CHALLENGES IN A CHANGING MARKET; IT TOOLS AND R&D

Arild Tanem

SINTEF user meeting production planning 20-21.5.15

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STATKRAFT & POWER MARKETS

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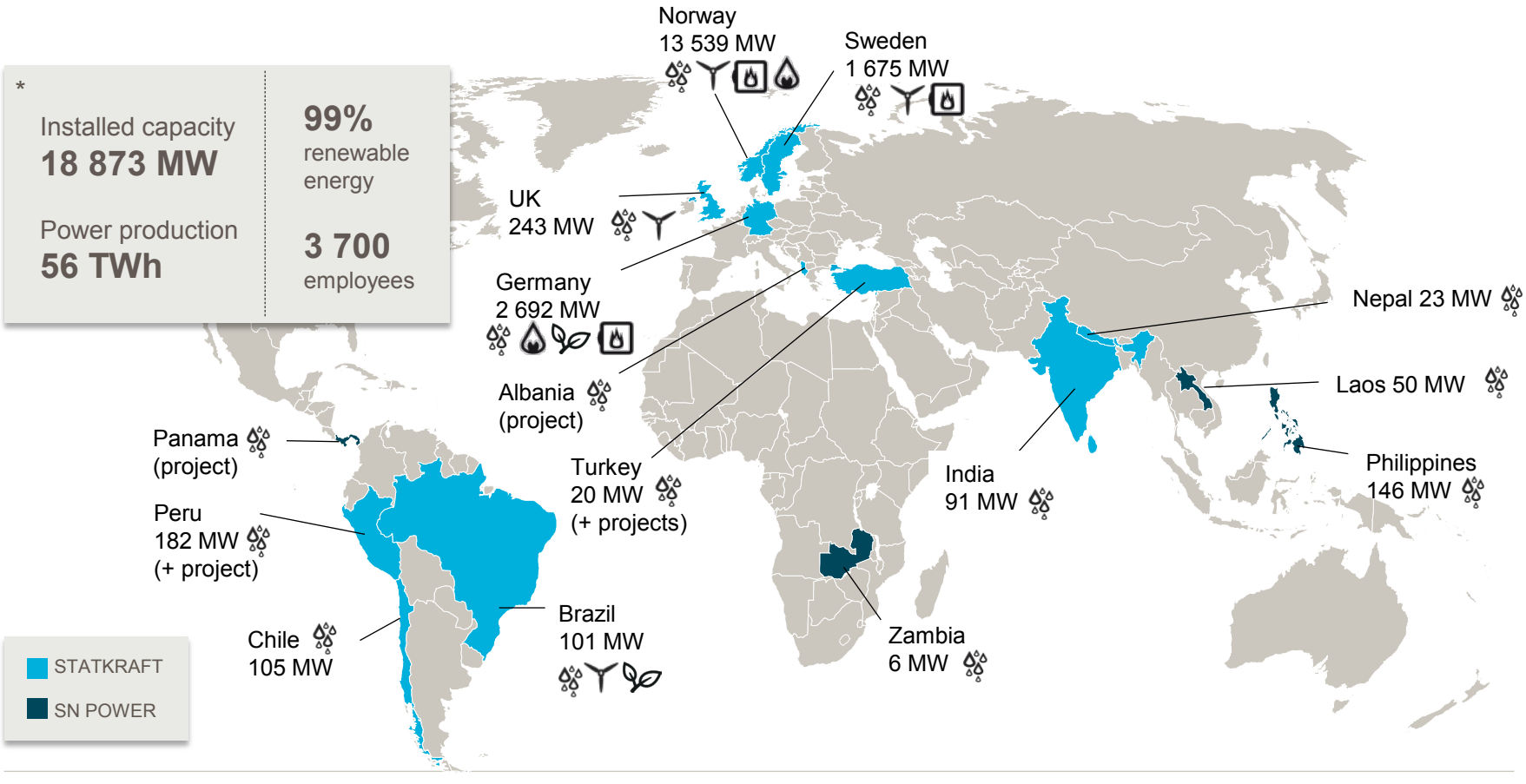
Statkraft's production



