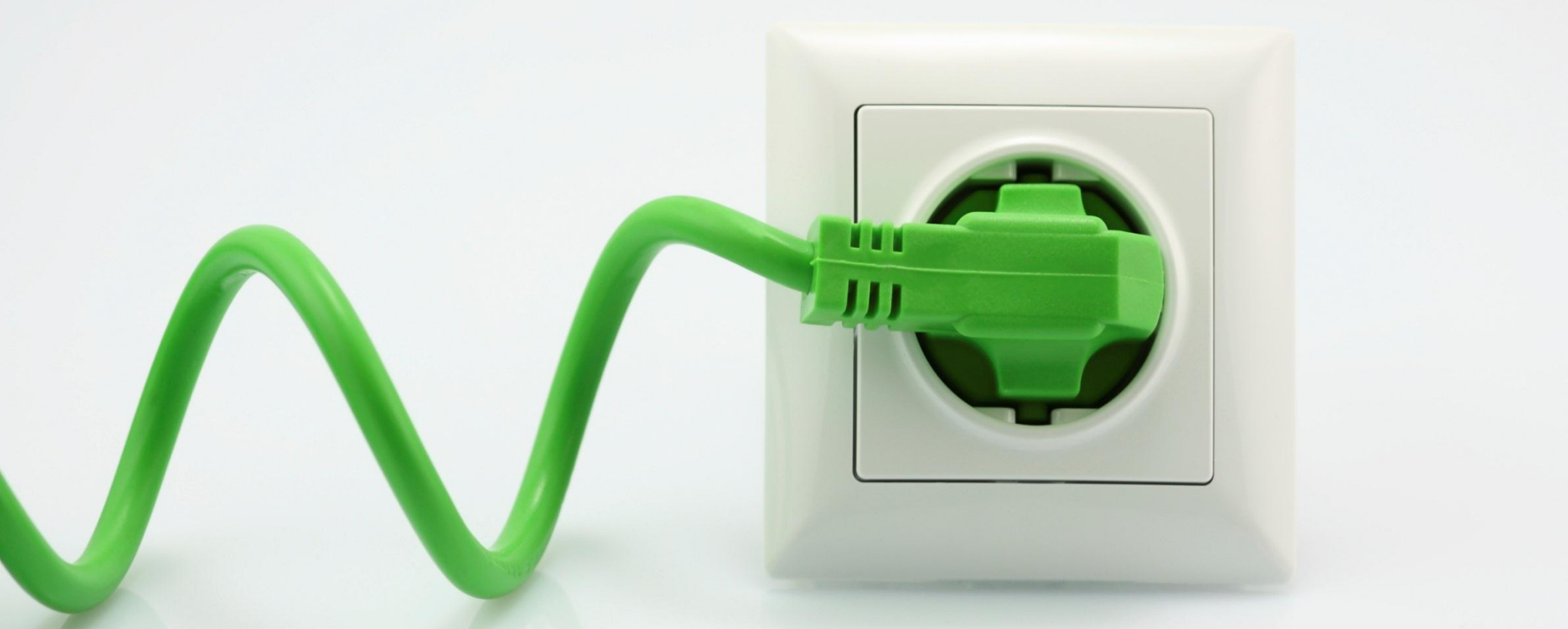

Electricity market developments in Nordic/Baltic and Russia

Tallinn, 30.9.2015

Simon-Erik Ollus, Chief Economist, Fortum

Next generation energy company | Fortum

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Past performance is no guide to future performance, and persons needing advice should consult an independent financial adviser.

Summary

- **Nordic and Baltic power market a pioneer in power market development:** Affordable power prices, low emissions, good security of supply
- **Multiple demands on power market going further**: Technological development, decarbonisation, renewables, consumer behavior and digitalization changes the scene
- **Strong growth of subsidized RES and poor power demand** has decreased power prices to unsustainable low levels.
- **Consumer plays an increasingly important role**. And the Electricity market need to incentivize them to be active.
- **The Russian Power Market reform** was the World's largest single power market reform and completed by end of 2010. Russian power market consist of two markets, one for energy and one for capacity
- **Russian heat sector reform** started enabling Russia to decrease energy intensity of its economy

Content

- Summary
- **Fortum briefly**
- Nordic & Baltic energy markets and challenges
- Russian energy markets and challenges

Our current geographical presence

Nordic countries


Power generation


Heat


Electricity sales

Power generation	48.0 TWh
Heat sales	3.3 TWh
Electricity customers	1.3 million

Key figures 2014

Sales	EUR 4.1 bn
Comparable operating profit	EUR 1.1 bn
Balance sheet	EUR 21 bn
Personnel	8,200

Russia

OAO Fortum

Power generation	23.3 TWh
Heat sales	26.0 TWh

Poland

Power generation	0.7 TWh
Heat sales	3.4 TWh

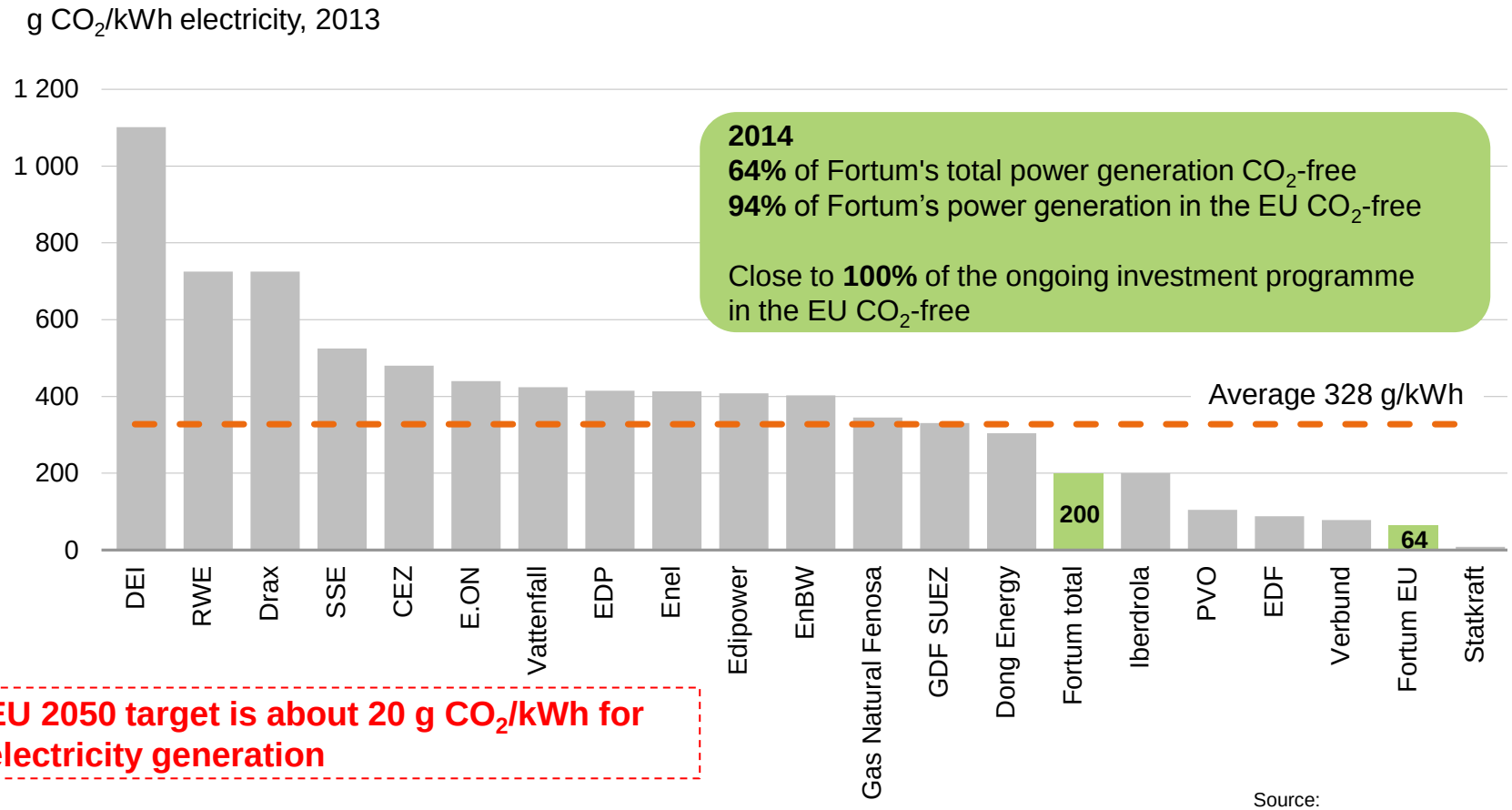
Baltic countries

Power generation	0.7 TWh
Heat sales	1.2 TWh

India

Power generation	9 GWh

Fortum's carbon exposure among the lowest in Europe

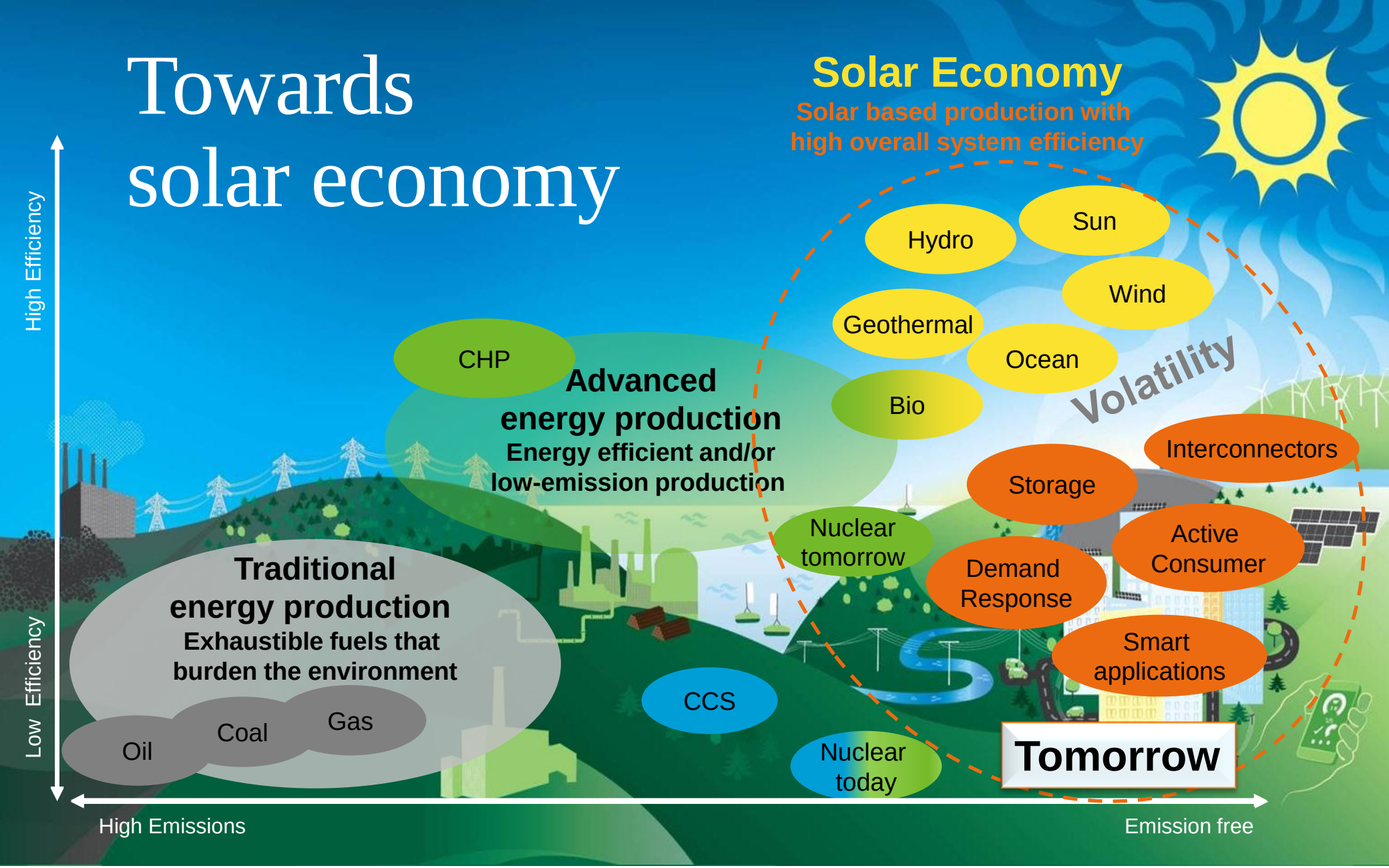


EU 2050 target is about 20 g CO_2/kWh for electricity generation

Note: : Fortum's specific emissions of the power generation in 2014 in the EU were 39 g/kWh and in total 177 g/kWh.
Only European generation except "Fortum total" which includes Russia.

Source:
PWC & Enerpresse, December 2014
Climate Change and Electricity, Fortum

Towards solar economy



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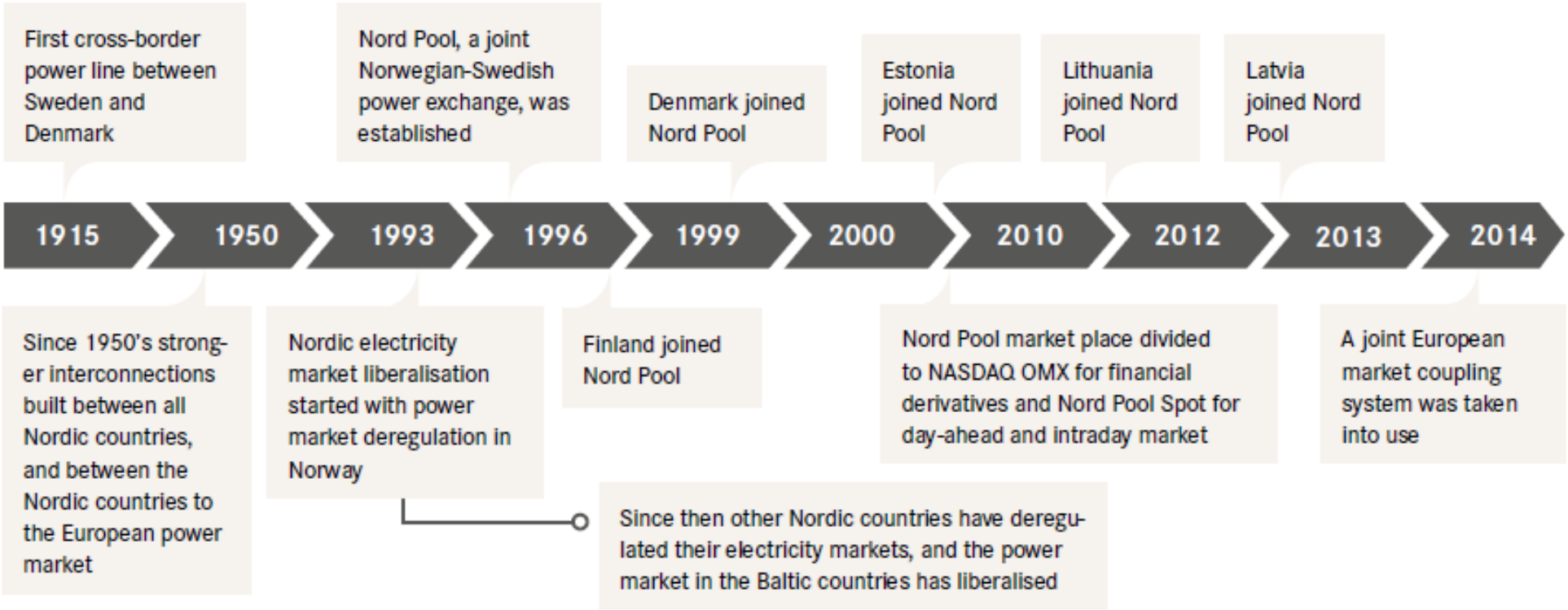
Content

- Summary
- Fortum briefly
- **Nordic & Baltic energy markets and challenges**
- Russian energy markets and challenges

Nordic market the pioneer in power market liberalisation and regional electricity markets.

