



Investments in CO2 free power amid geopolitical turmoil

Presentation in Montel Nordic Energy Day 2023

Mats Persson, SVP Portfolio Management and Markets at Fortum

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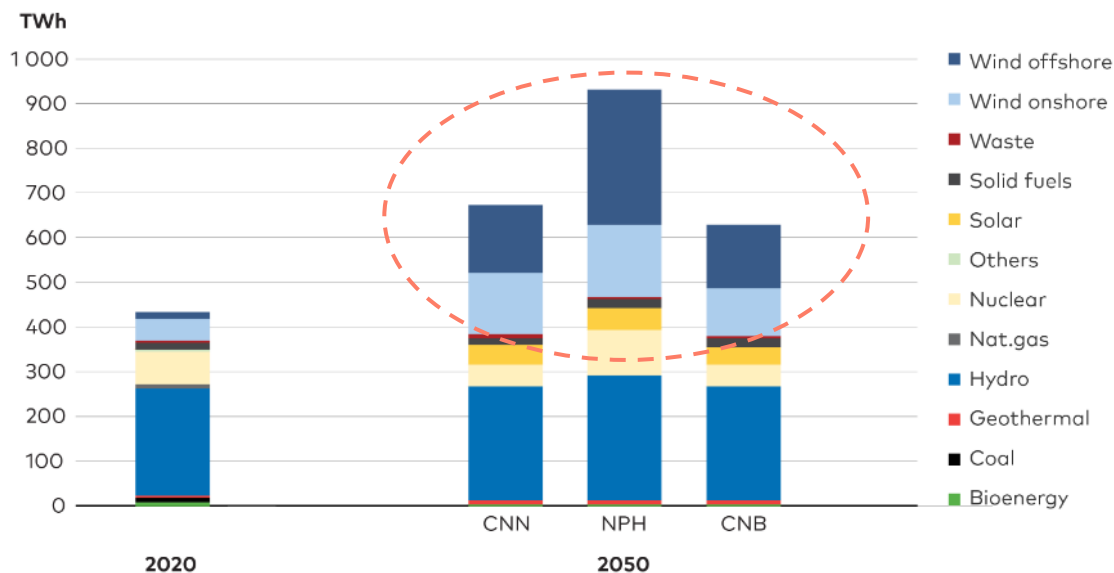
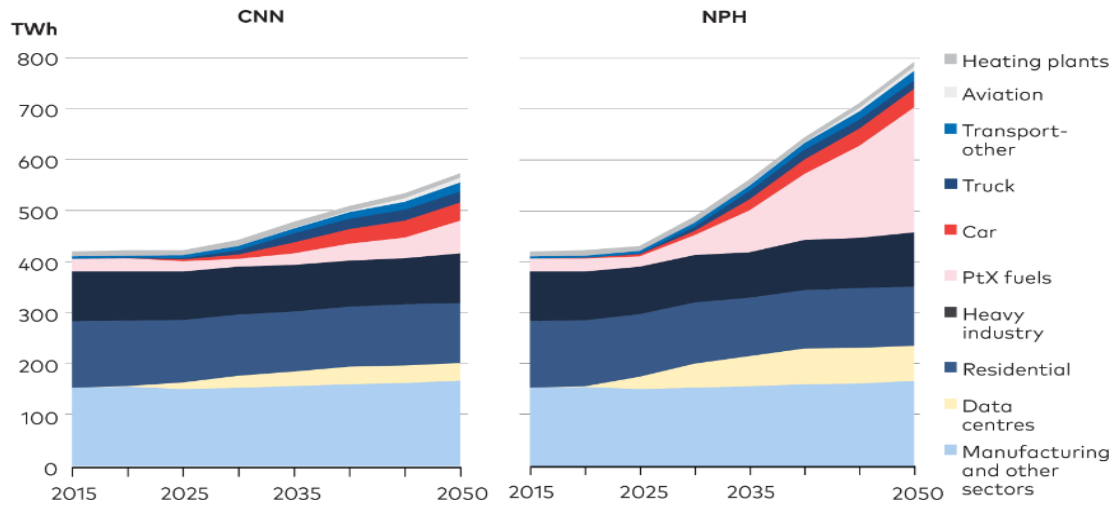
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Electrification will enable a net-zero Nordic region, and wind will be the primus motor in that journey