** 2014 figures. Includes: - Statkraft/SN Power's share of installed capacity*

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Strategic directions

European Flexible Generation

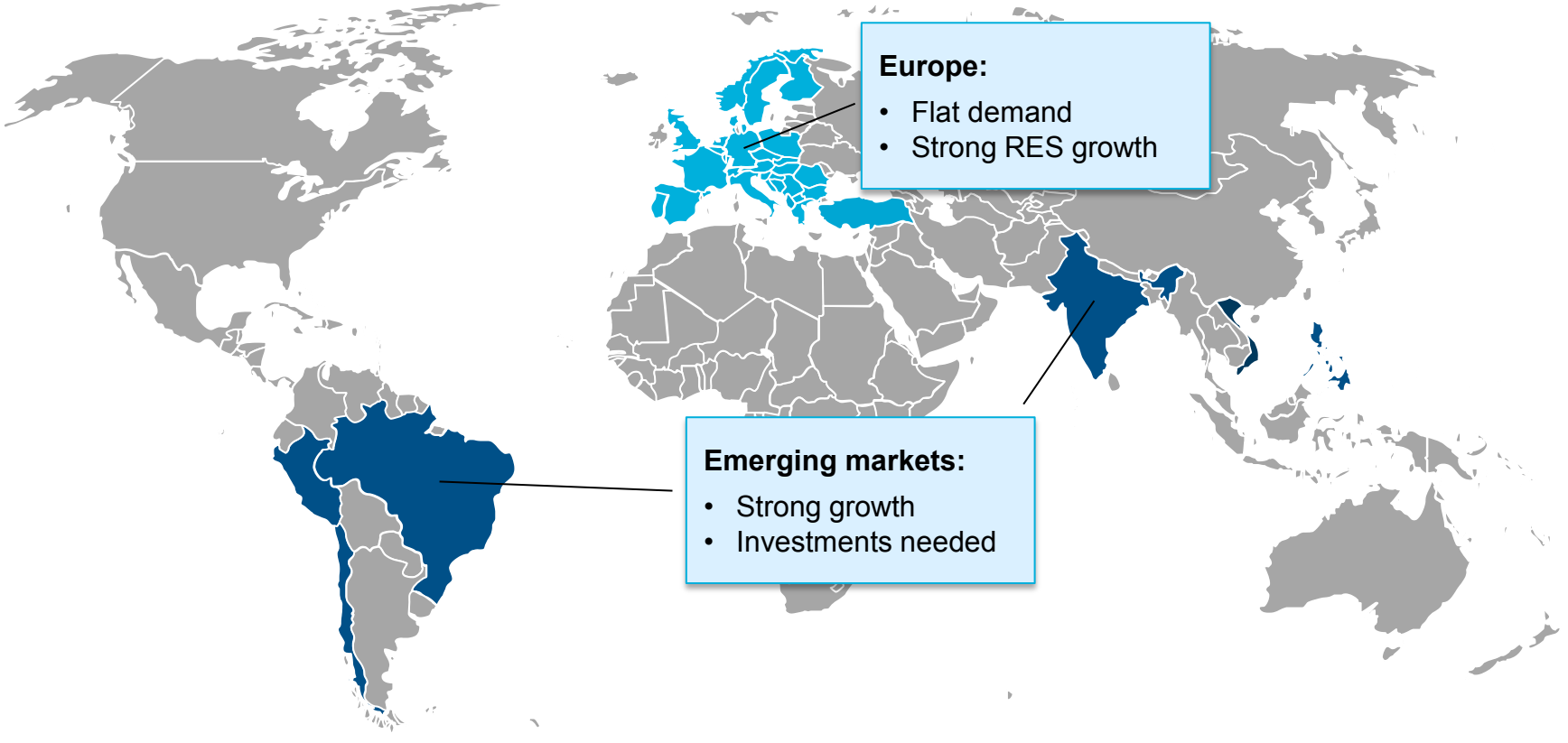
Market Operations

International Hydropower

Wind Power

District Heating

Market developments - a story of two worlds



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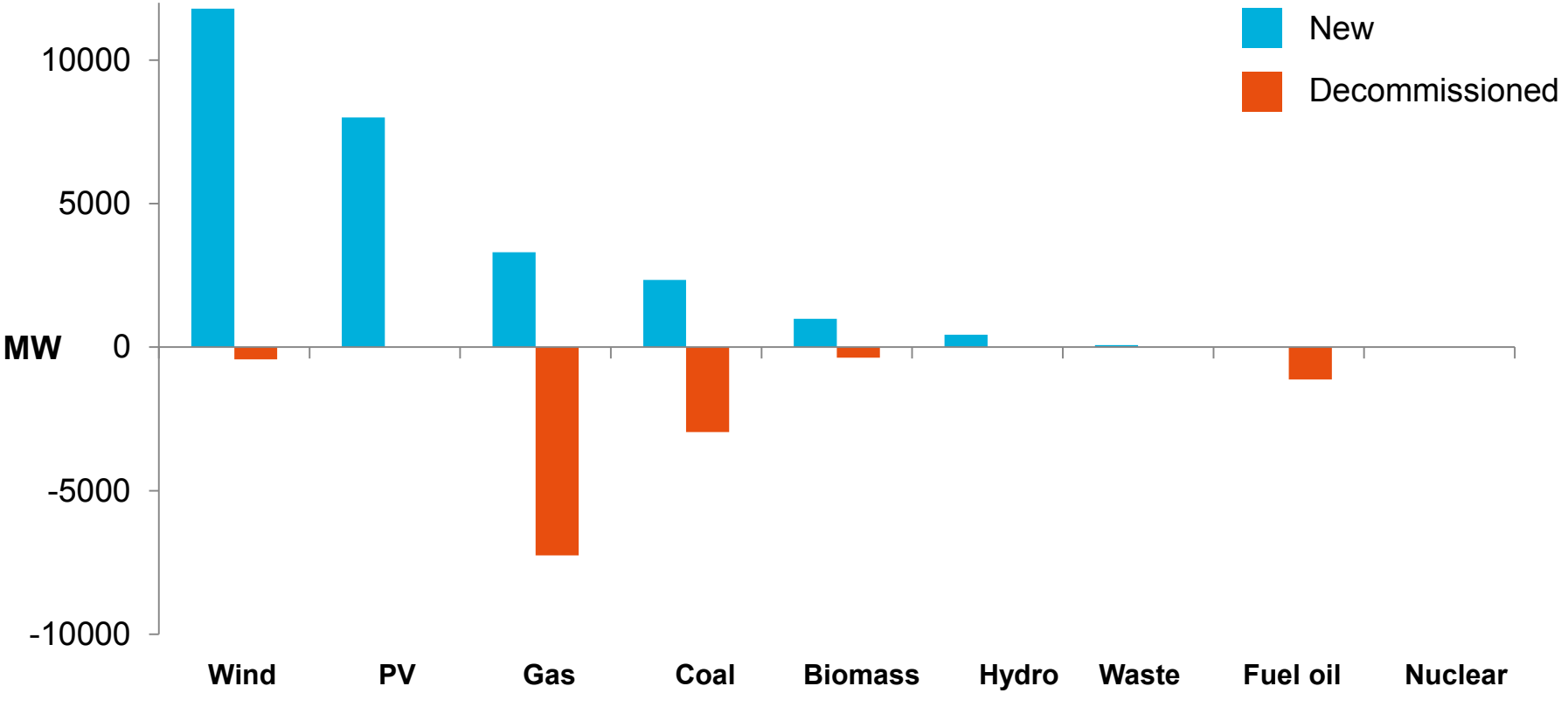
EU 2014: Renewables are replacing power from fossil fuels