Nord Pool market was created in 1993, today 7 countries involved

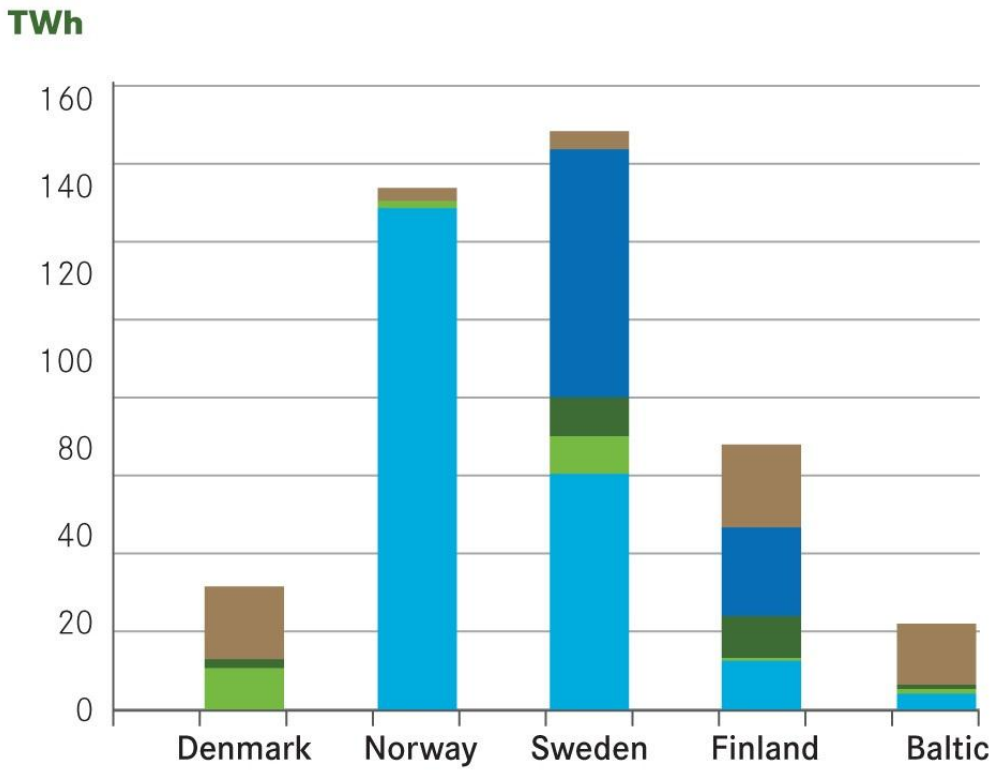
- Nordic electricity market is the outcome of far-sighted and determined cooperation
- Today the market covers seven countries



Source: Fortum

Excellent generation mix in the Nordic and Baltic countries

Over a half of power generation is flexible hydropower



Total generation in 2013	Nordic 383 TWh		Baltics 22 TWh	
	TWh	%	TWh	%
Fossil fuels	48	13	16	72
Nuclear	86	23	–	–
Biomass	23	6	1	5
Wind	23	6	1	5
Hydro *	203	53	4	18

Nordic net export in 2013: 0.4 TWh
Baltic net import in 2013: 4.8 TWh

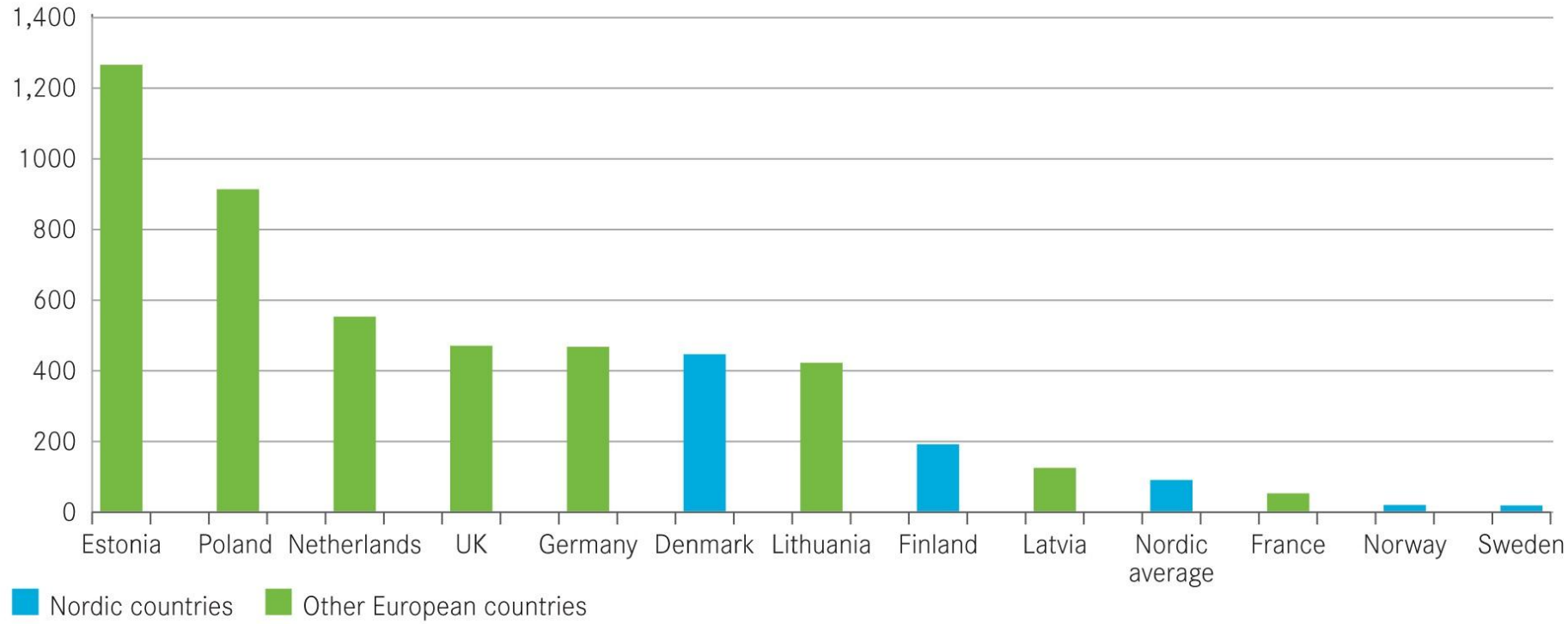
* Normal annual Nordic hydro generation 200 TWh, variation +/- 40 TWh

Source: ENTSO-E Statistical Factsheet 2013

The Nordic countries have one of the world's lowest CO_2 emissions levels

Average emissions are only 80 g CO_2/kWh

Electricity generation's specific CO_2 emissions, gCO_2/kWh in 2011



*) Estonia year 2000

EU 2050 target is about 20 g CO_2/kWh for electricity generation

Source: Eurelectric Power Statistics & Trends 2013

Nordic power market structure; classical structure regulated transmission and distribution systems, while competitive wholesale and retail markets

NordpoolSpot = Day ahead and Intraday market
Nasdaq = Financial market

Competitive businesses

Generation

Export, import, market coupling

Nordic wholesale market

Power exchanges and bilateral

Large customers

Retail companies

Private customers, small businesses

Regulated businesses

Transmission and system services

Distribution

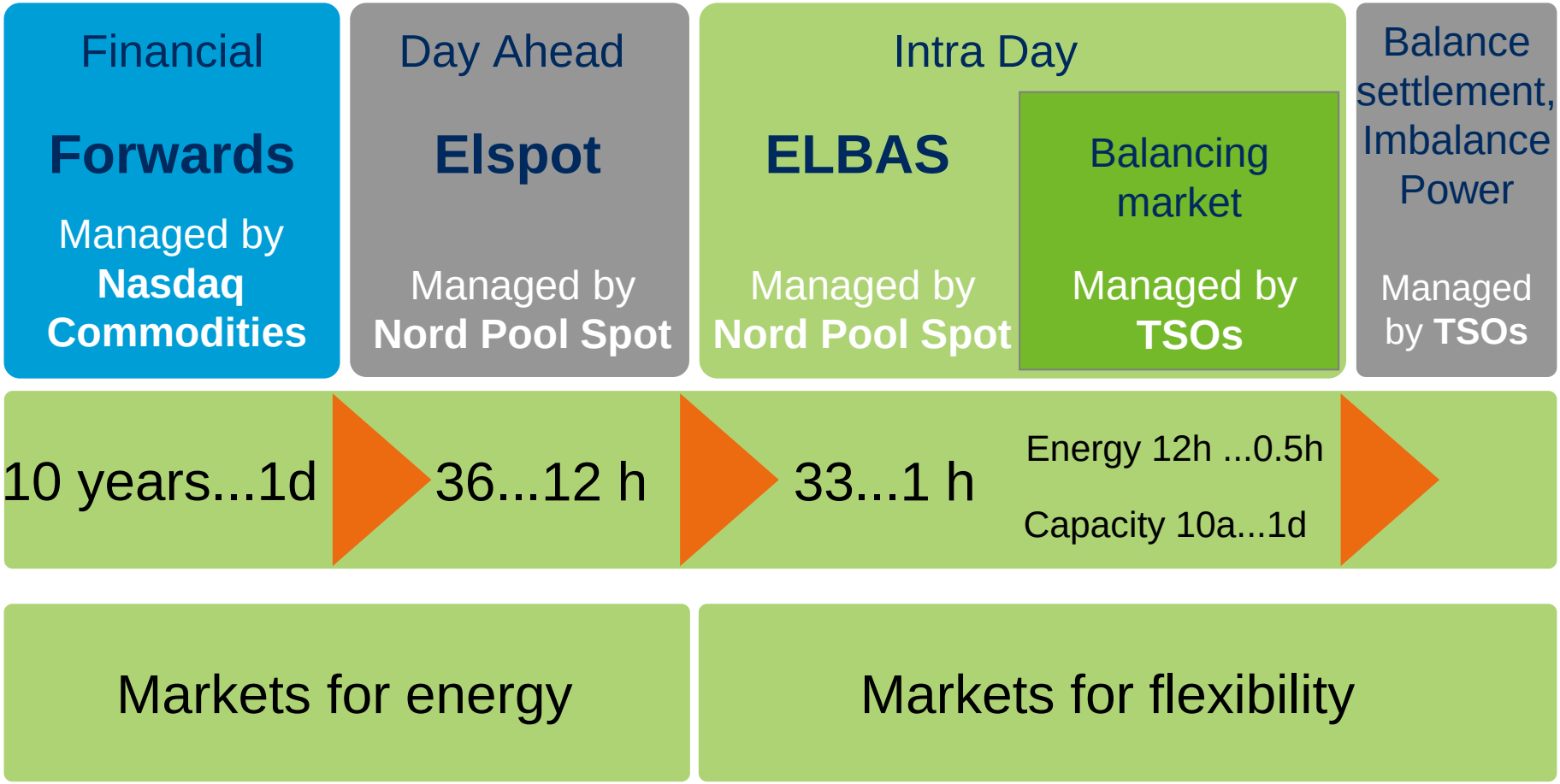
Independent transmission system operator