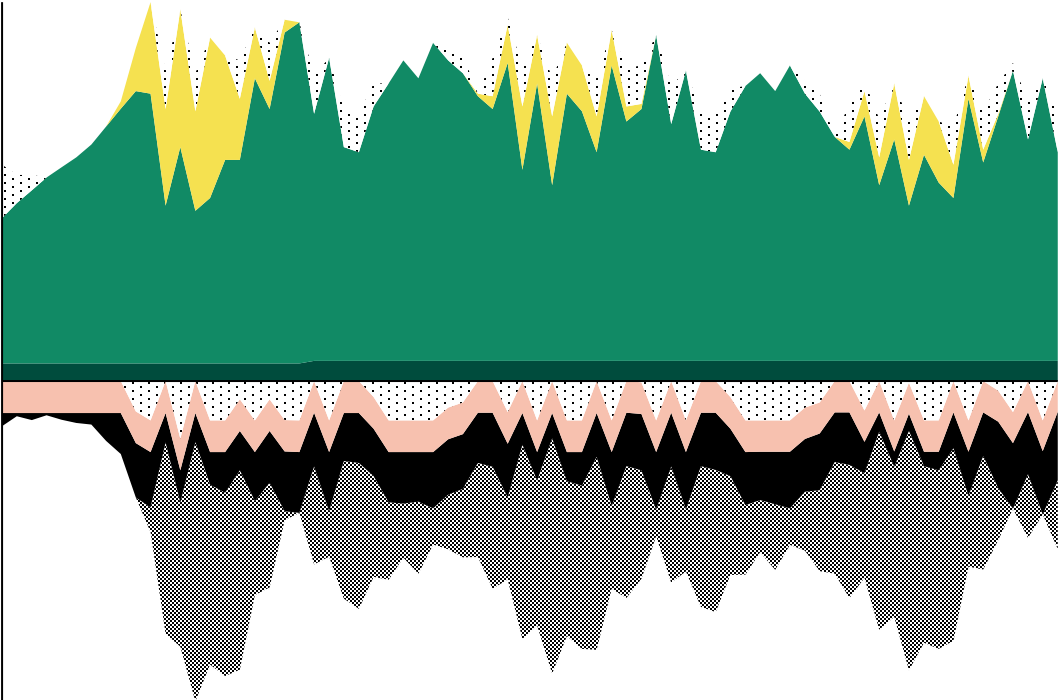


- Electricity will replace fossil fuels in transport, heating and industry. Energy efficiency also improving with electric vehicles, heat pumps, etc.
- Further emission reductions require clean hydrogen replacing fossil energy
- Onshore and offshore wind power will clearly be the biggest contributors. Solar power is a good addition, with most generation during the summer period when wind power produces less.
- Fortum is actively taking part in this growth: Pjelax-Böle (380 MW, 1.1 TWh), operational in 2024

A renewables dominated system needs an adequate amount of dispatchable capacity for back-up

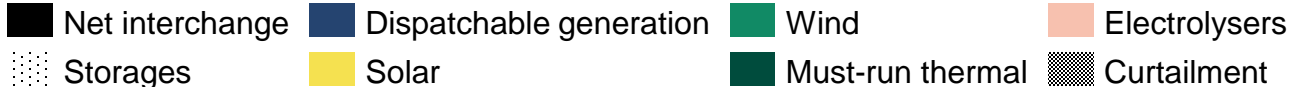
High renewables period:

Low need for dispatchable capacity, excess power directed to electrolysis, export and curtailment