Source: EWEA

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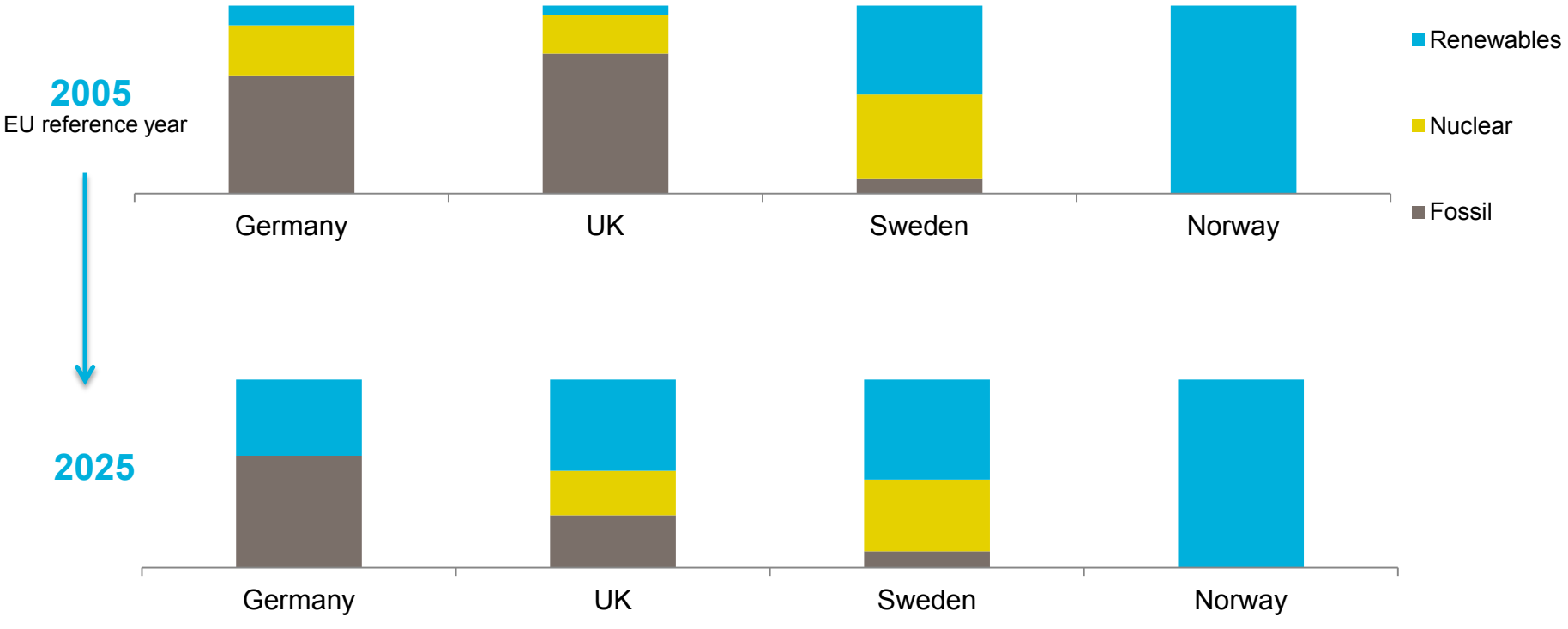
Projected power production mix