Large customers

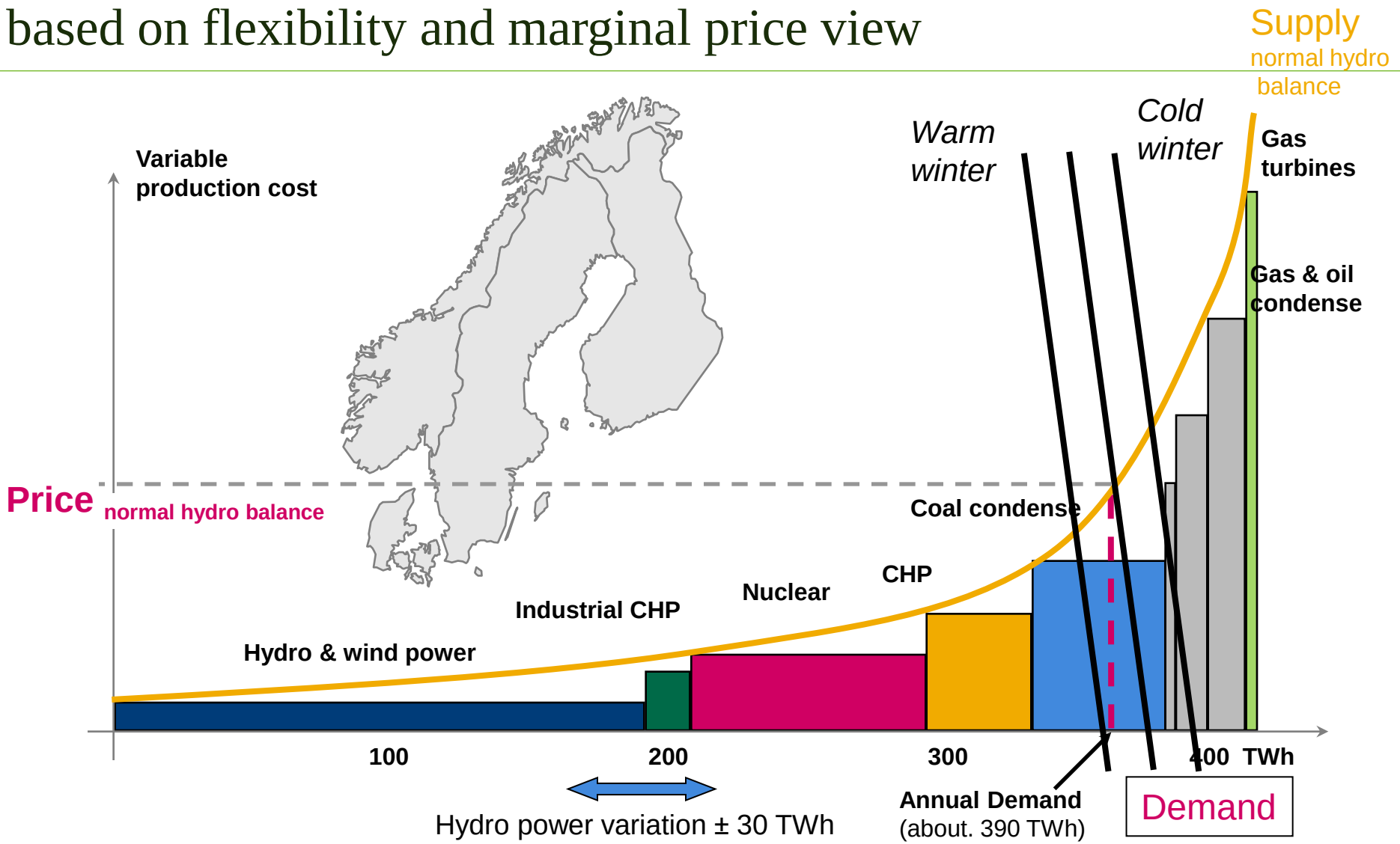
Retail companies

Independent distribution company

Nordic wholesale markets consists in fact of several market places

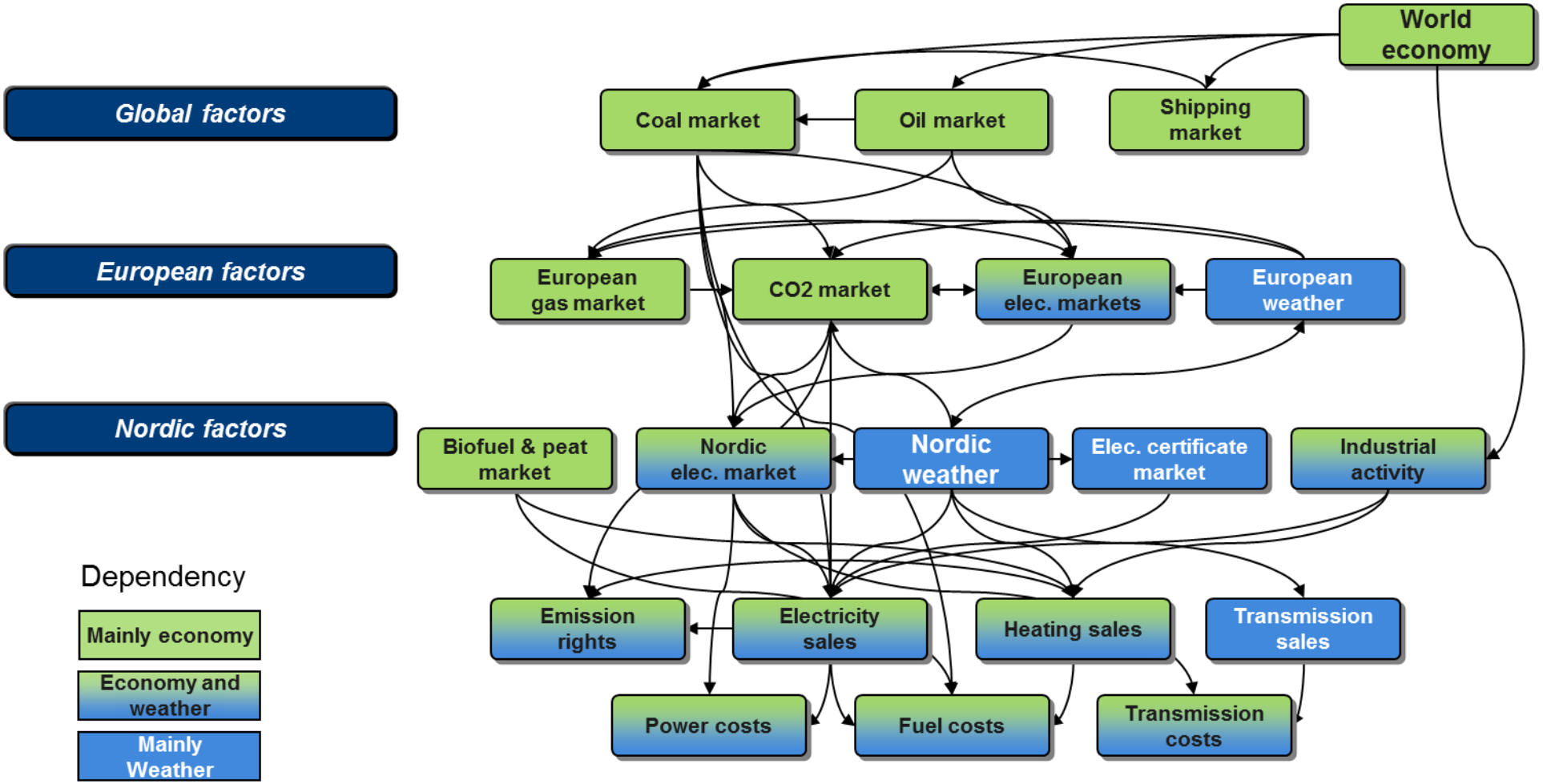


Price formation in Nordic power market – hydropower utilized based on flexibility and marginal price view



Nordic power price forecasting is dependent on several factors

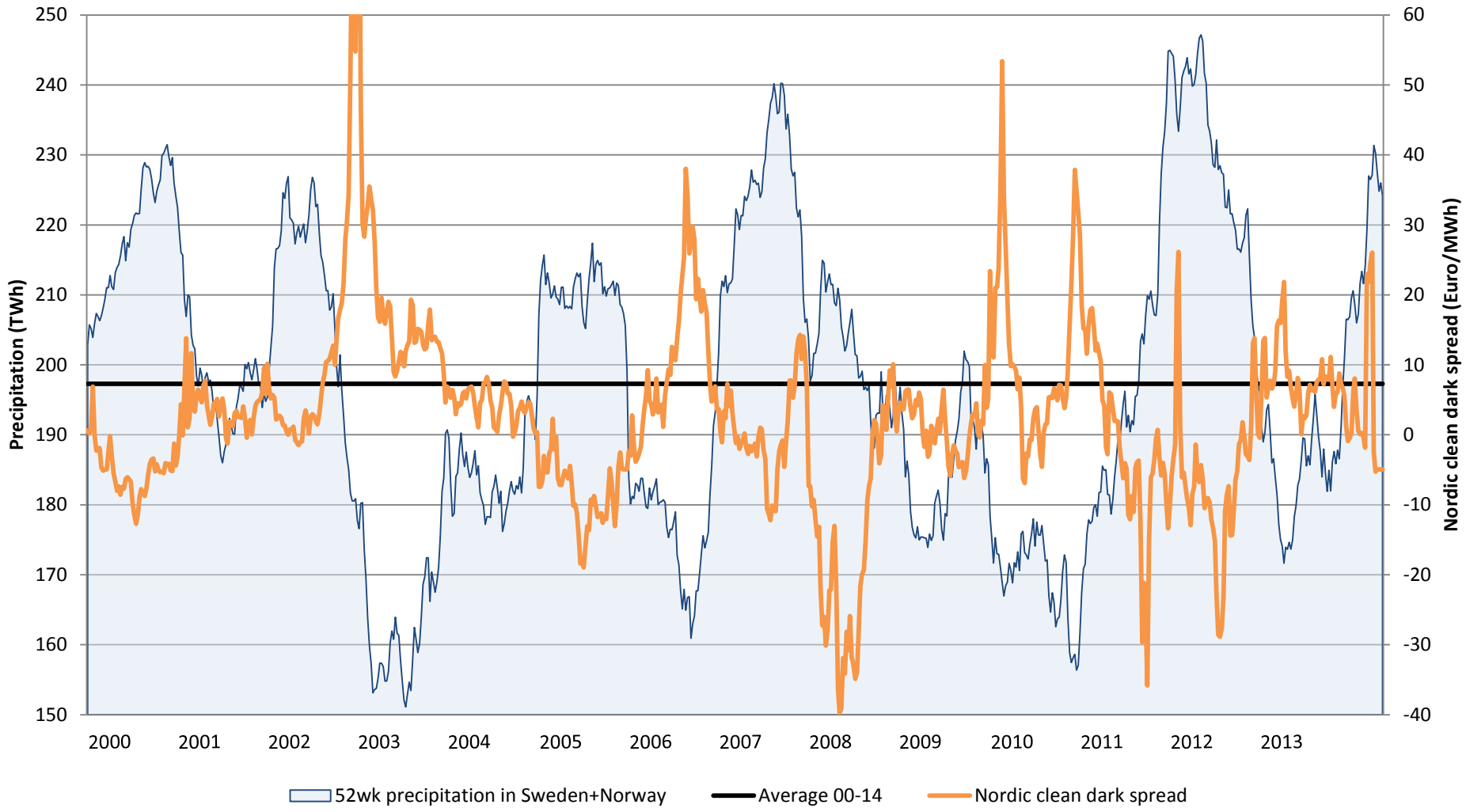
Success in production optimization requires mastering the complexity of the Nordic power market



* Global economy affects both power demand (industrial activity in Nordics) and price of fuels

Precipitation in the Nordic system can fluctuate by ca. 80 TWh/a

This is equivalent to total Finnish demand and ca. 20% of the Nordic consumption



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Nordic, Baltic, Continental and UK markets are integrating – interconnection capacity will double by 2021

The Northern Seas Offshore Grid and the Baltic Energy Market Integration Plan are included as priority electricity corridors in EU's Infrastructure Guidelines, approved in April 2013

Two 1400 MW NO-UK links as EU Projects of Common Interest: NSN link to England agreed to be ready in 2021, NorthConnect to Scotland still requiring Norwegian permission

First direct 1400 MW NO-DE link contracted to be built by end-2019

New 1000-1400 MW DK-UK Viking Link not yet decided, but planned to be built by end-2020/2022

EU financial support for a 700 MW DK-NL link, due to be built by 2019

Jutland – DE capacity planned to grow by 860 MW by 2020, with further 500 MW increase by 2022

New 400 MW Zealand – DE Kriegers Flak connection by 2019

New interconnections will double the export capacity to over 10,000 MW by 2021

New internal Nordic grid investments provide for increased available capacity for export to the Continent and Baltics

EU's Connecting Europe Facility co-financing 3rd EE-LV transmission line, due to be ready by 2020

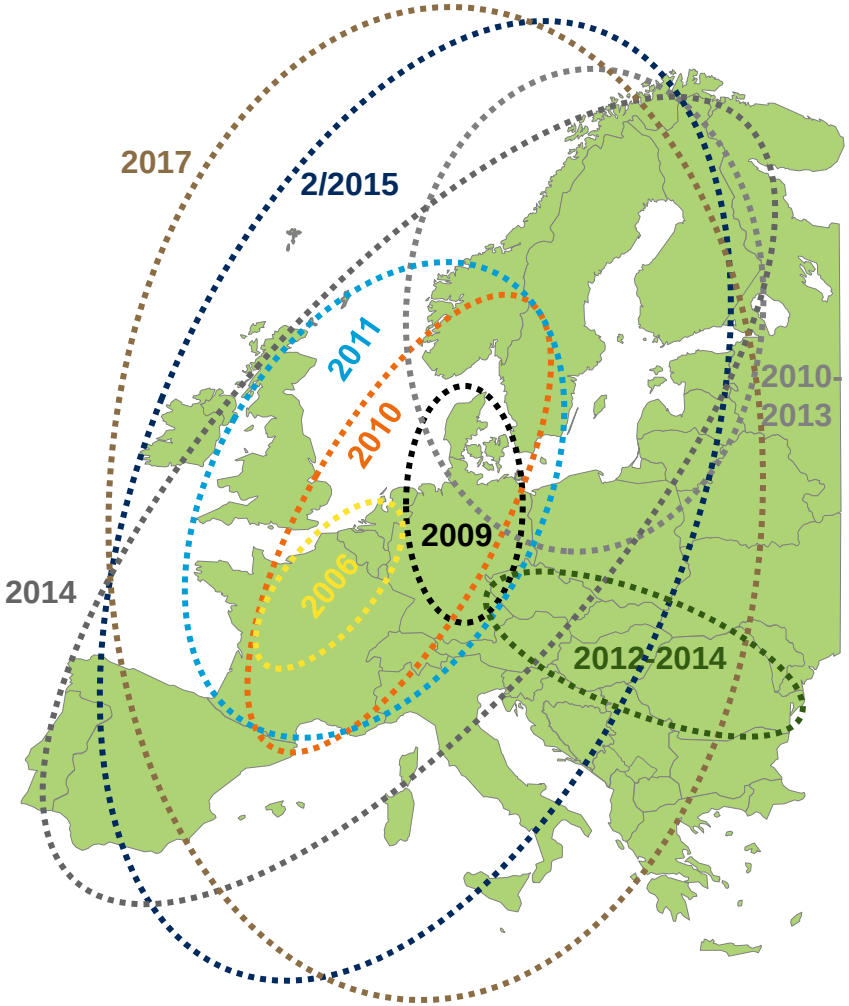
EU's European Energy Programme for Recovery co-financing 700 MW NordBalt (ready 12/2015)

LitPol Link (500+500 MW) to connect the Baltic market to Poland by end-2015/20. It will open a new transmission route from the Nordic market to the Continent

Svenska Kraftnät agreed 3/2014 with 50Hertz to study a new Hansa PowerBridge DC link between Sweden and Germany

Market coupling milestones
- cross-border power flows optimised by power exchanges

- Market coupling between NL, BE and FR since 2006
- Germany – Nord Pool Spot coupling started 11/2009
- Market coupling for Central Western Europe (DE, FR, NL, BE) since 11/2010 with a continued coupling with Nord Pool Spot
- Poland coupled with Nord Pool Spot since December 2010
- NorNed (NO-NL) and BritNed (UK-NL) included in 2011
- Estonian price area in Nord Pool Spot since 2010 and Lithuanian area since 6/2012. Latvia joined in June 2013
- Czech, Slovakia and Hungary coupled together since September 2012. Romania joined in November 2014
- A common day-ahead market coupling for the whole north-western Europe was started in February 2014. Iberia (Spain & Portugal) joined in May 2014. Italy and Slovenia joined in February 2015
- Flow-based cross-border capacity allocation for further trade optimisation taken into use in May 2015 for the CWE region
- Lithuania-Poland (LitPol Link) coupling to start by end-2015
- CEE (Central Eastern Europe) market coupling region to join in 2017. Switzerland waiting for agreement with the EU
- In addition to day-ahead coupling, intraday market coupling and balancing market integration under development as well