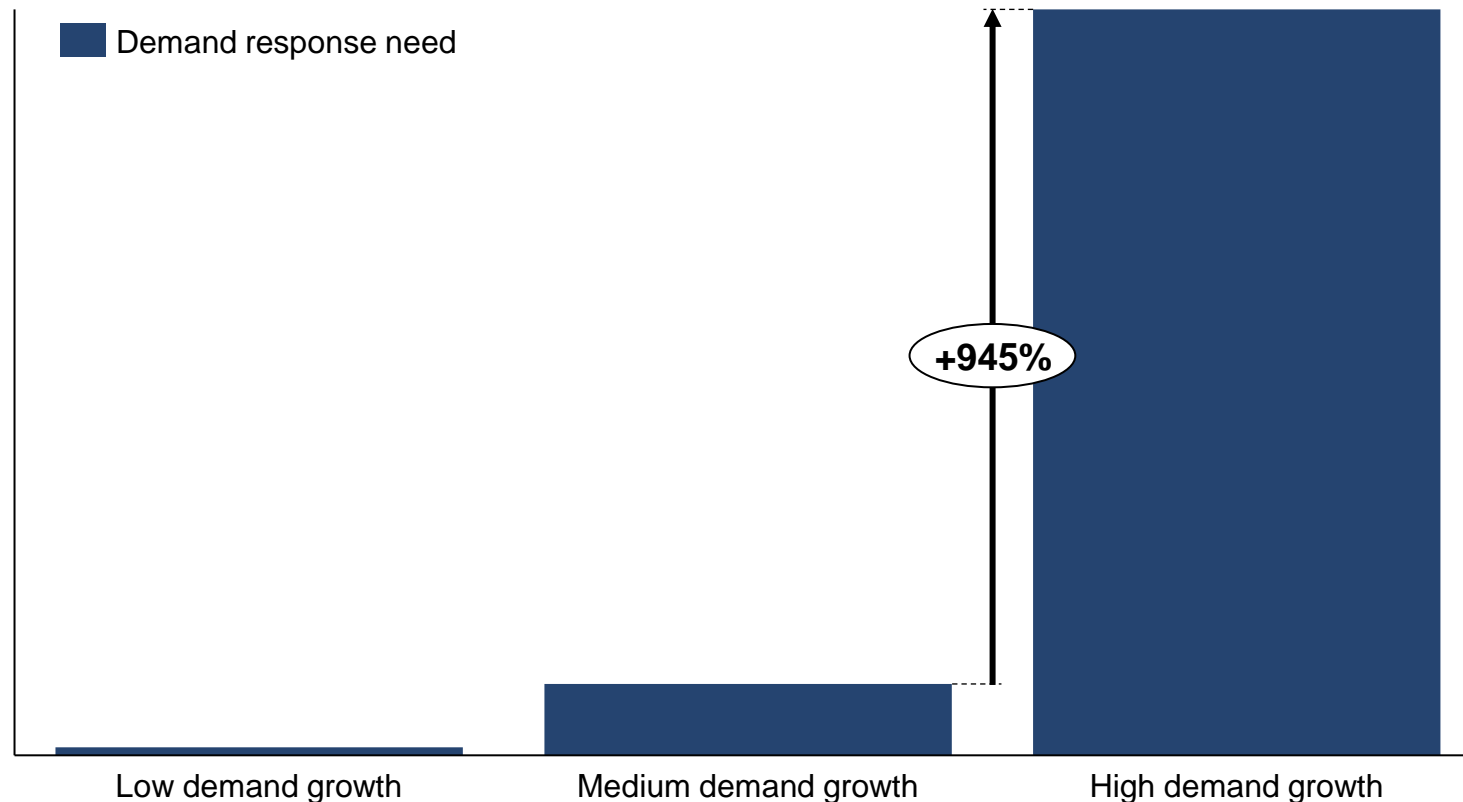
Low renewables period:

High need for dispatchable capacity and imports



Our models identify a clear “breaking point” in the Nordic system, if aggressive demand increase would only be 1:1 matched with new onshore wind

