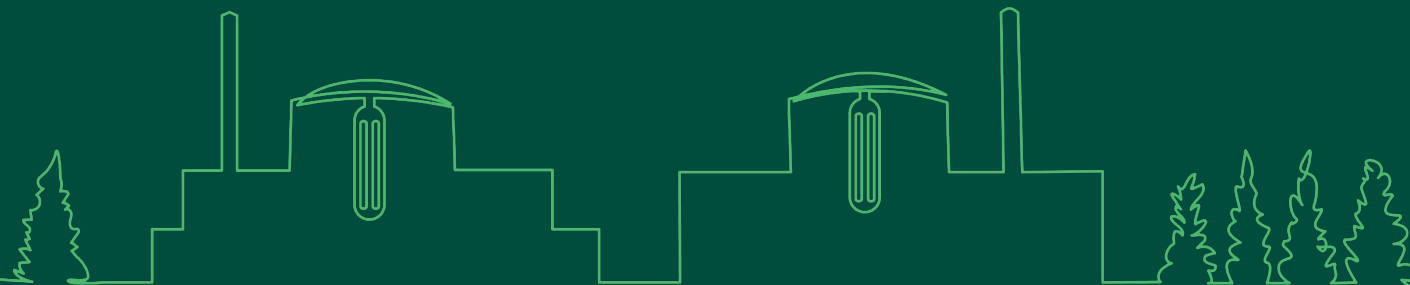
Nuclear power provides **stability to the grid**, through e.g. inertia.

Nuclear power provides a **stable weather-independent production** profile, requested by large industrial customers

We believe that new nuclear can also be **profitable**, given a successful project execution and other pre-conditions that are being determined in the Feasibility Study



# Feasibility study for new nuclear



# Feasibility study on new nuclear

**Our goal is to enable decarbonization in the Nordics and to explore the preconditions for growth in new nuclear in active dialogue with different stakeholders**

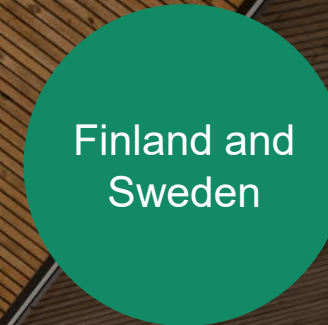
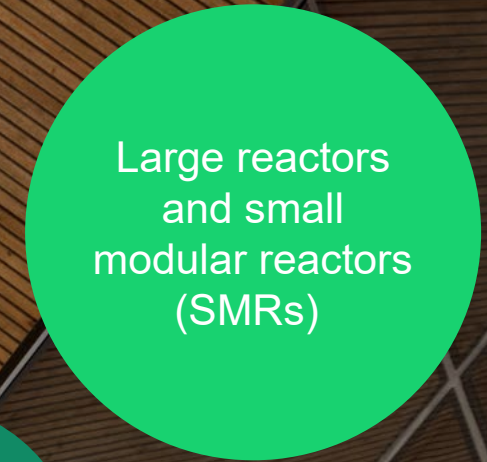
During the two-year study, we explore:

- commercial, technological, and societal, including political, legal, and regulatory conditions
- both for small modular reactors (SMRs) and conventional large reactors in Finland and Sweden.

The study also investigates new partnerships as well as new innovative business models

As part of the study, we have made several cooperation agreements with vendors and customers

