EFFEKTKONSEKVENSER AV EN BETYDLIGT LÄGRE ANDEL KÄRNKRAFT

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Statkraft Energi AS

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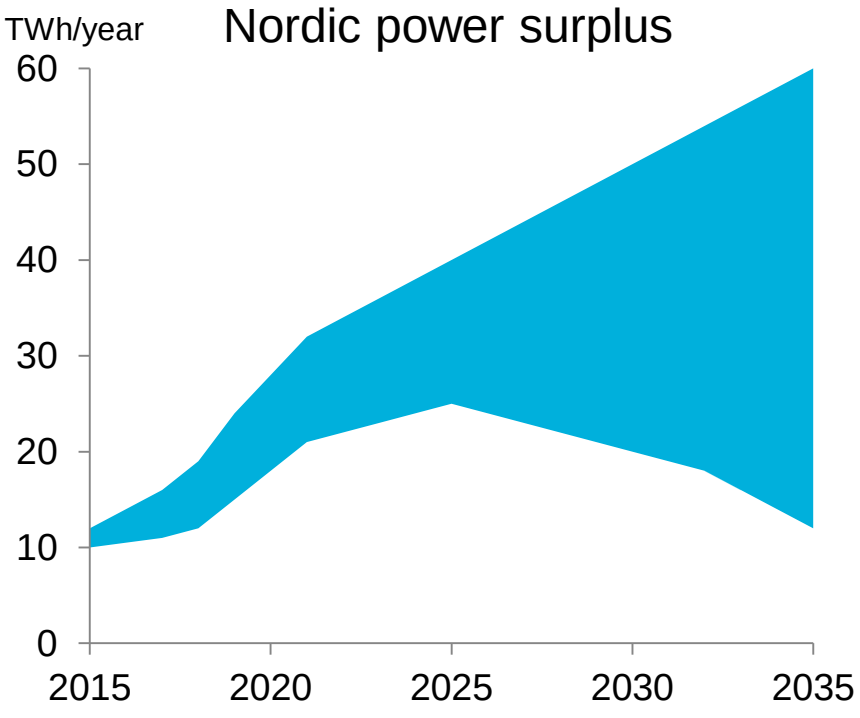
Increased Nordic power surplus towards 2030



- Main drivers
  - Norwegian / Swedish elcert scheme
  - Finnish nuclear project(s)
  - Flat demand in all Nordic countries
- Swedish nuclear power is the largest uncertainty

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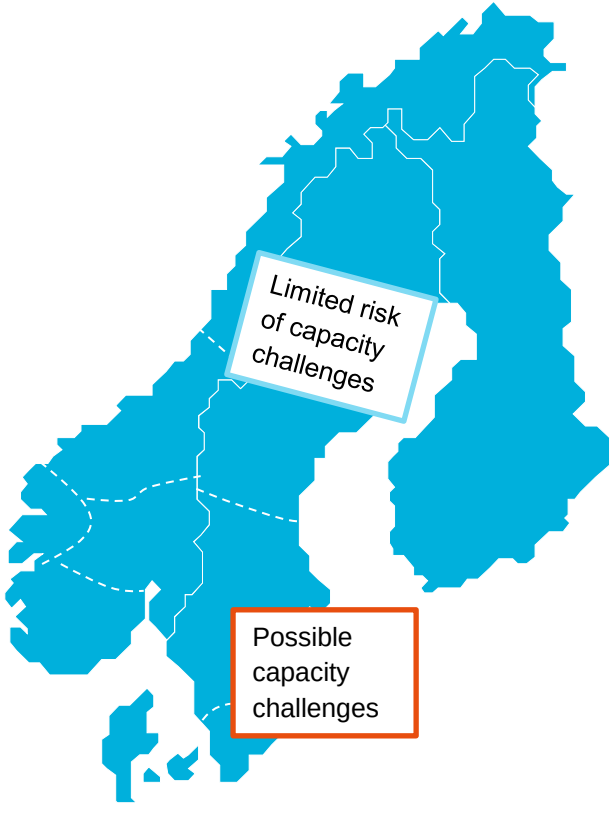
Capacity consequences with less Swedish nuclear

Scope

- Nordic capacity challenges as a consequence of less Swedish nuclear
- Possible mitigating actions

Framework

- Based on the Statkraft long term market analysis for 2030
- 80 years of correlated European weather data on 3 hours granularity
- Transmission capacity represented as limitations between price areas