Annual energy volume (GWh) on a normal weather year

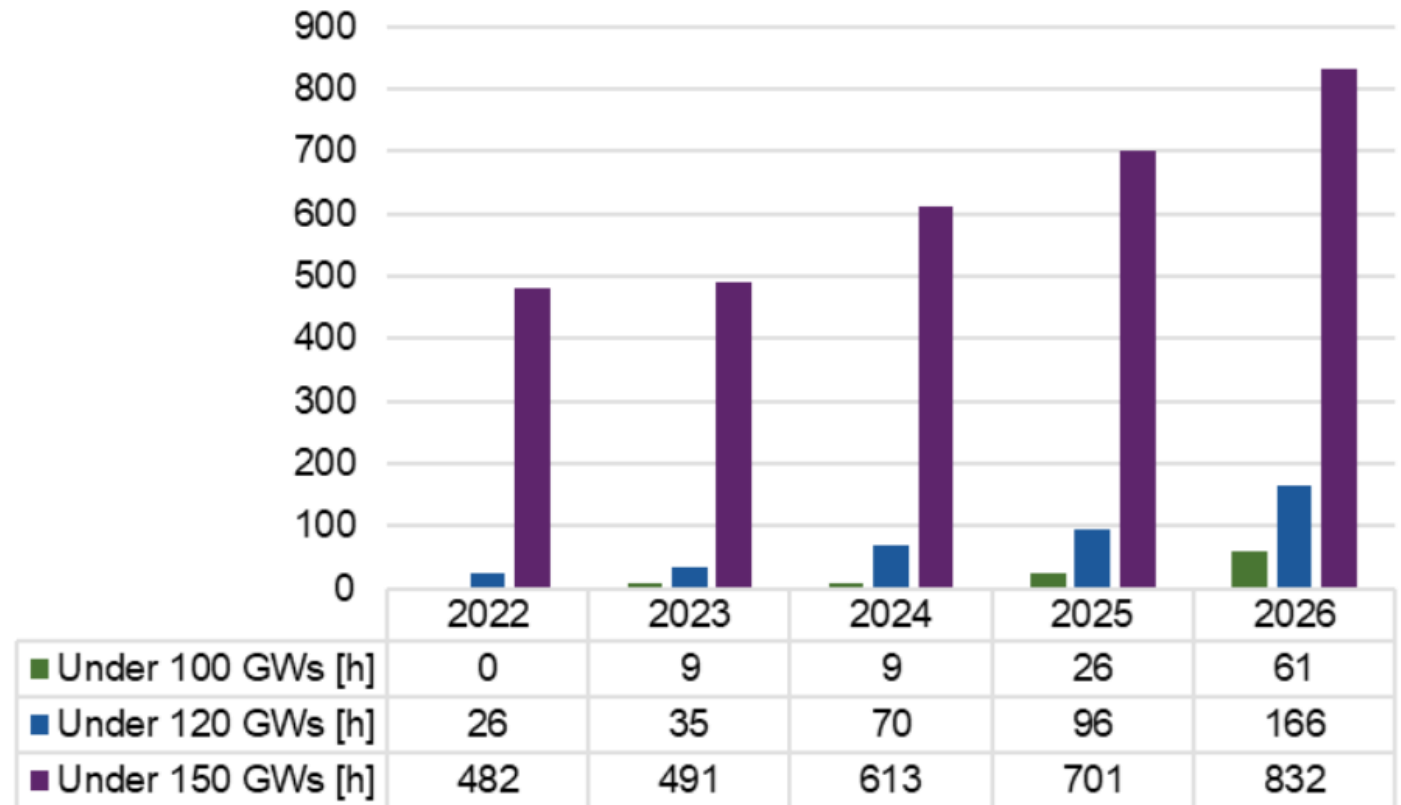


- Assumption: new demand met in 1:1 annual matching with new onshore wind
- In case no dispatchable capacity is added, the Nordic system starts to need to rely excessively on demand-side load moving and ultimately shedding to be in balance
- If demand response is not adequate, the system security of supply and overall stability is at risk
- Financing such capacity additions in the current market structure is very challenging, if not impossible

Beyond peak capacity adequacy, we also need to guarantee system stability in the Nordics