Yearly production in TWh



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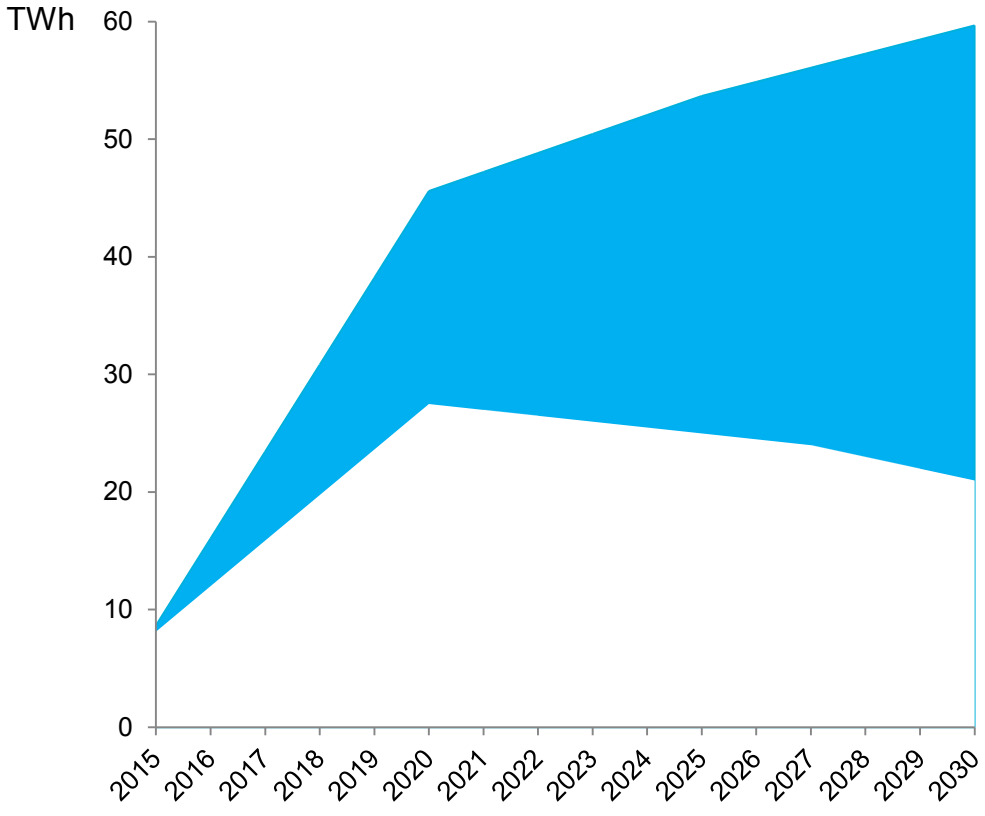
Towards a Nordic power surplus



- The elcert system will add 26.4/28.4 TWh in Norway and Sweden
- Declining technology costs for new RES
- New nuclear plant in Finland and some upgrades of Swedish nuclear
- BUT: Hardly any demand growth in the Nordics towards 2020
- Question: What to do with the surplus power?

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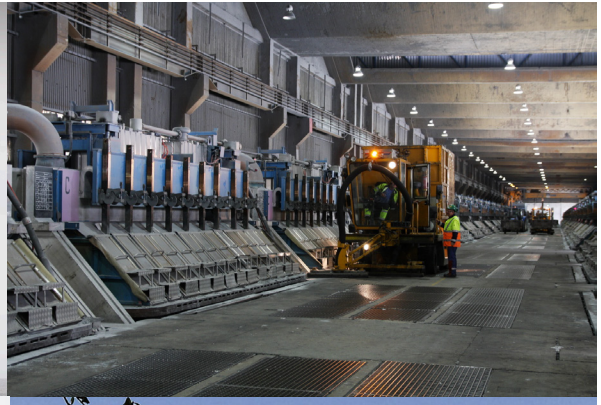
Power market developments Nordics

- The Swedish Energy Commission
  - Nuclear phase out
  - Capacity and grid challenges
  - Market design
  - Support schemes
- Strategic reserves in Sweden will be prolonged to 2025 (newly announced)
- Elcertificate market
  - Control station this year, possible challenges with approval for the agreed changes in the Swedish parliament.
  - Next control station 2017 – possible common rules for “deadline” for projects to take part of the market (also Sweden).
- Norwegian White paper on Energy policy 2016