Multiple demands on power market going further:

Technological development, decarbonisation, renewables, consumer beaviour and digitalization changes the scene

Demands on power markets

Yesterday

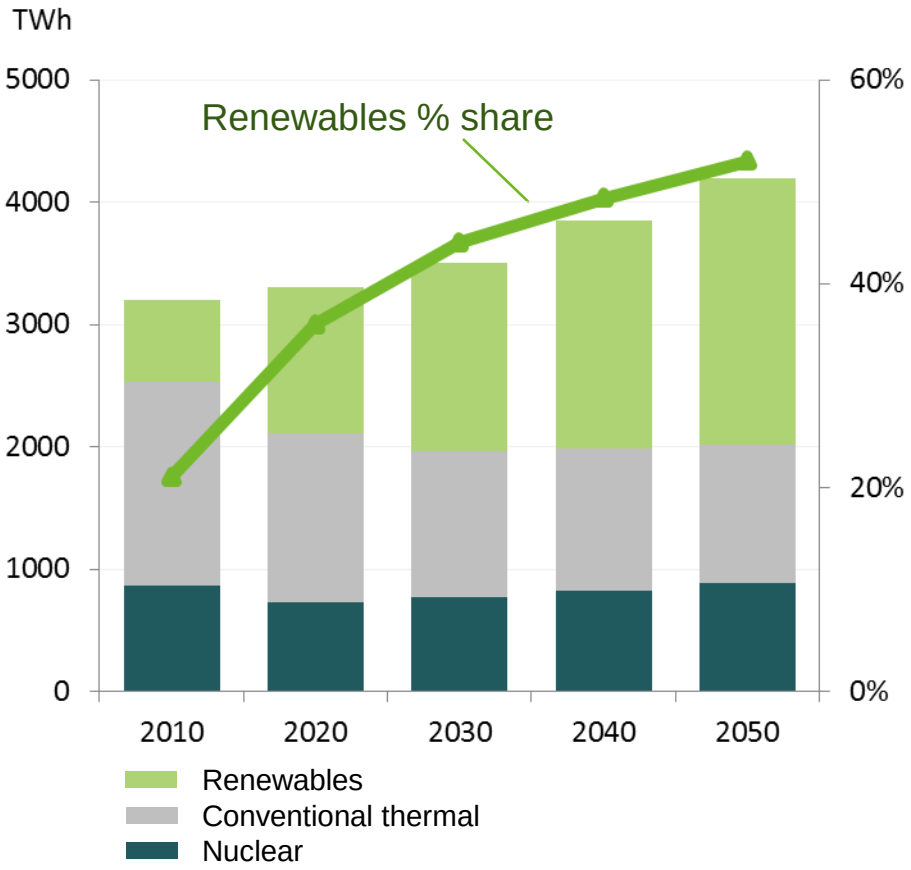
- Competitive **electricity price**
- **Generation adequacy** on national level

Today and in the future

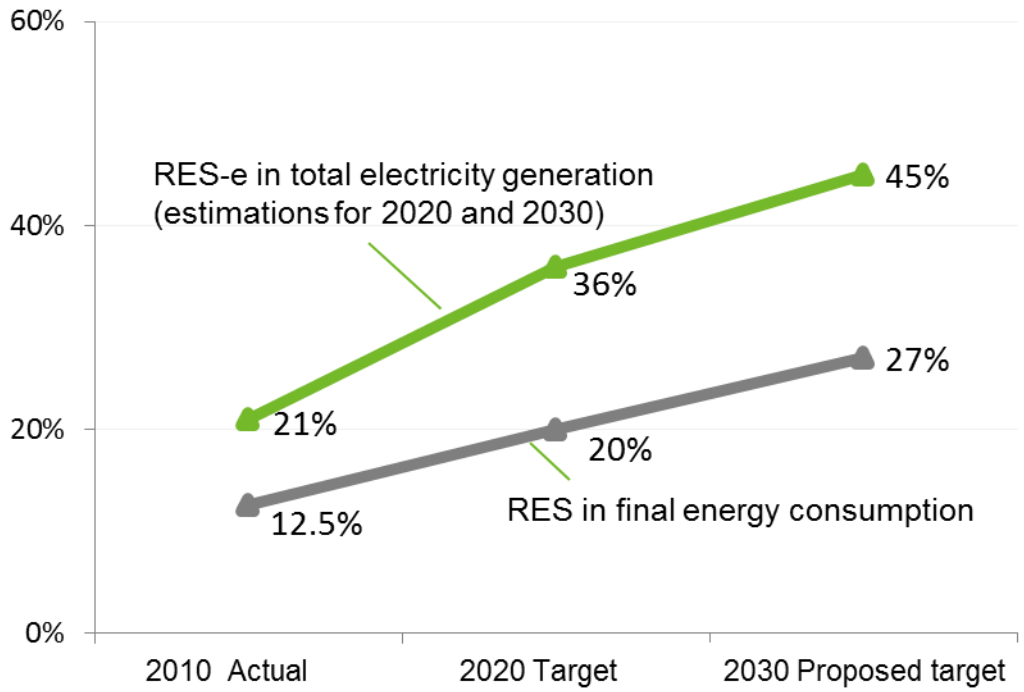
- **Competitive electricity price** and **generation adequacy on regional level**
- **CO_2-free power generation**
- Increased **RES generation**
- Integrate **intermittent generation**
- **Active consumer** and increased DES
- **Digitalisation**, improved customer offerings and DSM opportunities

In Europe renewable power has been rapidly growing due to a variety of support mechanisms

EU 28 Generation mix forecast by technology



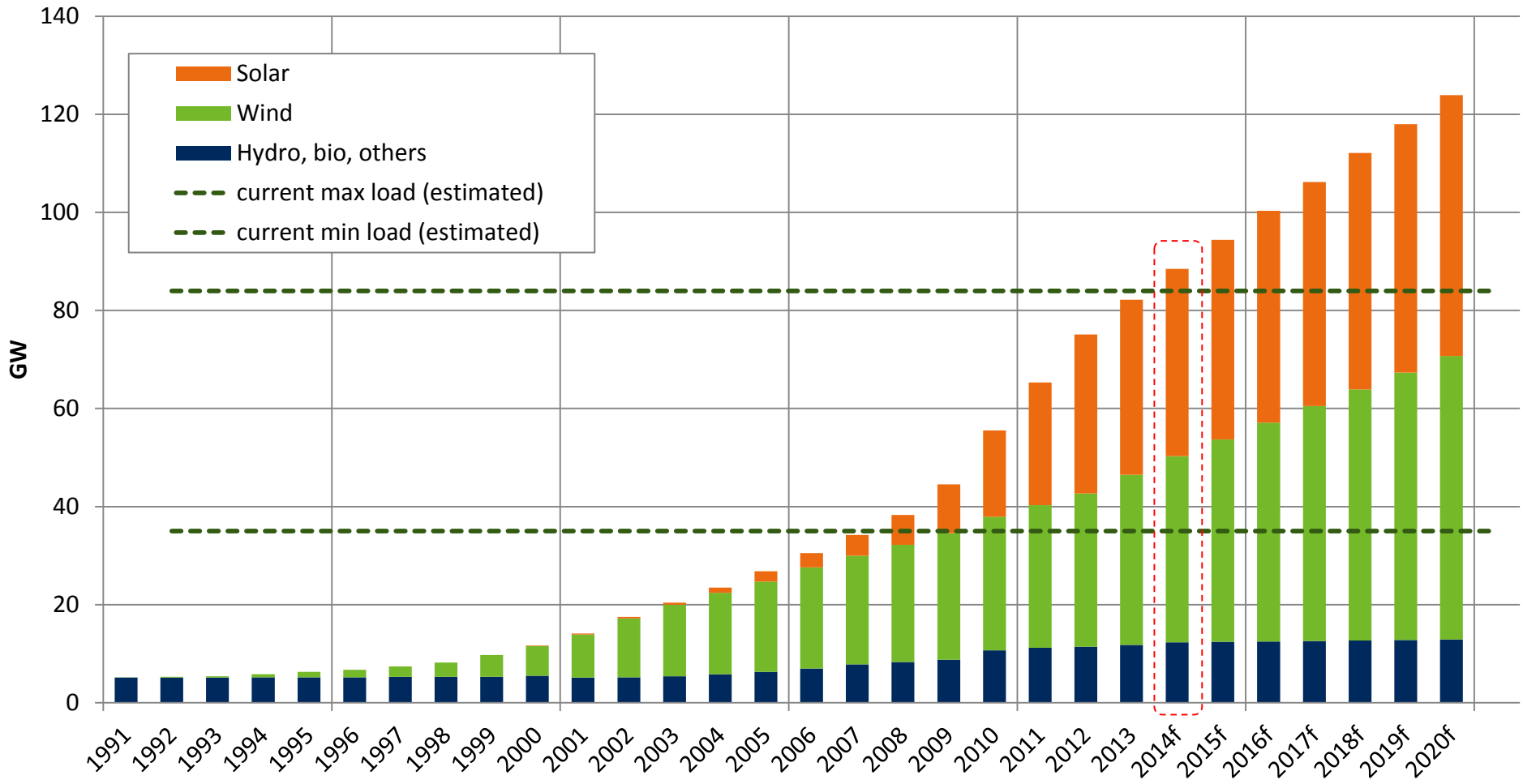
EU renewables targets



Sources: DG Energy, Transport and GHG Emissions Trends to 2050, European Commission, 2013; European Environment Agency http://www.eea.europa.eu/

German weather-dependent capacity above peak consumption

Balancing the system is challenging, but plants struggle to make profits due to oversupply



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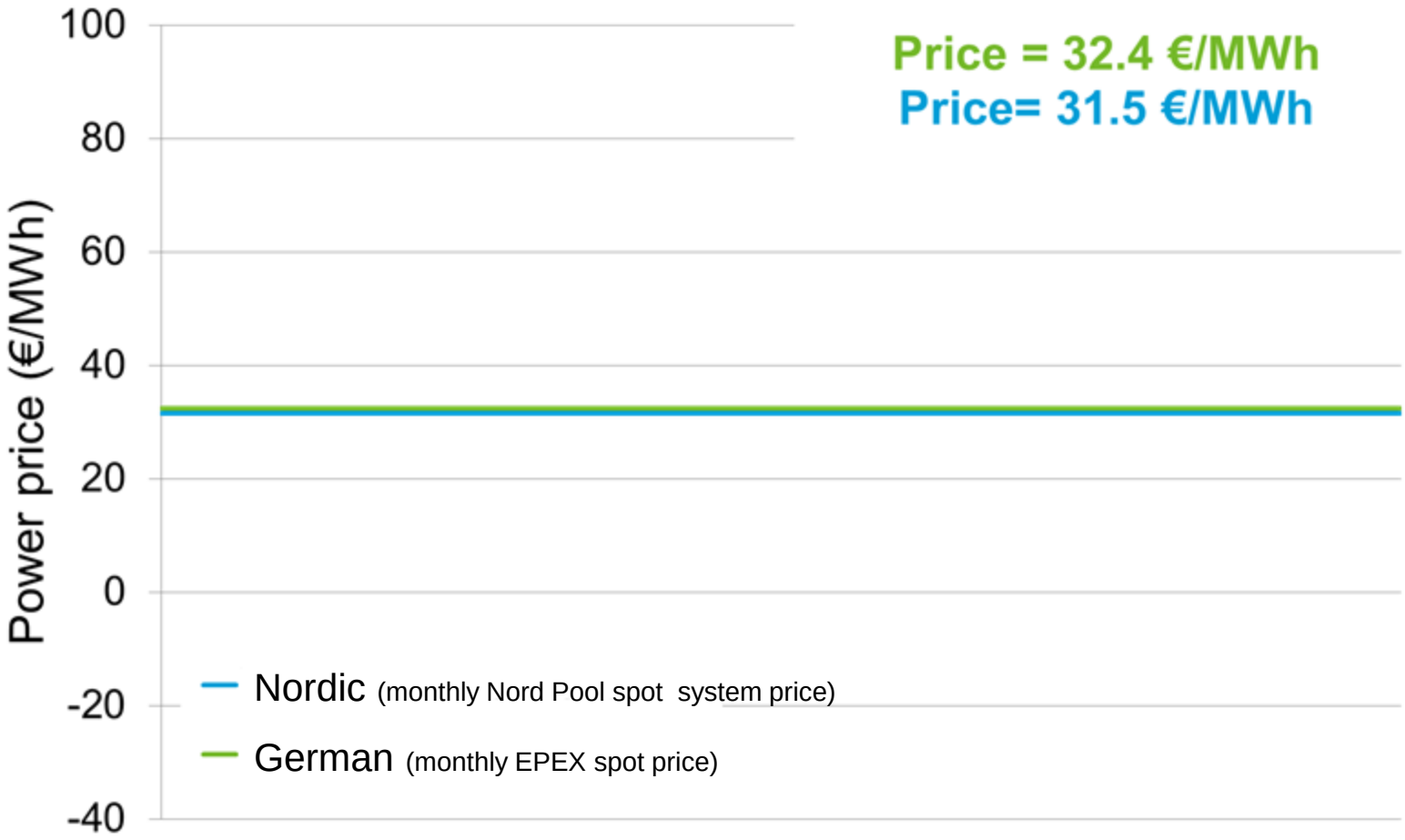
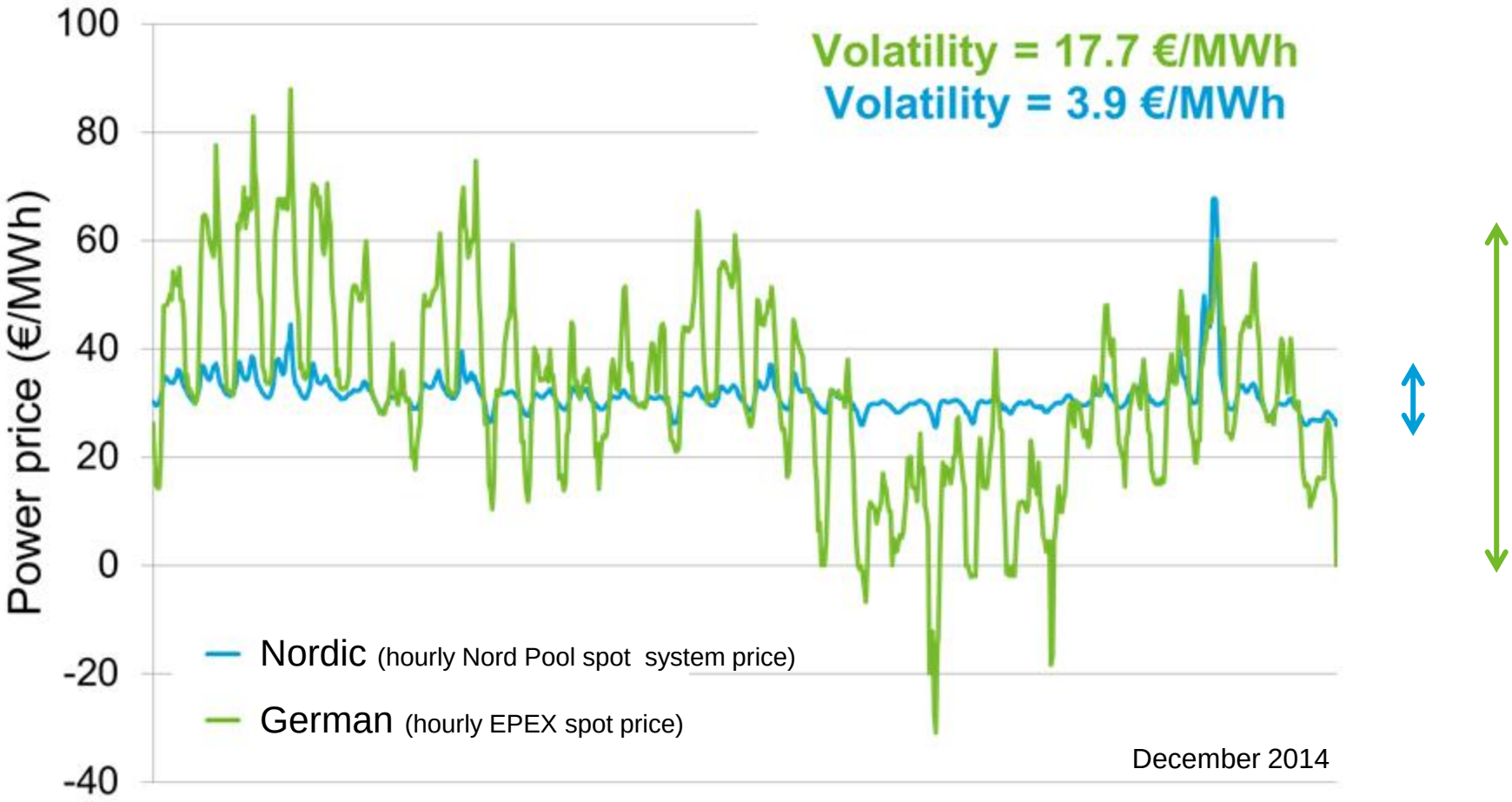
Sources: Bundesministerium für Wirtschaft und Energie, Eurelectric, Tennet, Fortum estimates