The study will be completed by the end of 2024





# Our Feasibility Study evaluates technical and economical possibilities for new nuclear

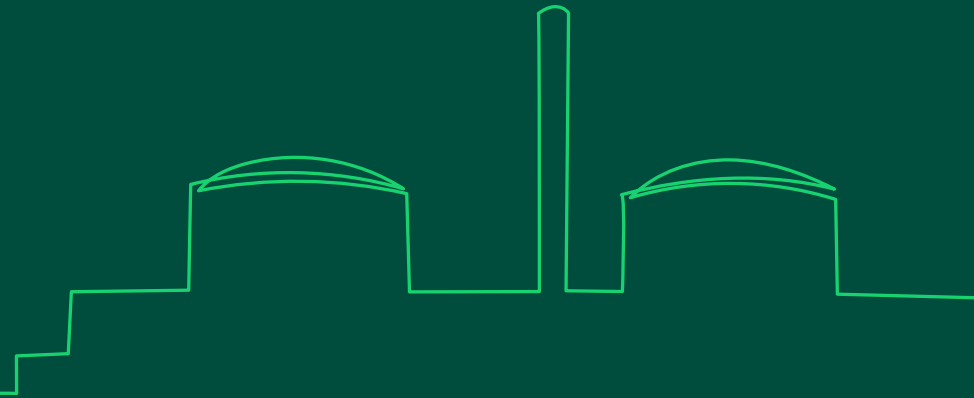
Technical		Economical	
We deepen our knowledge on the technologies available in the <b>market today</b> by collaborating with the vendors		We explore <b>business opportunities</b> in Sweden and Finland by engaging with large energy consumers	
Large nuclear power plants	Small modular reactors	De-risking (e.g. long-term contracts)	Co-investment

## Newbuild Feasibility Study activities



Comprehensive documentation done in 2023 provides a strong foundation for the rest of the study

# First lessons learnt



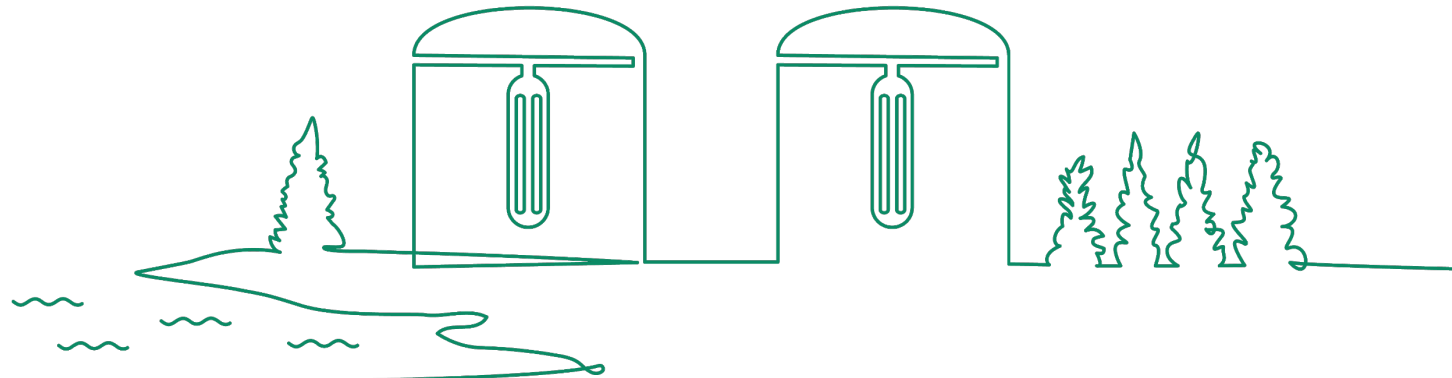
# There are markets both for large and small reactors

## Large Reactors

- + In-built economy of scale
- + Proven technologies
- + Reference plants in operation
- + Experienced vendors with lessons-learned from recent projects
- + Better cost optimization for multi-unit site
- Longer construction times
- Recent difficult projects in the Western world
- Larger CAPEX exposure