The future is electric



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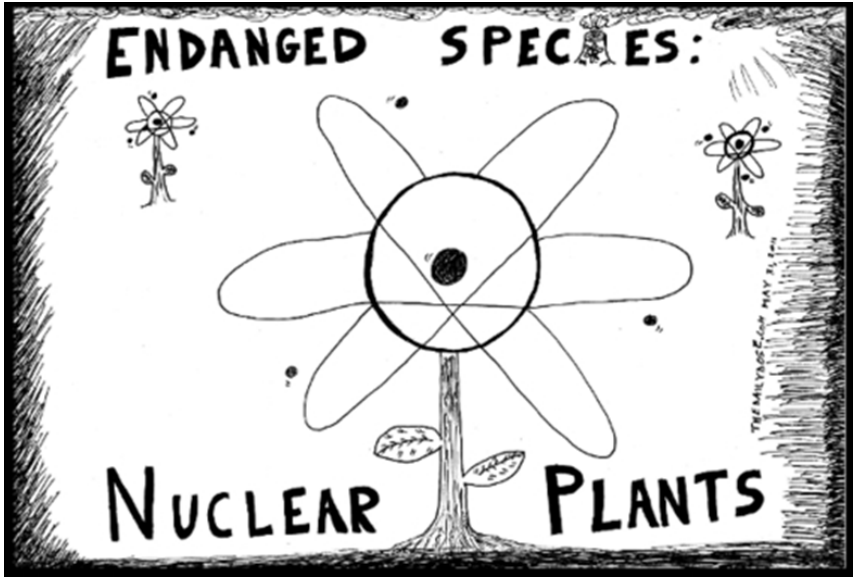
What will happen to Swedish nuclear plants?



- Nuclear power production in Sweden: 60-70 TWh (10 reactors)
- No support for direct subsidies to nuclear plants
- Very likely that 3 reactors will be closed down before 2020
- Uncertain if the remaining reactors will run as long as 2032-45
- AND not likely that Sweden will ever renew its nuclear fleet.

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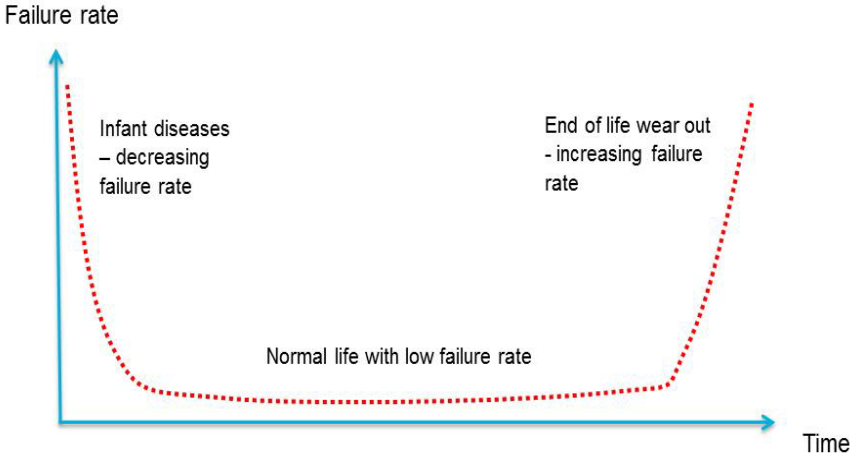
What do we know about the future?

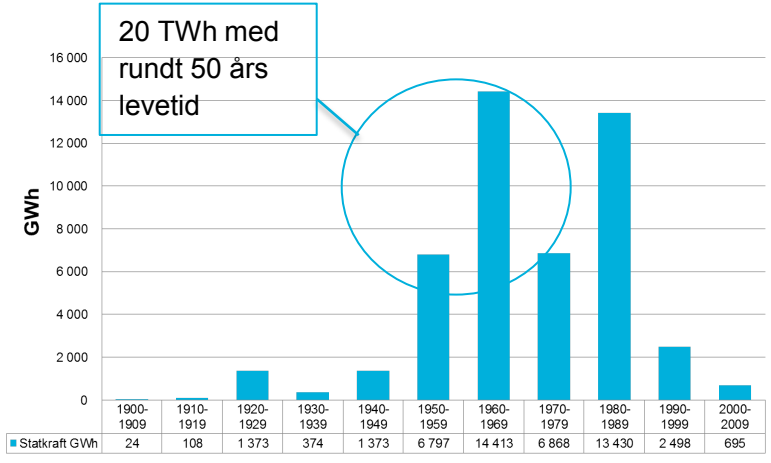
- Renewables will become cheaper than fossil and nuclear production
- Distributed energy technologies will play an increasing role
- Future technological breakthroughs will strengthen the case for RES