Average power prices in Nordics and Germany were very close in December 2014 …



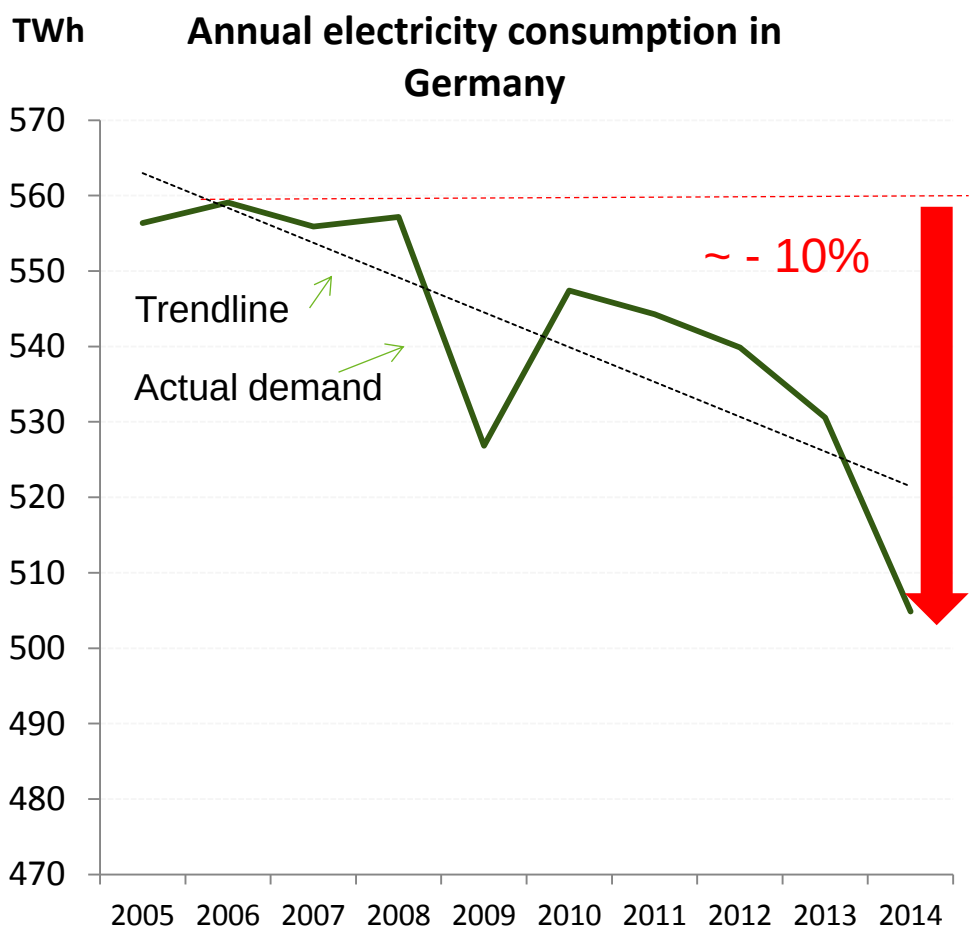
Source: Nord Pool Spot, Bloomberg Finance LP

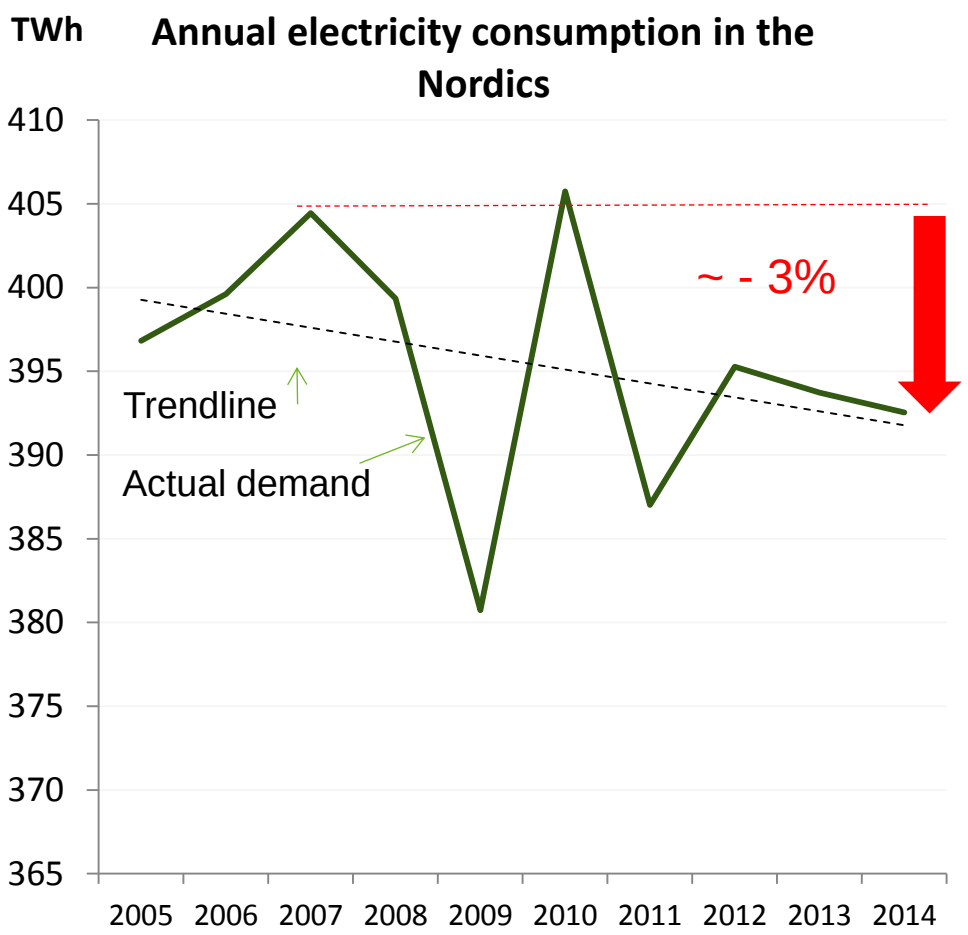
… but hourly prices were very different
Price pattern is getting more important than average price



Source: Nord Pool Spot, Bloomberg Finance LP

But power demand has been declining in recent years…





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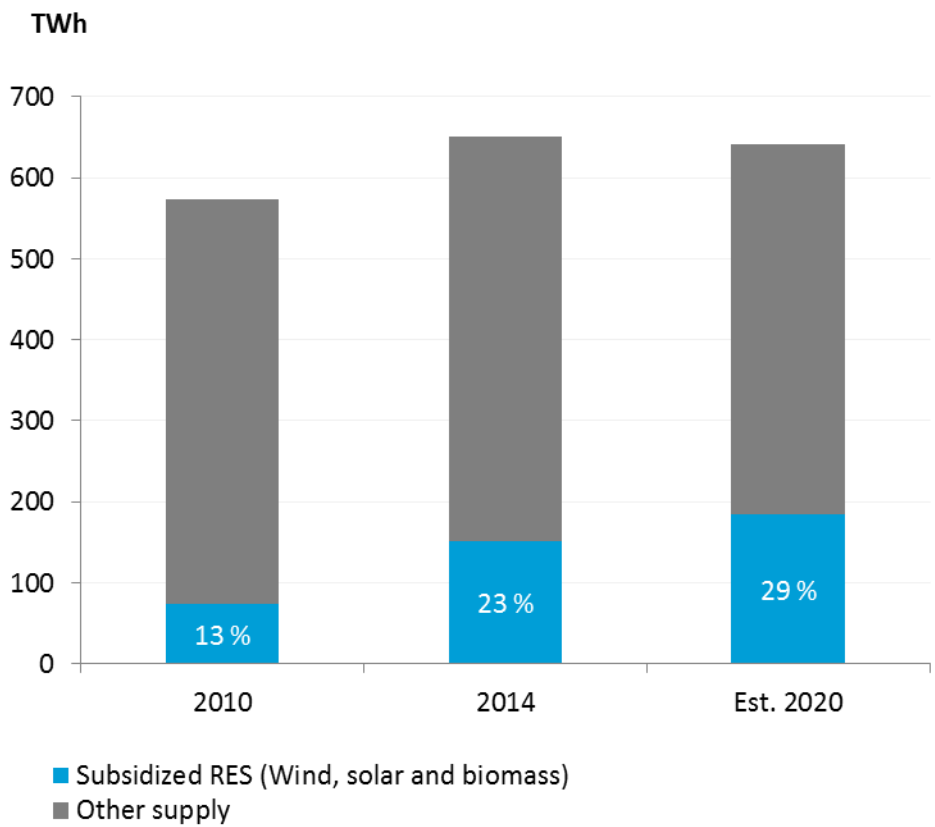
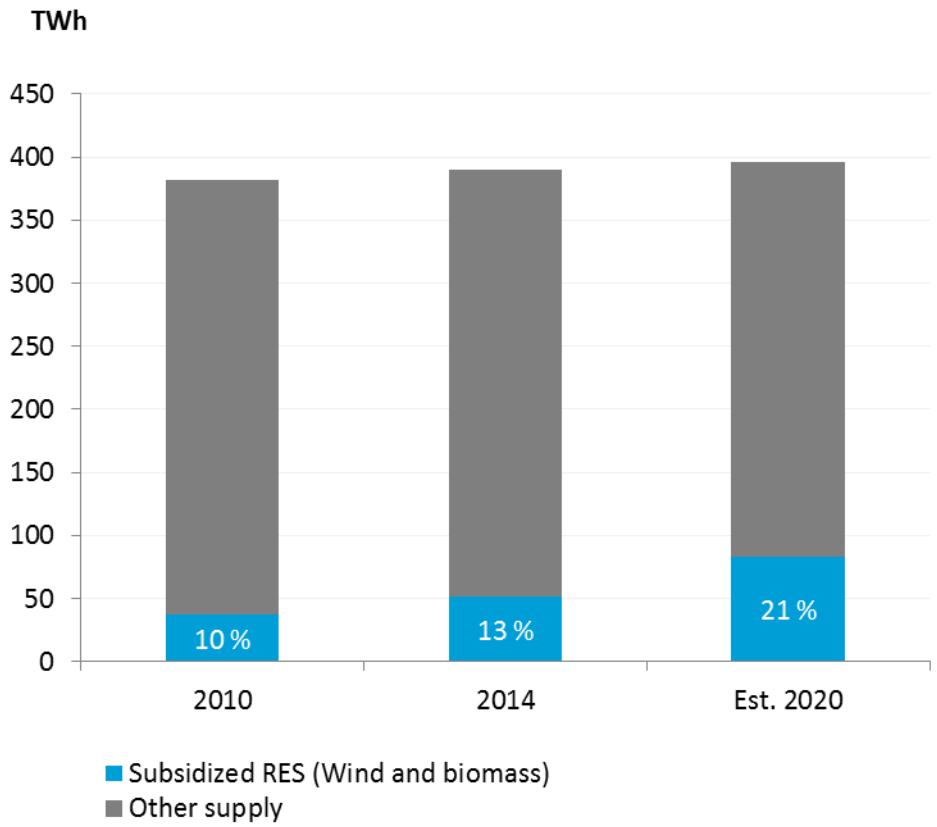
Source: Fortum Industrial Intelligence, ENTSO-E. Note, the consumption figures are the actual figures, not adjusted to normal temperature