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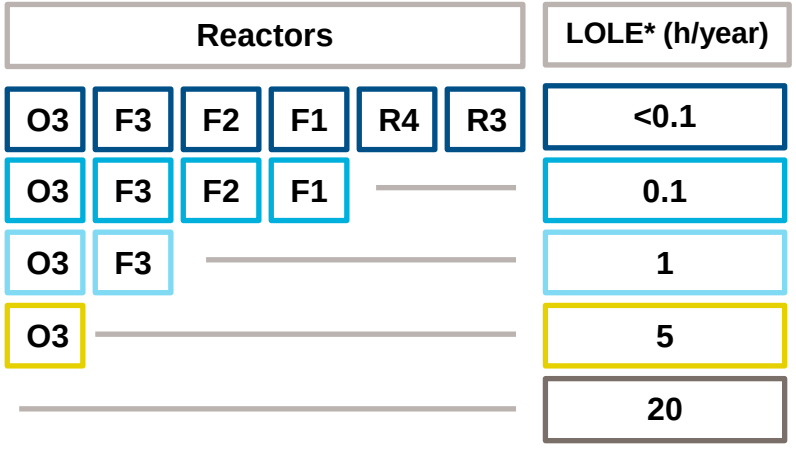
Capacity challenges with different degrees of nuclear phase-out

Degrees of nuclear phase-out



Main take-away

8 out of the 10 existing nuclear reactors can be phased out before significant capacity challenges arise

*LOLE = Loss of Load Expectancy (due to capacity inadequacy).
England and France have designed their capacity mechanism to reach 3h Loss of Load expectancy per year

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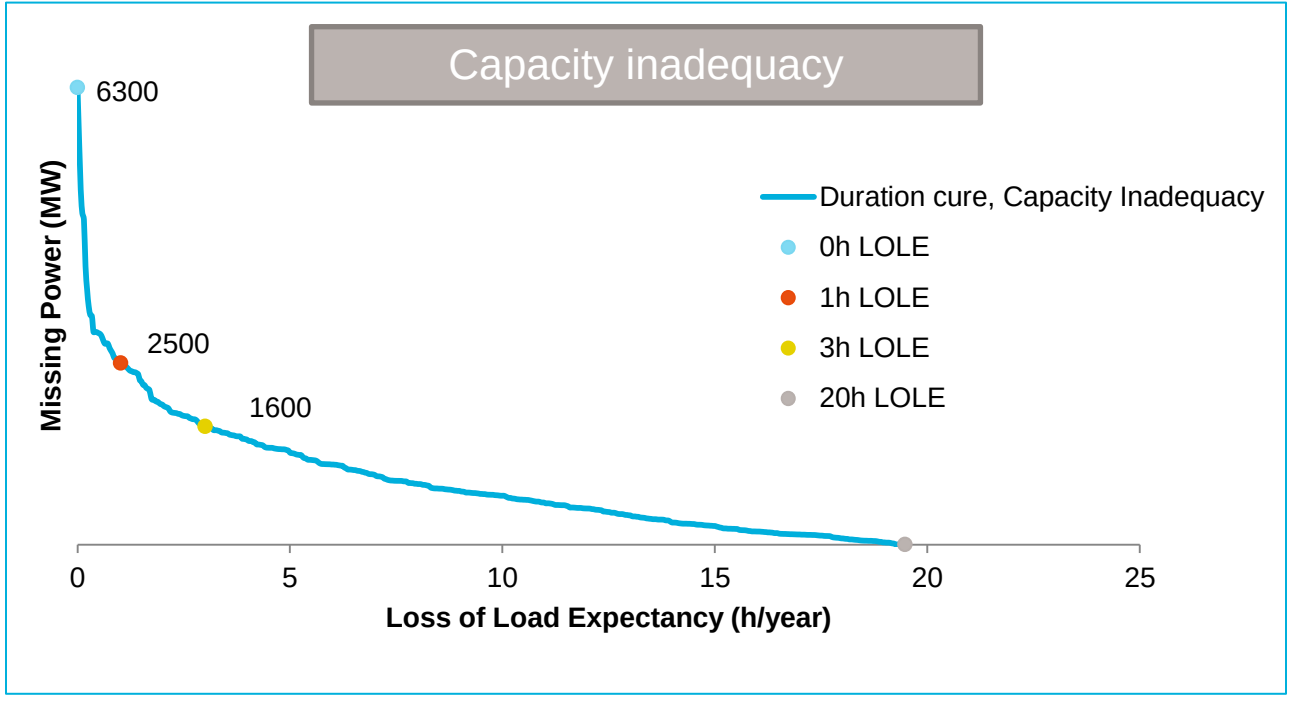
In case of full phase-out of Swedish nuclear by 2030

Capacity challenges in a few hours



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Several measures can strengthen capacity in southern Sweden

Pre-requisites	An efficient market providing reasonable price signals to consumers and producers
	Maintain capacity and flexibility of hydropower

Measures with limited potential	New CHP
	New on-shore wind
	New off-shore wind
	New solar

Measures with clear impact	Peak load reduction
	Transmission reinforcement
	New gas capacity
	New bio capacity