Stort investeringsbehov i gammel vannkraft

Sannsynlighet for feil vs. tid



Statkrafts vannkraftportefølje



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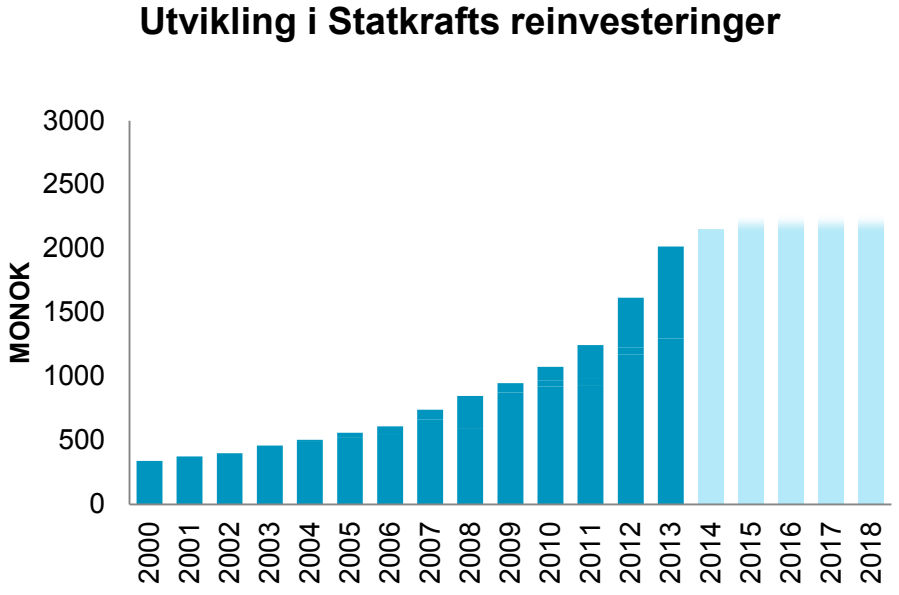
Utvikling i Statkrafts reinvesteringer

- Sterk økning i Statkrafts reinvesteringer
  - Eldre anleggspark som nærmer seg større reinvesteringer
  - Investeringer i dammer og strengere krav fra myndigheter
- Økte reinvesteringer i en periode med lave energipriser



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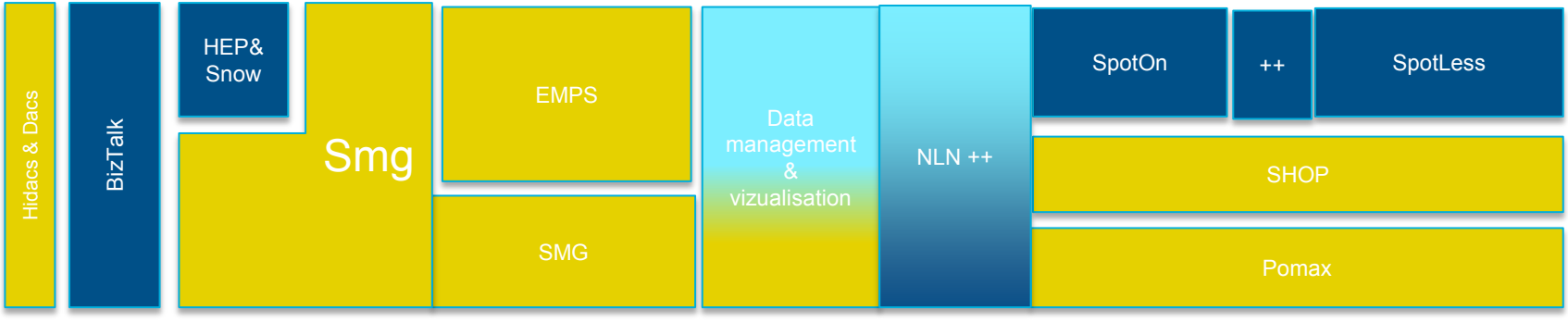
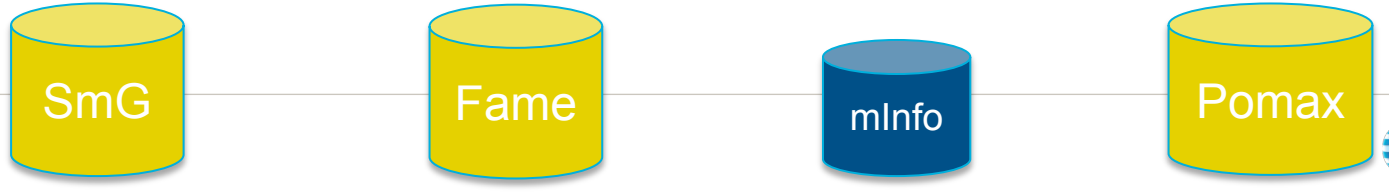
System landscape Nordic Energy Management