…while supply has been growing, driven by subsidised renewables

Total supply and share of subsidized renewable energy in Germany



Total supply and share of subsidized renewable energy in the Nordics

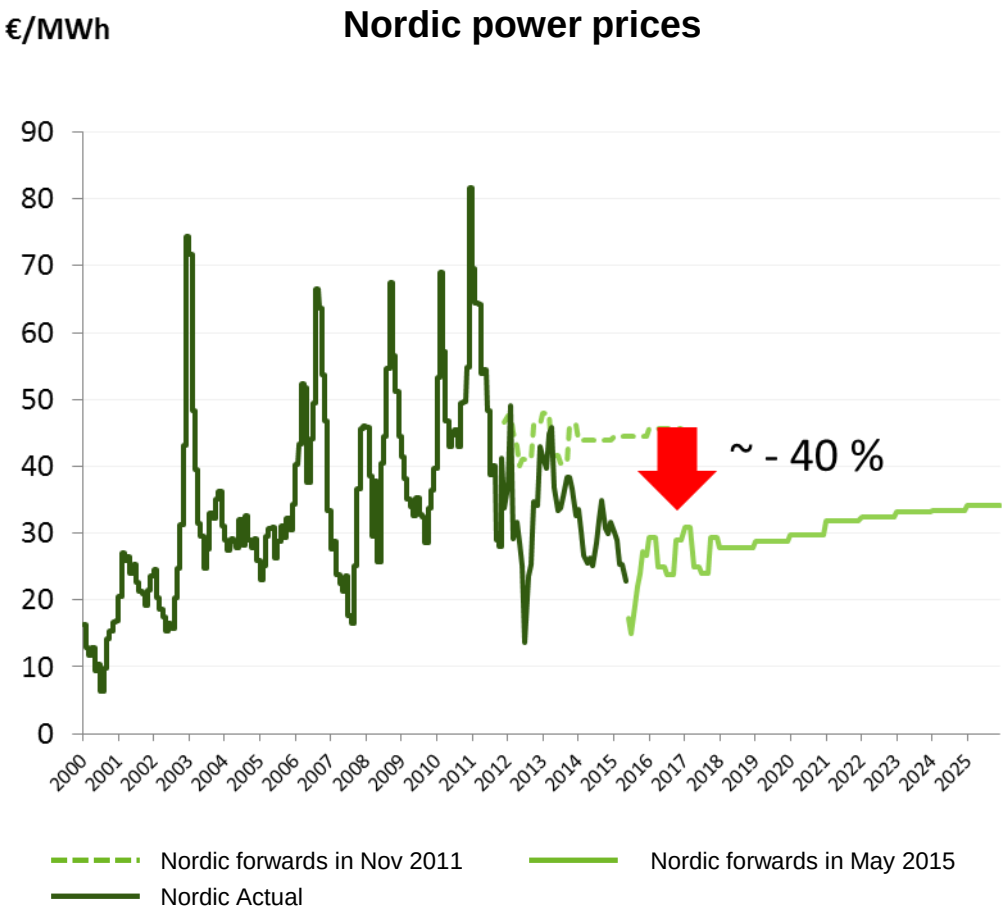


Disclaimer: The presented future development is based on Markedskraft analysis, and does not represent a Fortum view on the development

Source: ENTSO-E for 2010, 2014, Marketskraft for 2020

…and today the market is notably oversupplied and consequently power prices have declined

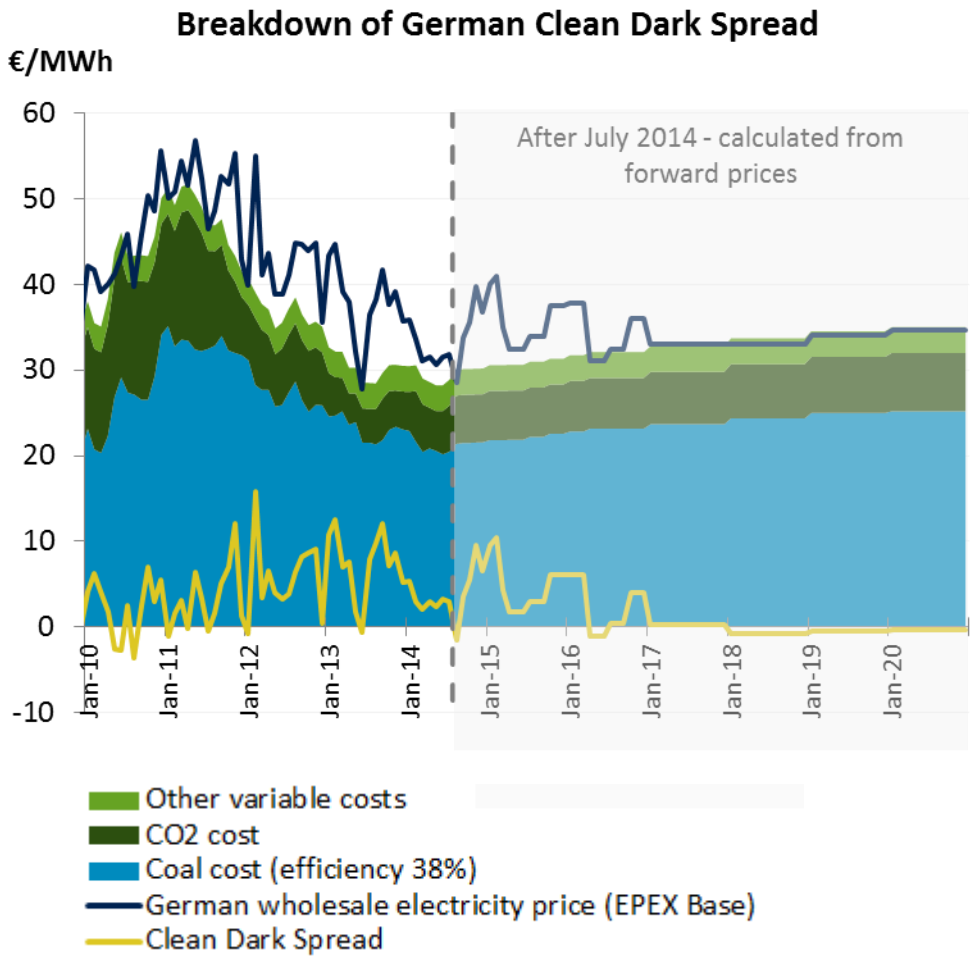
Power prices have declined by ~40% since 2011 and even ~60% since 2008

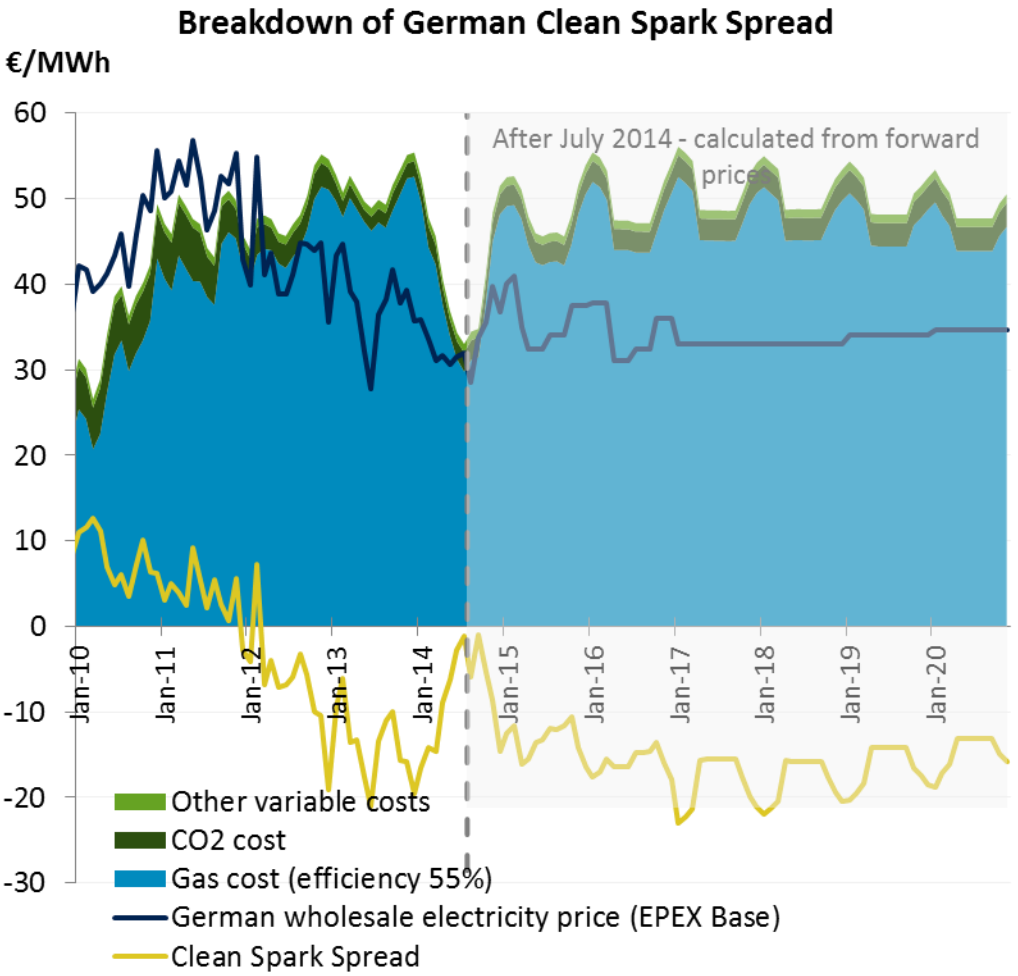


Source: Bloomberg

Current market conditions favour coal-fired generation over gas

Poor power demand and generous subsides undermine the commercial generation's profitability

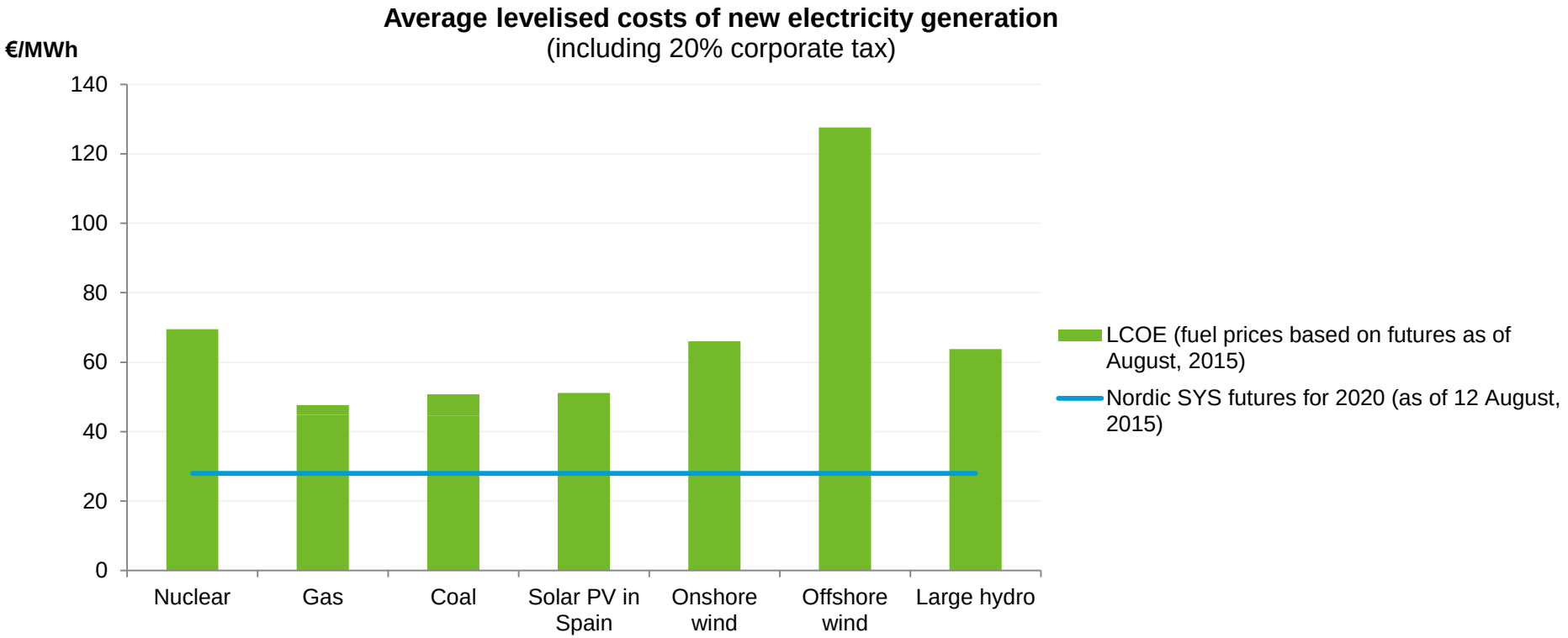




Source: Bloomberg, August 2014

Levelized cost of electricity in Europe

Current market prices hardly justify any investments into new generation



The levelised cost shows the achieved electricity price required for an investment to break even over the lifetime of the project.

***Disclaimer*: The presented figures do not represent Fortum's own view on the levelised costs of electricity.**

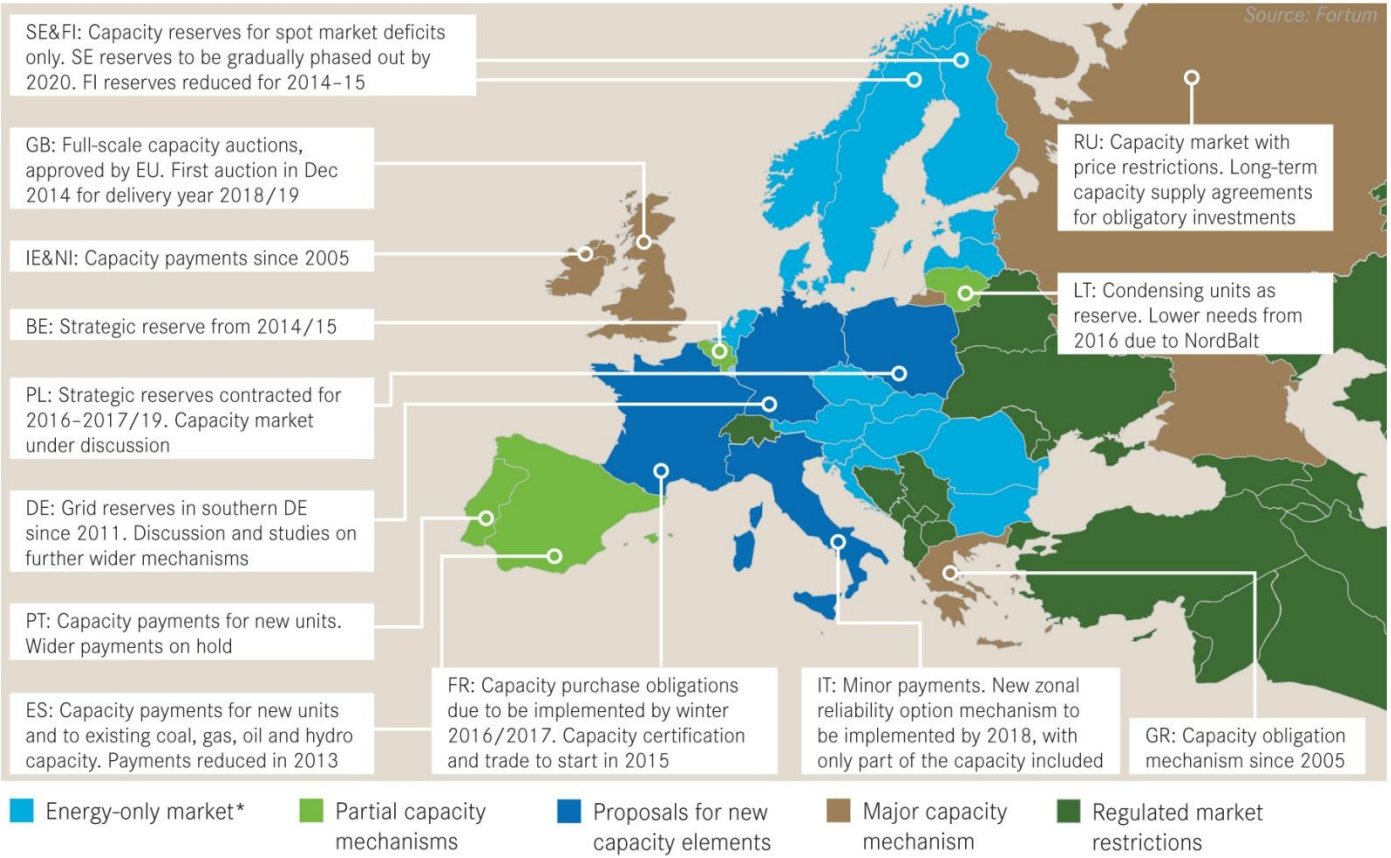
The figures are based on recent external publications. Key assumptions: real discount rate 5%, corporate tax 20% . Overnight costs, €/kW 5400 for nuclear, 747 for gas, 2304 for coal, 1269 for onshore wind, 3400 offshore wind, 2700 for hydro, 975 for ground mounted solar. Peak load factor for ground mounted solar 19%; for onshore wind 27%; for offshore wind 34%, for large hydro 40%, for nuclear, gas and coal 91%. Economical lifetime: 30 years for solar, 40 years for nuclear and hydro, 25 years for others. Fuel prices are the market forward prices as of August 2015 extended by applying inflation of 2%. Note, there are large variations in cost of hydro, wind and solar depending on location and conditions.