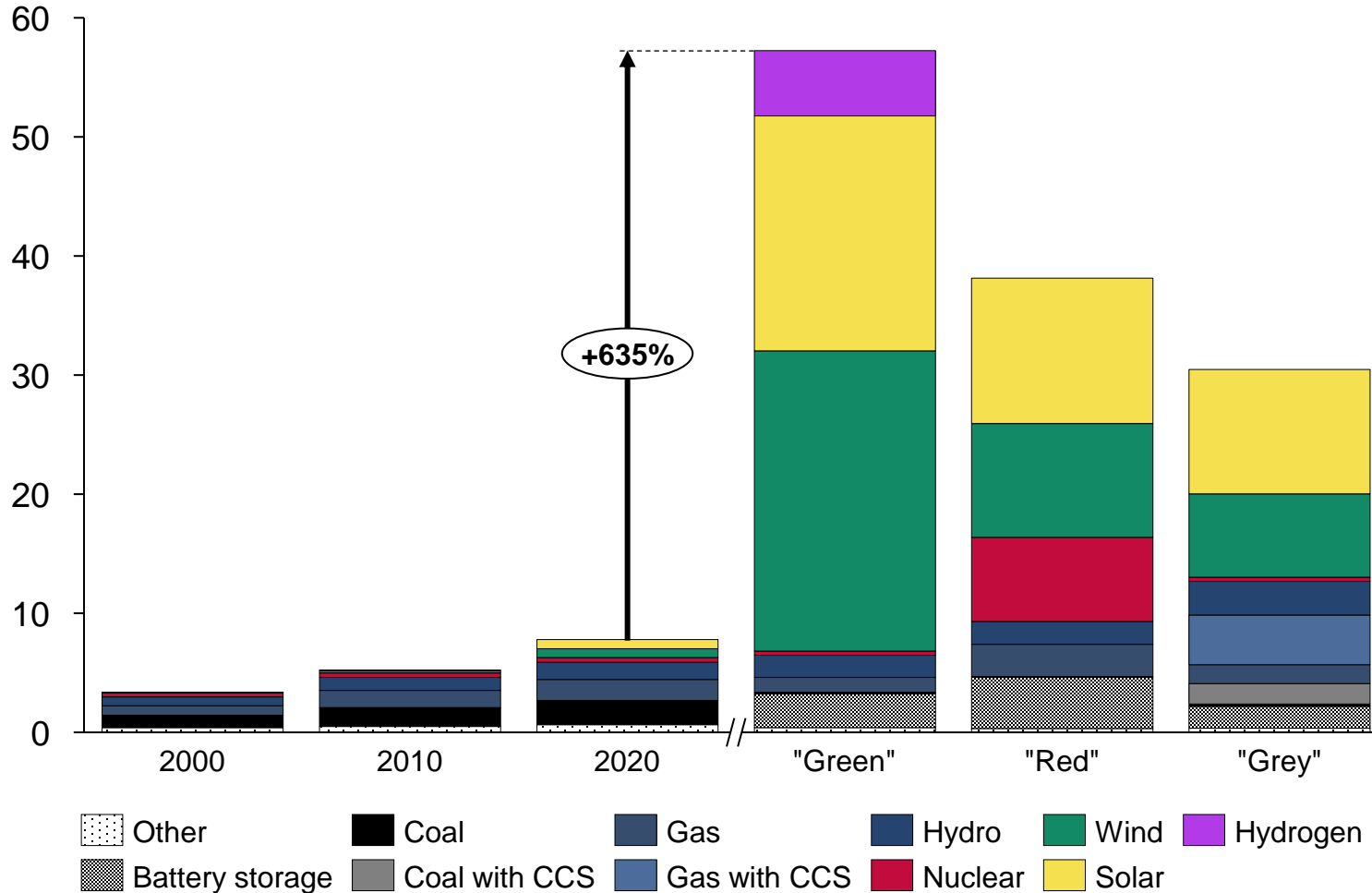
- Historically, the Nordic power system has had a good level of inertia – but the level is decreasing fast, leading to problems:
 - In 2018, the max production in Oskarshamn nuclear power plant was limited as a result of low inertia
- Type of production and location in the grid is increasingly important:
 - In 2020, Svenska Kraftnät emergency-procured plannable production in southern Sweden to ensure system stability (reactive and short-circuit power)
- Availability of important production units also impacts transmission capacity:
 - Transmission capacity on Fennoskan impacted by Swedish nuclear output
- The Nordic TSOs see a need for new types of system services in addition to huge grid investments:
 - Inertia, FFR
 - Voltage regulation, reactive power

Antal timmar per år med låg rotationsenergi



What kind of net zero carbon energy system do the society and energy customers want to have?