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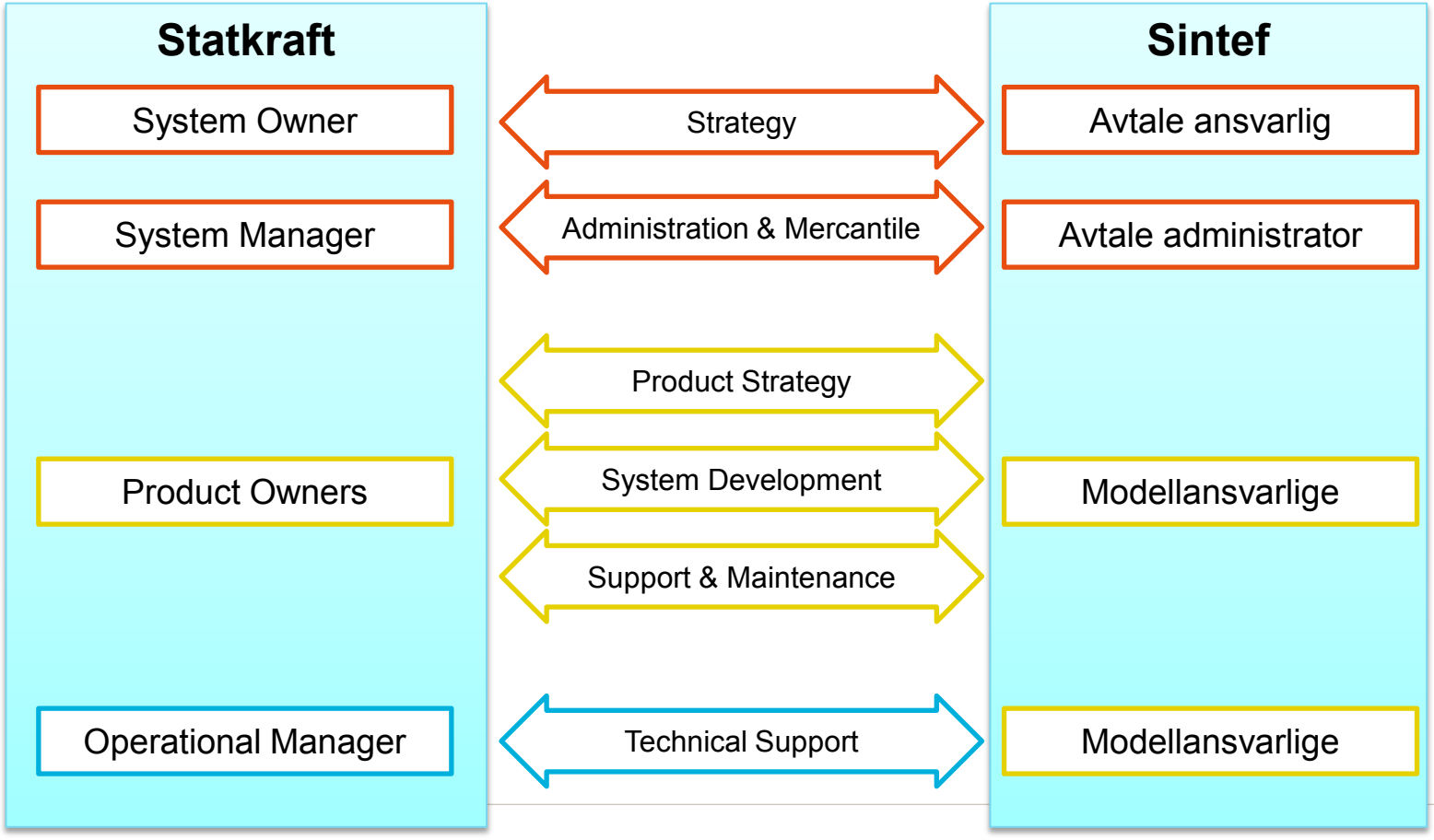
SINTEF– Statkraft relationship



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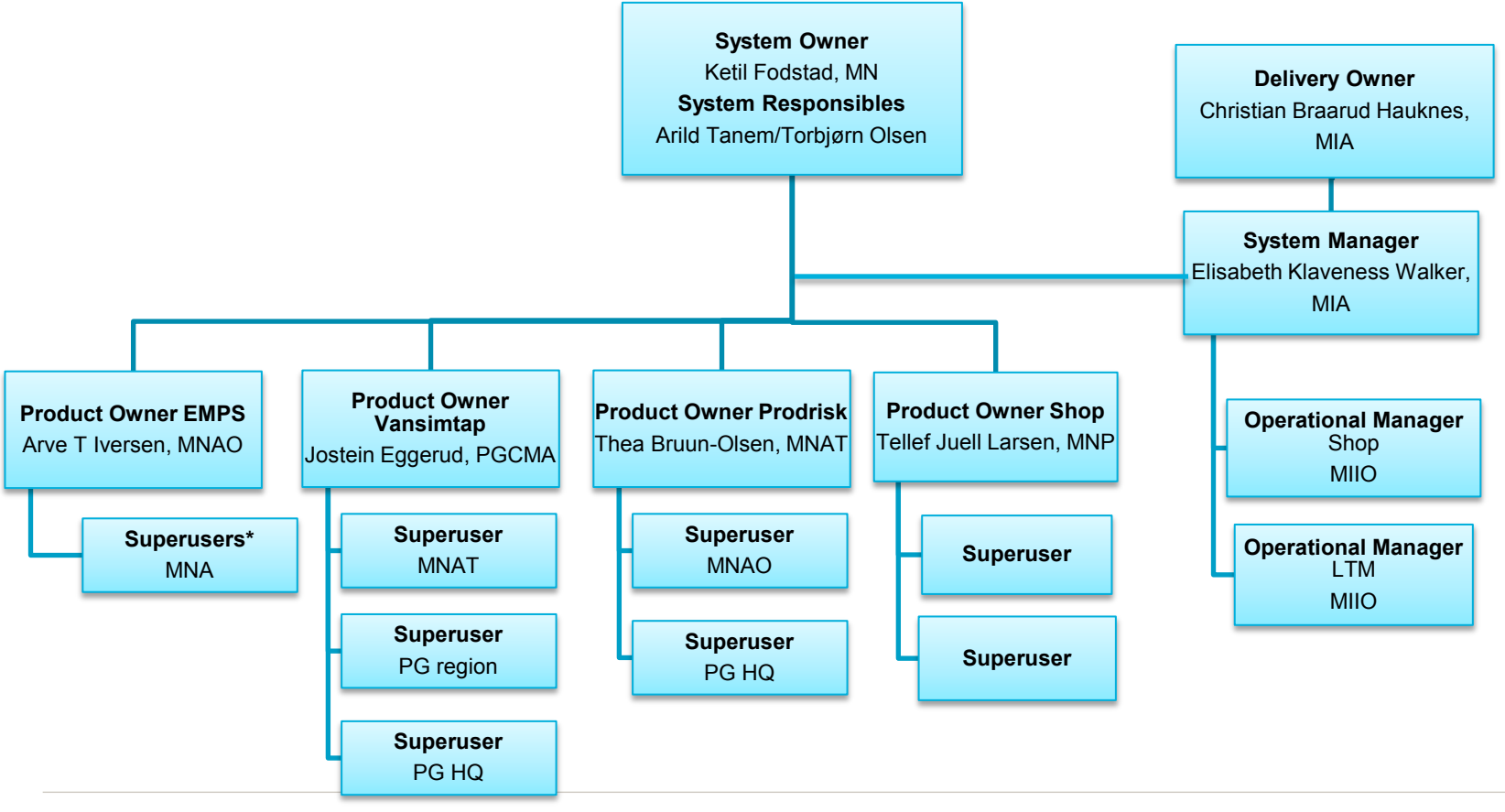
Roles and responsibilities SINTEF systems