Sources:

1. *World energy council 2013, Cost of energy technologies*
2. *European PV Tehcnology Platform Streering Committee, PV LCOE working Group: PV LCOE in Europe 2014-30, Final report*
3. *IRENA: Renewable power generation costs in 2014*
4. *Fraunhofer: Levelised cost of electricity, Edition November 2013*
5. Lazard's Levelized Cost of Energy Analysis - Version 8.0. 2014

Abundance of subsidies a challenge for the efficiency of the electricity market in Europe

Existing and planned capacity mechanisms in Europe:



*No capacity payments to power plants in the day-ahead and intraday markets, but balancing market reserve capacity is contracted in advance.

Several countries are considering capacity markets

- to support the competitiveness of flexible generation and
- to drive new investments

Source: Fortum

The poor market conditions have triggered capacity withdrawal

~4 GW of early capacity withdrawal announcements in Nordic area during last half a year

June 2015	No license application for **TVO's Olkiluoto 4**
June 2015	**E.ON** proposes not to resume production at **O2** (661MW) and to close **O1** (492MW) in 2017– 2019
June 2015	**PVO's Kristiina** (242MW) and **Tahkoluoto** (235MW) coal-condense mothballed
June 2015	**Helen's** new bio CHP project (200 MW) put on hold and renovation of Hanasaari coal CHP plant cancelled; instead separate heat-only solutions
April 2015	**Vattenfall** to close **Ringhals** 1 (878MW) and 2 (865MW) between 2018-20
April 2015	**Kanteleen Voima**'s Haapavesi peat (160MW) and **Tampereen Energiantuotanto**'s Naistenlahti 1 gas-CHP (129MW) to capacity reserve
Nov 2014	**Vattenfall** not to upgrade **Forsmark 3** (1170 MW) to 1340 MW
June 2014	**Lietuvos Energija** closed 2x150 MW gas units in Q1 2015 and closing 2x300 MW by 2016
April 2014	**Naturkraft's** (**Statoil** & **Statkraft**) **Kårstø** (420 MW) gas CCGT plant mothballed

In Germany, ~7 GW confirmed for closure by end 2018

4.9 GW closed since Jan-2014 ('14 =2.4 GW, '15 ytd = 2.5 GW including 1.3 GW nuclear)

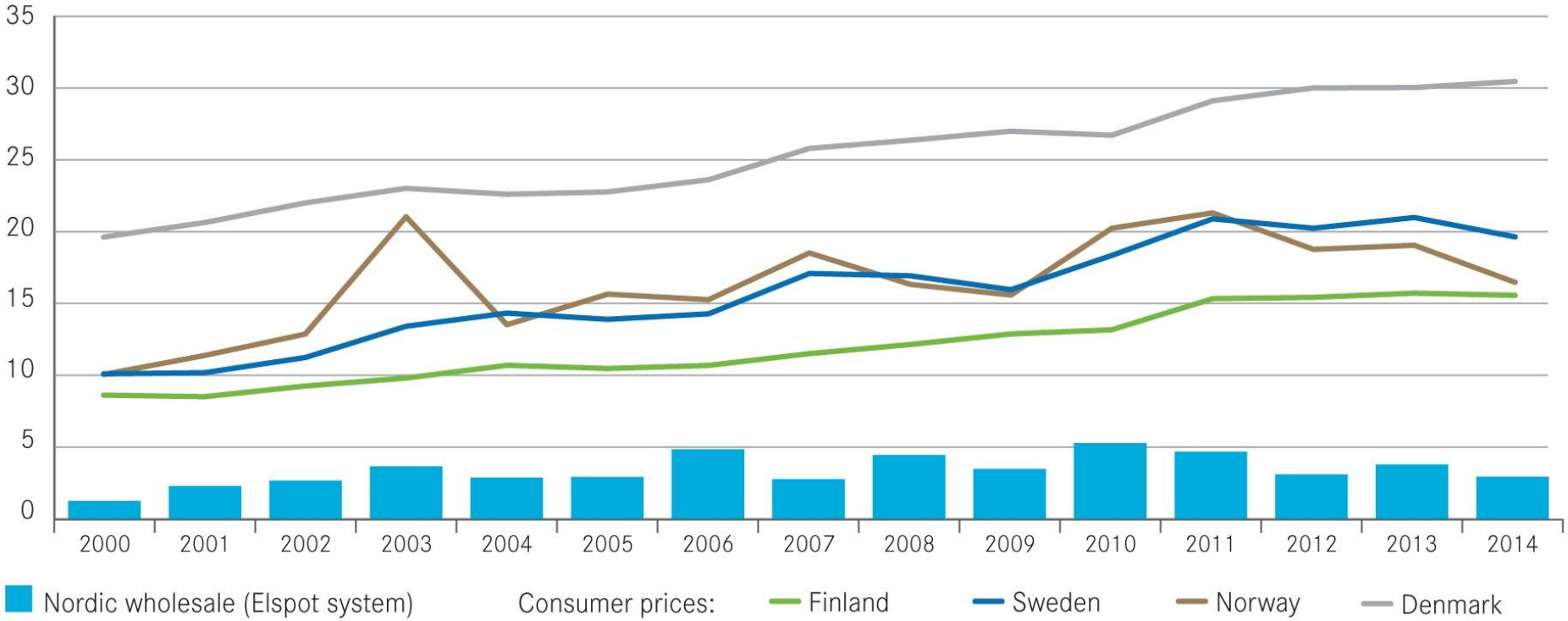
6.5 GW confirmed for closure by Dec-2018 (including 1.3 GW nuclear in end 2017)

11.9 GW waiting for permission to close (4.8 GW of which temporary/seasonal only)

Source: Fortum Industrial Intelligence, Bundesnetzagentur

Electricity wholesale price has dropped in recent years while retail price has climbed

Nordic wholesale and end-consumer prices in 2000-2014, €c/kWh:



Increased taxes, grid charges and subsidies have raised the price consumers pay for electricity

Source: Nord Pool Spot, Eurostat

Consumer plays an increasingly important role

Sizeable investments in smart meters and smart grids in all Nordic countries

- Major opportunities in new, smart services
- Increasing demand-flexibility improves security of supply
- Reduces consumer costs

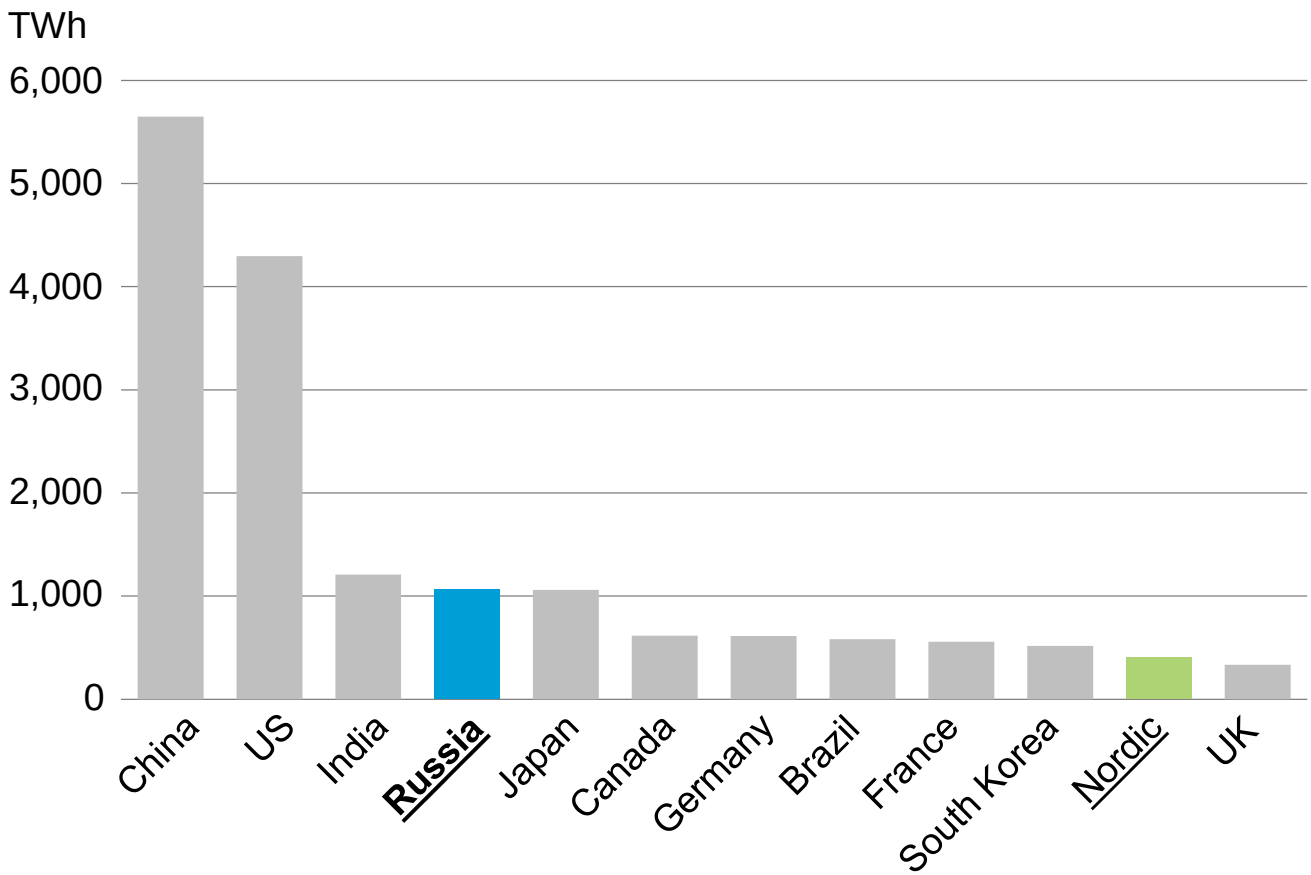
All Nordic countries to transition to a retailer-centric market model

- One interface and bill for the consumer
- More efficient data hubs

Content

- Summary
- Fortum briefly
- Nordic & Baltic energy markets and challenges
- **Russian energy markets and challenges**

Russia is the World's 4th largest power market



Power generation in 2014 based on gross output.
Source: BP Statistical Review of World Energy June 2015

Fortum has long experience of co-operation with the Soviet Union and Russia

1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

- Construction of hydro power plants in Kola area
- Electricity import to Finland
- Construction of Loviisa nuclear power plant
- Nuclear fuel import to Finland* →
- Permanent presence in Moscow & St. Petersburg →
- Automation & information system deliveries to thermal power plants
- Construction of North-West CHP in St. Petersburg
- Safety improvements for nuclear power plants
- Hydro refurbishments →
- Agreement on Joint Implementation of Kyoto Protocol with TGC-1
- Executing of 2400 MW CSA investments in OAO Fortum (6 plants ready out of 8) →

Co-operation

Ownerships

- Lenenergo shareholding
- Lenenergo split
  - TGC-1, Generation
  - Lenenergo, Distribution (divested in 2007)
- TGC-10 acquisition, today OAO Fortum

*) Including single largest purchase agreement of uranium with TVEL

The Russian Power Market reform was the World's largest single power market reform and completed by end of 2010

2003	2006	2007	2008	2010	2011	2011	Ongoing
Transitional model of electricity markets.	Launch of the current electricity markets model. Only volumes deviating from the expected power balance were traded at market prices.	Start of deregulation of the traded electricity volumes.	Launch of the capacity market transitional model. Start of deregulation of the traded capacity volumes.	Adoption of the target capacity market rules. Launch of the system services market. Start of the electricity futures trading.	All purchased/ sold volumes are supplied at unregulated prices, except for supply to households and consumers of some regions. Launch of the target capacity market model.	Launch of RES support model	• Heat market reform • Gas prices liberalisation • Development of the capacity market rules