Global installed capacity (TW)



Net zero carbon can be achieved with different technology mixes:

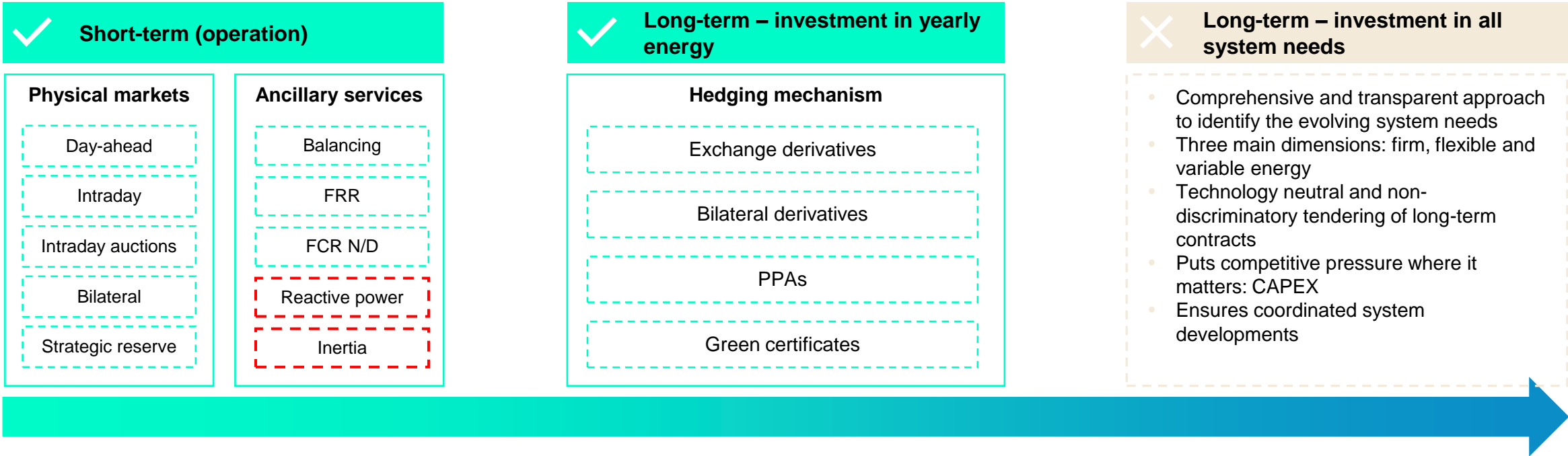
- “Green”: renewables forming the bulk of clean electricity and hydrogen production
- “Red”: nuclear complementing renewables, less need for clean dispatchable capacity
- “Grey”: remaining fossil fuel emissions abated with CCS, blue hydrogen also important

Is going all-in in the “Green” way the most cost-effective and secure alternative? Are energy customers ready to live with high volatility such a system entails?

We need an investment framework to complement today's short-term and energy focused markets

Key framing principles for an investment framework fit for Net Zero

- **Build on existing markets to deliver short term operation efficiency** and overlay a structured framework to meet long term policy objectives
- **Identify the evolving system needs** and ensure that the **contribution of all resources is adequately rewarded**
- **Revise governance to ensure holistic planning** and unbiased / transparent definition of system needs
- **Implement contracting arrangements for the long-term system** needs to provide credible commitment towards policy objectives