*: Flere funksjoner

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EMPS API and high resolution data

OWNER / SPONSOR / STATUS (according to Statkraft DG-model)

BA/SA: MN	Ketil Fodstad	DG3 planned June 2014

NEED/OPPORTUNITY

- Market changes with more intermittent production challenges current market modelling. More details and increased amounts of data need.
- LTM is a state of the art marked model, but the interface for input and results is from the 1970 and an impediment for better analysis.
- A modernisation of model interface and higher frequency data is needed.

RECOMMENDED SOLUTION — TOT. COST: Xx MNOK

- SINTEF to deliver first version of API, calendar correct and high resolution data

COMPLIANCE PROJECT (ref. to legal / licence requirement)

PROJECT IMPLEMENTATION RISK

VL	L	M	H	VH
			X	

- Time delay: Sintef not able to deliver model upgrades on time
- Value creation dependent on project "LTM Analysis Platform"

BUSINESS CASE — NPV: -xx MNOK

- Has no positive NPV alone, but is essential for the value of project "LTM Analysis Platform
- Improve modelling and analyses to better understand price volatility and value of flexibility
  - Basis for simplification of application portfolio

BENEFIT REALISATION PLAN

- First benefits will come when data from EMPS are made available through a DB and analysis tool.
- Benefits will also be realized through later projects (reports, integration)

CONTRIBUTION TO STATKRAFT STRATEGY

VL	L	M	H	VH
				X

- LTM is the core system for maximizing the value of Statkraft's Nordic asset base
- Improved analysis support for cable promotion

REDUCTION OF OPERATIONAL RISK

VL	L	M	H	VH
		X		

- Communicating with the application via an API will reduce risk of errors
- Better availability data for analysts and stakeholders will reduce the risk of errors in modelling.
- However more data (high res) also creates more complexity.

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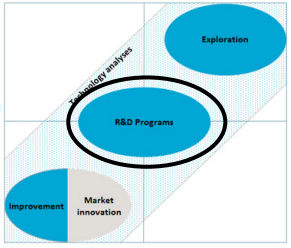
Corporate R&D Programs



Focus areas

European Flexible Generation

Trading and Origination

Hydropower in Emerging Markets

Wind Power

District Heating

R&D Programs

- **Future Hydro Power**
- **Competitive Wind Power**
- **Energy from Biomass**
- **Consequences of Climate Change**

Why R&D is important for Nordic Energy

- Energy management, including market data and integrated processes with O&M, is one of Statkraft's sustained competitive advantages
- Energy management is competence-based value creation
- We utilise competence with the help of methods and tools
- Statkraft aims to remain at the front of developments to sustain competitive edge in a dynamic market
- Statkraft has a growth strategy based on competence from Nordic hydro power
- **R&D is important to develop necessary competence, processes, methodology and tools to support Statkraft's ambitions for operations and growth**

Main R&D projects with SINTEF involvement

- Hydrology
  - Stochastic Weather Generator
  - Weather radar
  - ENKI
- Long-term Energy Management
  - Stokastisk optimaliseringsmodell med individuelle vannverdier og nettrestriksjoner (SOVN)
  - Integrating balancing markets in LTM (IBM)
  - Models for Aggregation and Disaggregation (MAD)
  - Vannverdikobling LTM-SHOP
  - EMPS improvements
- Short-term Energy Management
  - SHARM evaluation
  - MultiSHARM
  - SHOP improvements

THANK YOU

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