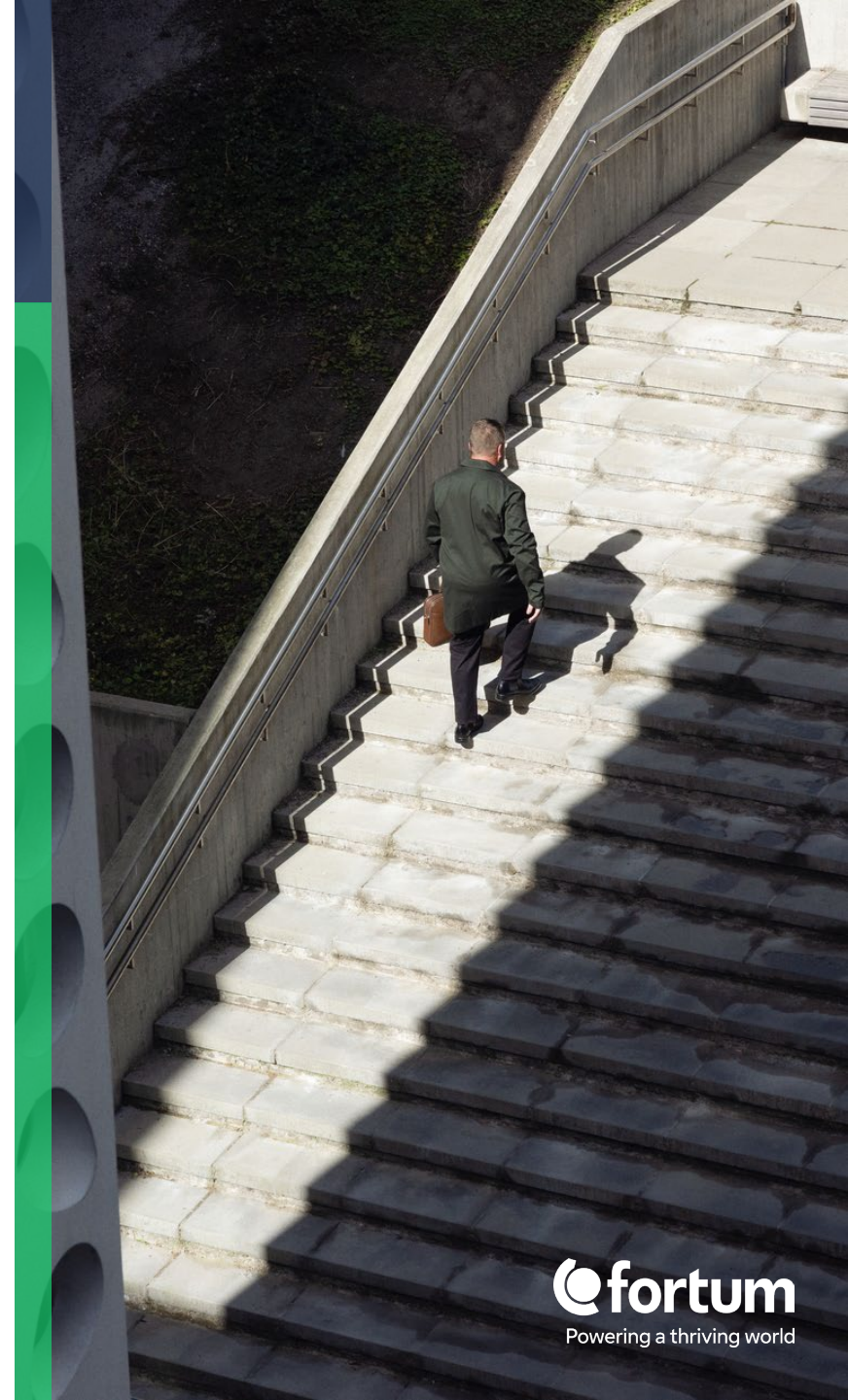
## Small Modular Reactors

- + Economy of scale through serial production
- + Simplified design
- + Shorter construction time
- + Faster learning curve
- + Possibility to install closer to cities and industrial areas
- Novel design features
- Economical competitiveness to be demonstrated
- Most of the designs not yet finalized