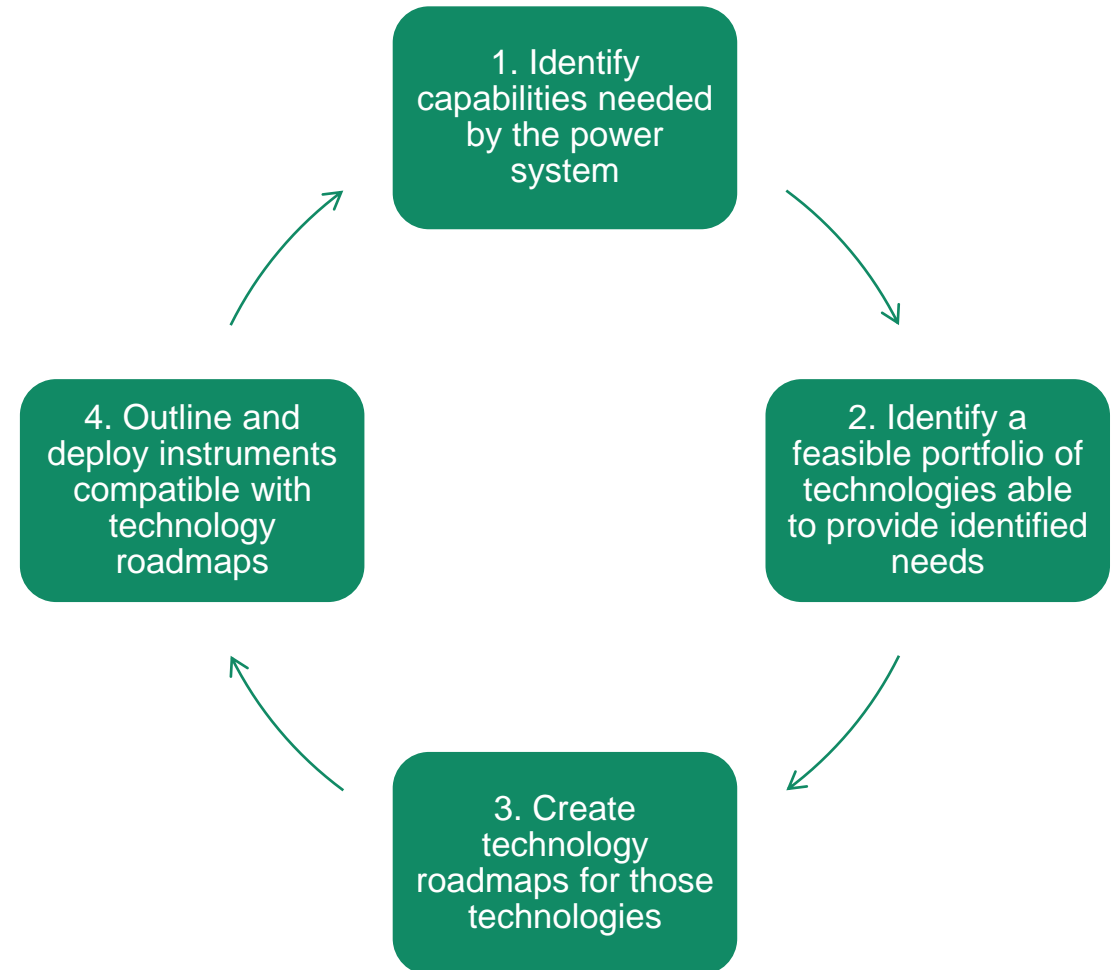


The only sustainable and affordable way out from the current crisis is to massively invest in decarbonisation and security of supply

1. The European energy landscape is currently extremely volatile and uncertain. Affordability and security of energy supply are in key societal focus.
2. There are no easy tricks available: in the short-term, the only way out is to reduce demand; in the mid-to-long-term, we need to massively step up investments to secure the targeted clean energy transition.
3. However, it is naïve to think adding only intermittent renewables would be sufficient. The time of confrontation between different clean energy sources is over.
4. Today's predominantly energy-remuneration based markets do not credibly and effectively incentivise all needed investments. We need a holistic planning and investment framework, taking into account all energy system needs today & tomorrow.

Fortum's answer to Fingrid and SvK consultations on capacity adequacy

- Fortum stresses the fact that the **Nordics have reaped benefits from the strong power system backbone** and that **short term markets** and their price signals have proven to well **optimise existing resources** – delivering security and cost-efficiency
- However, **marginal pricing leaves the power system chronically scarce** and does not provide the levels of stability and security expected by citizens
- Furthermore, successful **decarbonisation via electrification provides a centennial opportunity for society** to reap more benefits than only outright mitigation of carbon emissions
- Fortum is calling for a recurring process, starting from a **holistic assessment of system needs and eligible technologies, followed by concrete technology roadmaps and instruments** for delivering solutions for the needs in the long-term
- In our view, **such a scheme would both ensure a rapid decarbonisation of our societies** and attract large-scale industrial electrification investments by providing a **stable, clean and affordable energy system**



Thank you!



Mats Persson
SVP Portfolio Management and Markets

mats.persson@fortum.com