Day-ahead (spot) market

Deregulation of electricity volumes

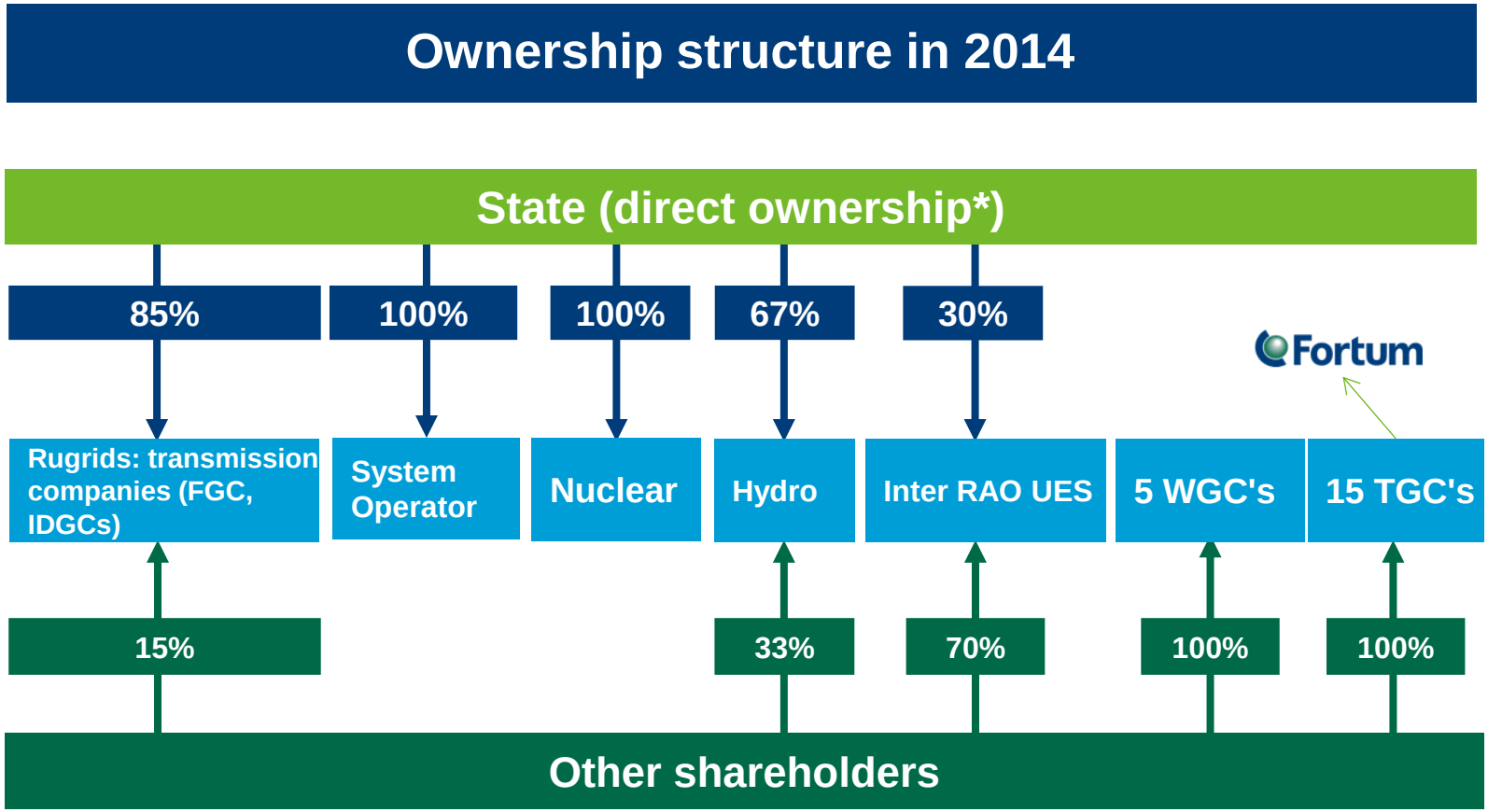
2007	2008	2009	2010	2011
5-10%	15-25%	30-50%	60-80%	**100%**

Capacity market

Deregulation of capacity volumes

Source: Fortum Industrial Intelligence

Ownership structure in Russian power industry



- The Russian electricity monopoly RAO UES ceased to exist 1 July 2008
- Transmission and distribution stayed natural monopolies
- Generation and sales activities were unbundled into competitive businesses
- Nuclear and large hydro power remained state-owned
- WGCs operate country wide (incl. E.ON.Russia and Enel Russia)
- TGCs are regional companies (incl. OAO Fortum)
- WGCs and TGCs have been privatized
- National interests have been carefully considered

FGC = Federal Grid Company
IDGC = Interregional Distribution Grid Company
WGC = Wholesale Generation Company
TGC = Territorial Generation Company

* Ownership through Federal Agency for State Property Management

Source: websites of related companies, Fortum Industrial Intelligence

Fortum - a major player in Russia

OAO Fortum (former TGC-10)

- Operates in the heart of Russia's oil and gas producing region, fleet mainly gas-fired CHP capacity
- 23 TWh power generation, 26 TWh heat production in 2014
- Investment programme to add 85%, almost 2,400 MW to power generation capacity

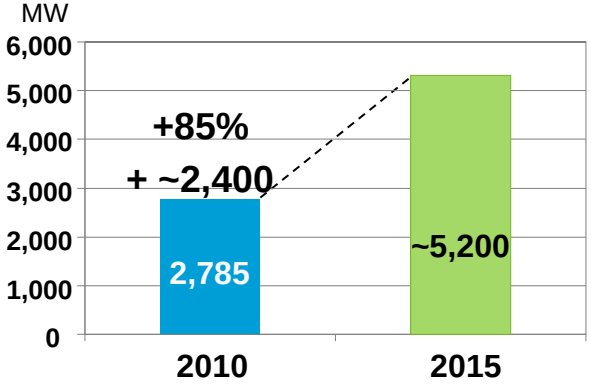
TGC-1

- 29.5% of territorial generating company TGC-1 operating in north-west Russia
- ~7,200 MW electricity production capacity (more than 40% hydro), ~24 TWh electricity, ~28 TWh heat in 2014

Extensive investment programme in OAO Fortum nearly finished – 2 units still to be commissioned

- Total amount of investments EUR 2.5 billion
  - Of which approximately EUR 0.2 billion still to be invested as of April 2015
- Increasing capacity by ~ 85% by the end of 2015

- Six units commissioned
  - Nyagan 3 was commissioned in October 2014 and started commercial operations in January 2015
- Two new units in Chelyabinsk during H2/2015



Six units commissioned

Mar/Dec 2013, Oct 2014	Feb 2011	Jun 2011	Oct 2011
			
Nyagan 1 + 2 + 3 **420 + 424 + 422 MW**	**Tyumen** **209 MW**	**Chelyabinsk** **216 MW**	**Tobolsk** **213 MW**

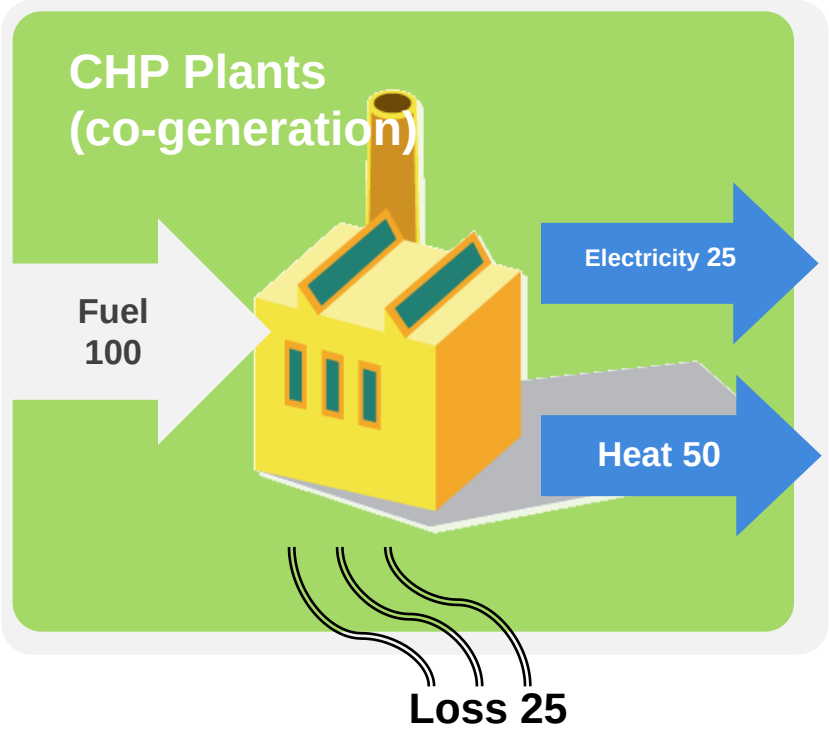
Units under construction

Chelyabinsk
2 x 248 MW

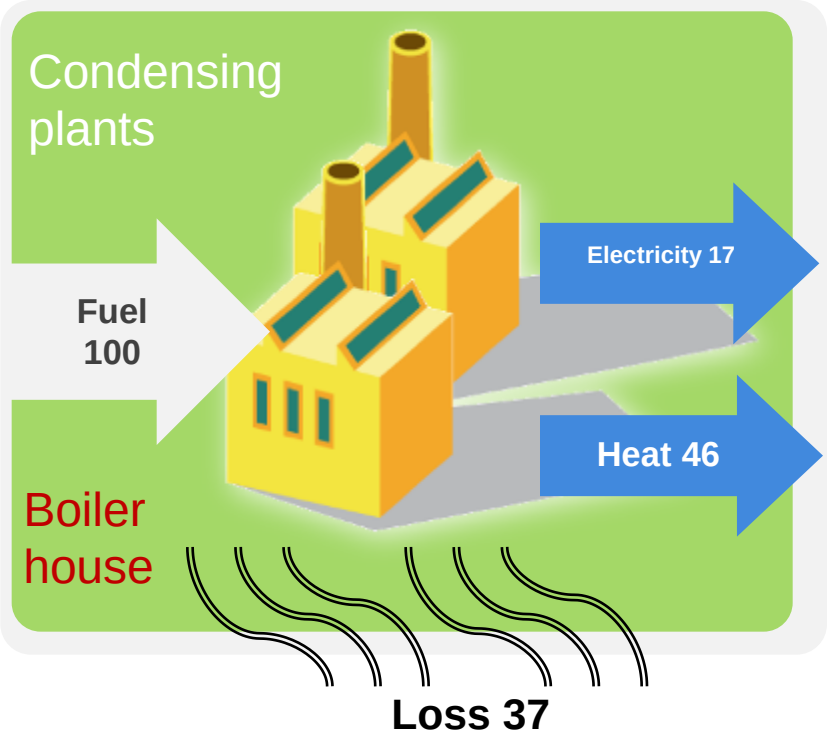
Fortum invests in CHP, with clear advantages compared to condensing power production

Combined heat and power production (CHP) is more efficient than separate production

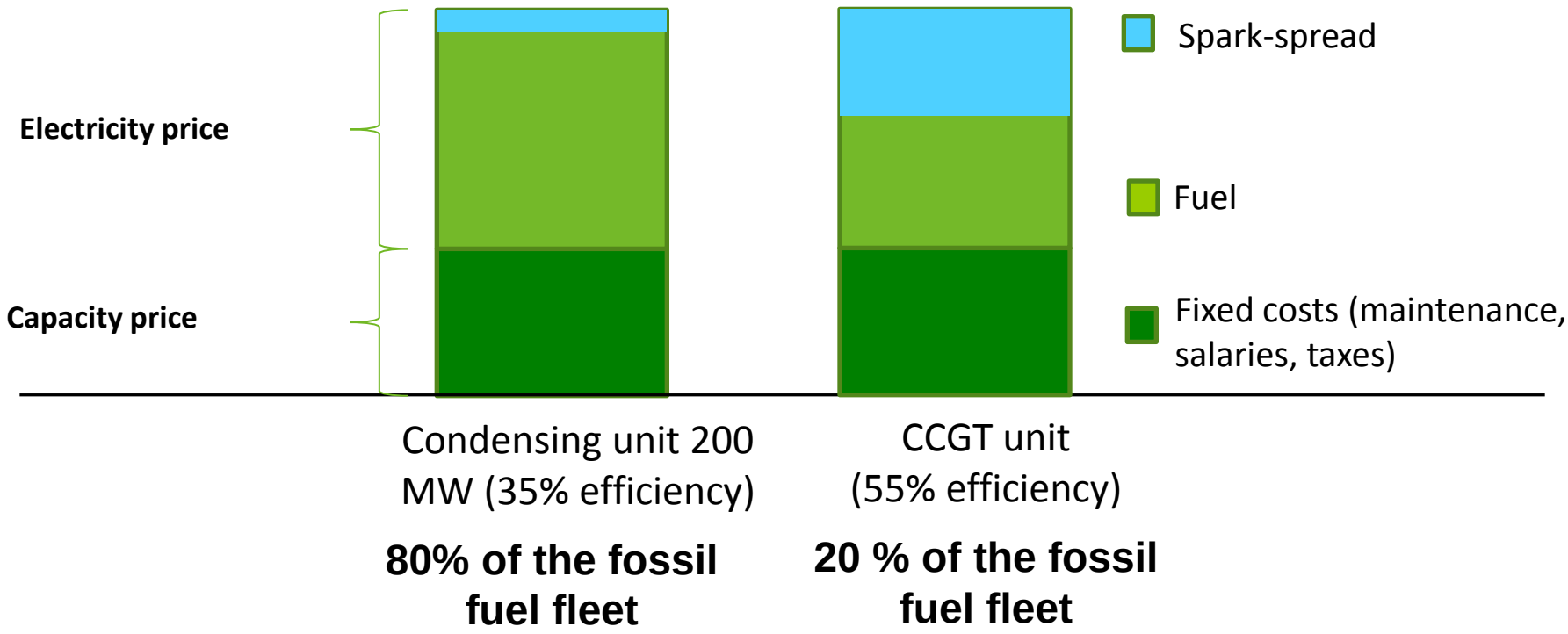
CHP production



Separate production



Fortum invests in the most efficient CCGT (combined-cycle gas turbine) generation in Russia, using fuels more efficiently and providing additional margin for new capacity



- Major part of power plants in Russia are very obsolete and inefficient;
- Investor which builds the new efficient equipment has a better margin than the owner of the old plants;

Fortum is long term committed to Russia and delivers resource efficient solutions – Russia diversifies our portfolio

- **The power market reform:**
  - World's largest single power market reform
  - Successful inflow of private capital into energy sector
  - Implementation of large-scale investment program and refresh of equipment stock

- **Russian power and heat markets:**
  - Wholesale spot market functions pretty well today
  - Financial market has started, but must be developed further in order to allow both buyers and sellers to hedge long term
  - Retail market still regulated
  - Heat sector reform started enabling Russia to decrease energy intensity of its economy

Summary

- **Nordic and Baltic power market a pioneer in power market development:** Affordable power prices, low emissions, good security of supply
- **Multiple demands on power market going further**: Technological development, decarbonisation, renewables, consumer behavior and digitalization changes the scene
- **Strong growth of subsidized RES and poor power demand** has decreased power prices to unsustainable low levels.
- **Consumer plays an increasingly important role**. And the Electricity market need to incentivize them to be active.
- **The Russian Power Market reform** was the World's largest single power market reform and completed by end of 2010. Russian power market consist of two markets, one for energy and one for capacity
- **Russian heat sector reform** started enabling Russia to decrease energy intensity of its economy

Thank you

Next generation energy company | Fortum