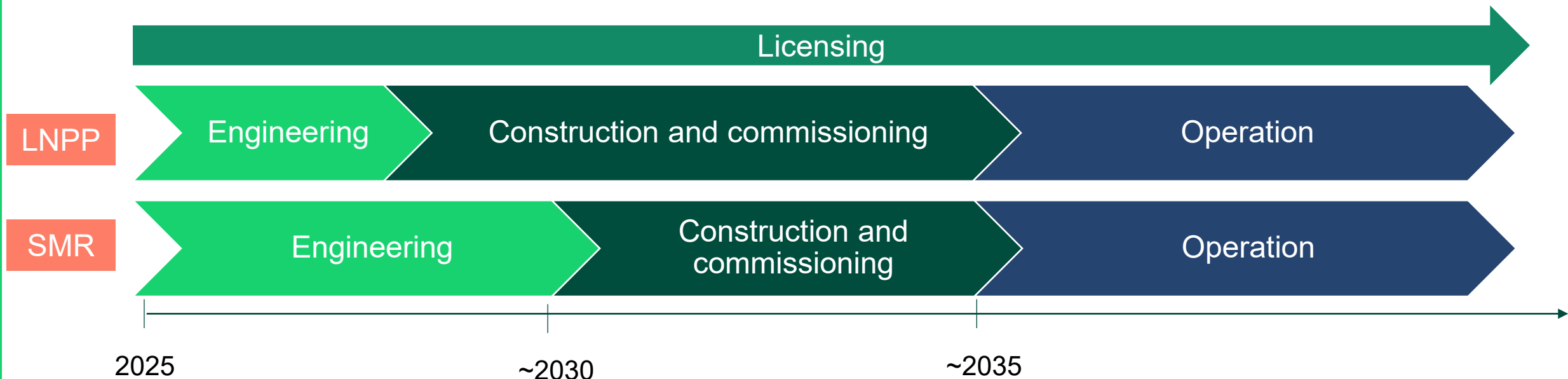
# Key learnings regarding reactor designs and reactor vendors

- Both for SMRs and large reactors the earliest possible commissioning would be **in the mid-2030s**
- SMRs would have **shorter construction** times but due to ongoing designs, **longer preparation and licensing phase** are foreseen
- **Large reactors are currently available** on the market - the focus is on the construction phase
- The reactor design should have **minimized changes** compared **to the standard design**
  - Regardless whether large reactors or SMRs
  - Both for nuclear and non-nuclear requirements
- The **experience of the vendors** varies between companies with both construction and operating experience, and companies which are new to newbuild
- **Risk management is key**: Choose either a mature technology or take part in the SMR development through strategic partnership with a supplier



# Nuclear projects take time and must start quickly to be ready by mid-2030s

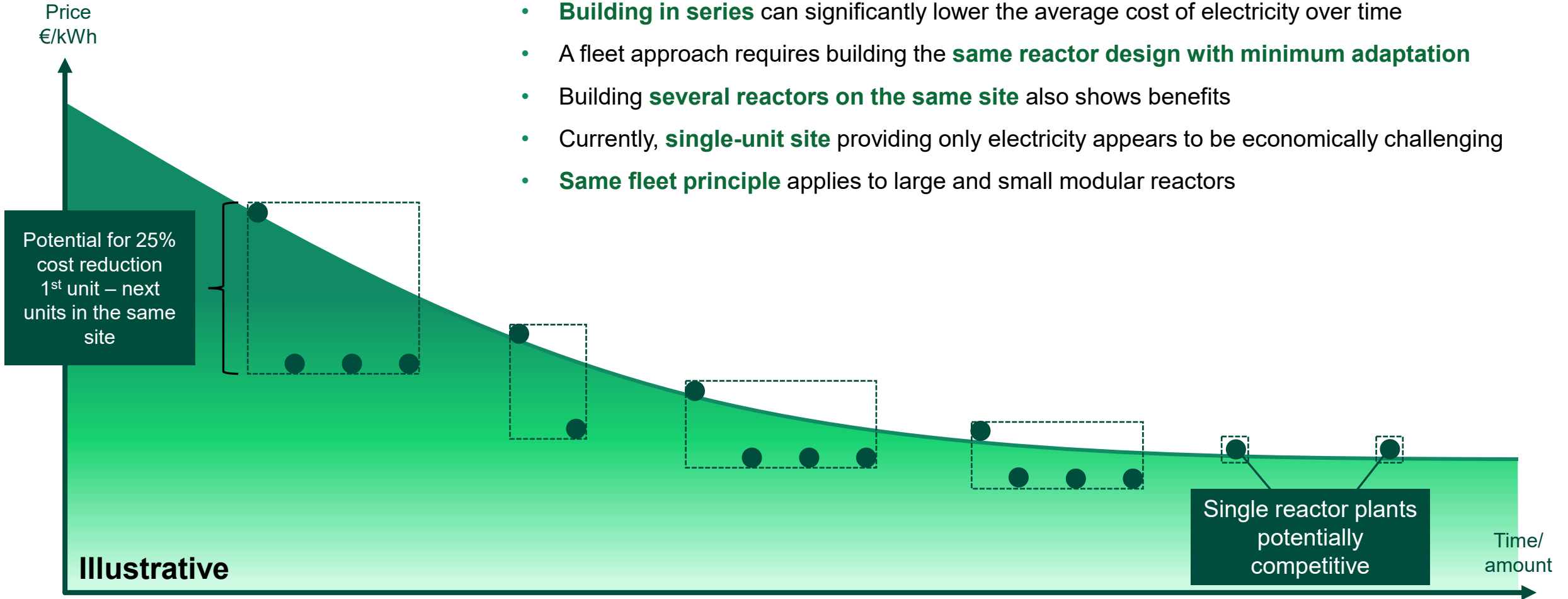
- Construction times are assumed to be **6-8 years for Large reactors** and **4-5 years for SMRs**
- Efficient licensing and permitting is a prerequisite for a smooth project execution
  - A new site is assumed to require more time to license, and permit compared to existing site
- To enable commissioning around 2035, the **engineering phase needs to start in 2025**



2025 ~2030 ~2035  
**Illustrative timeline**

# A fleet approach key to reaching competitive nuclear power production

- **Building in series** can significantly lower the average cost of electricity over time
- A fleet approach requires building the **same reactor design with minimum adaptation**
- Building **several reactors on the same site** also shows benefits
- Currently, **single-unit site** providing only electricity appears to be economically challenging
- **Same fleet principle** applies to large and small modular reactors



# We believe a fleet-approach combined with efficient public-private risk-sharing provides the best results for the Nordics

## Business model

- The interest from the industry for new nuclear as a large-scale CO2-free baseload electricity has been confirmed
- The uncertainty and volatility of the current electricity-only market does not adequately support investments into new nuclear
- Stable income mechanisms are needed to make new nuclear competitive
- Our starting point is to be operator of any future nuclear assets and we are open to co-investment setups
- Co-generation can improve the business model for SMRs

## Risk sharing

- New nuclear projects can bring stability, predictability and long-term visibility for the energy system. New nuclear could also ensure that the region remains self-sufficient with energy generation regardless of changes in geopolitical landscape
- Nuclear projects are extremely capital-intensive and front-heavy. Significant CAPEX required before any income is received from production
- Sharing risks between generation company, vendor, potential customers and the state would substantially reduce cost of capital and improve the new power plant economics. Risk sharing should be considered during entire life cycle of the project

# Current focus and next steps

After significant business and technical knowledge buildup in 2023, the focus during 2024 is on:

- **Siting**: Potential newbuild sites are investigated further in order to go deeper in business planning
- **Financing**: How to finance and de-risk the different phases of the project including the stakeholders like technology vendor, customers and society
- **Vendor evaluation**: Deep-dives in the focused designs, aiming at a shorter list at the end of the feasibility study
- **Licensing dialogue** with the regulators, also relevant ministries to be involved
- **Contract model** development is important to make the projects successful