Elaborated and analysed in next sections

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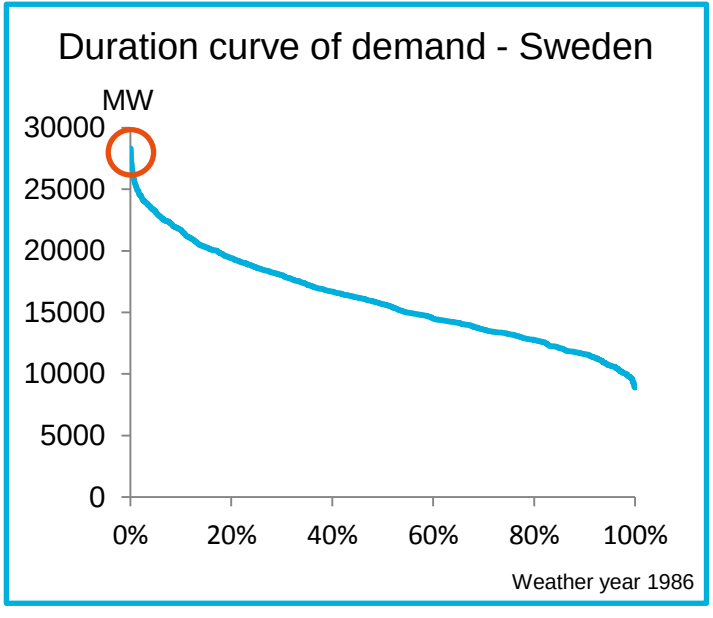
Mitigating action

Peak load reduction through demand flexibility

Reducing peak load by demand response is mitigating capacity challenges. Rapid technology development plays an important role.

Price sensitive demand 2030	LOLE (h/year)
Base case: Full nuclear phase-out	20
6 % demand response	12
12% demand response	3



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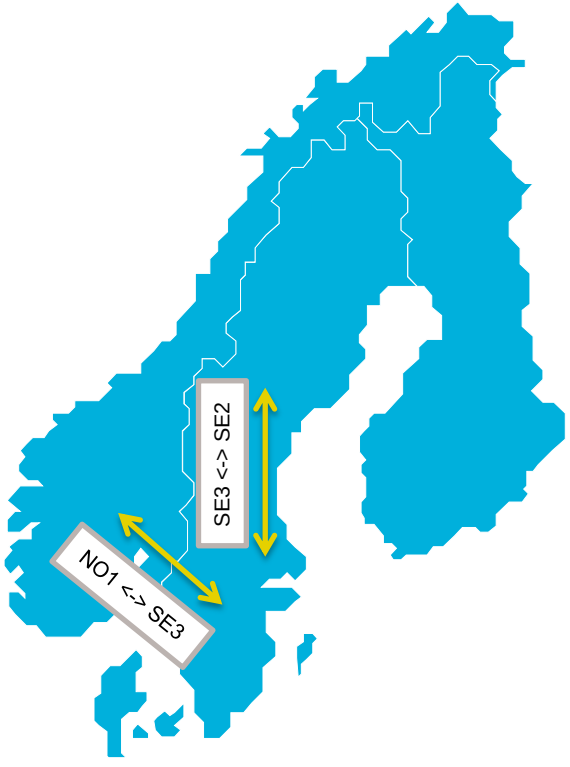
Mitigating action

Transmission reinforcement

Increased transmission would enable Swedish and/or Norwegian hydropower to mitigate capacity challenges

New transmission lines 2030 (MW)			LOLE (h/year)
Base case: Full nuclear phase-out			20
SE3 to	SE2: 1400		5
SE3 to	NO1: 1400		5
SE3 to	SE2: 1400	NO1: 1400	1



LOLE = Loss of Load Expectancy (due to capacity inadequacy)

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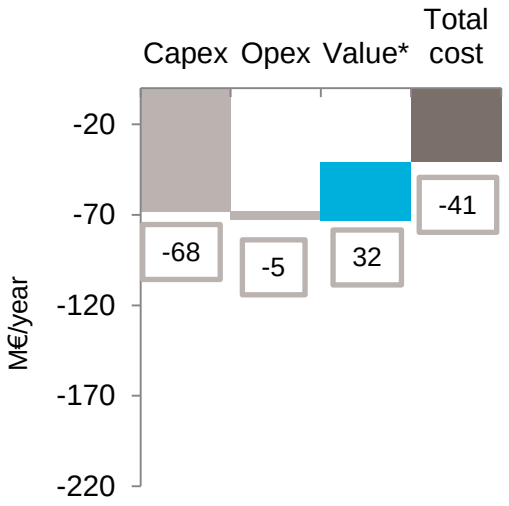
In case of full phase-out of Swedish nuclear by 2030

Choose the most cost efficient solution

Transmission reinforcement

”Västra grenen”, SE3-NO1, 1400 MW



Source of capex/opex: SvK/KTH

Value(*): Defined as increased producer surplus, consumer surplus and TSO congestion revenues with regards to a base-case

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In case of full phase-out of Swedish nuclear by 2030

Choose the most cost efficient solution

Transmission reinforcement

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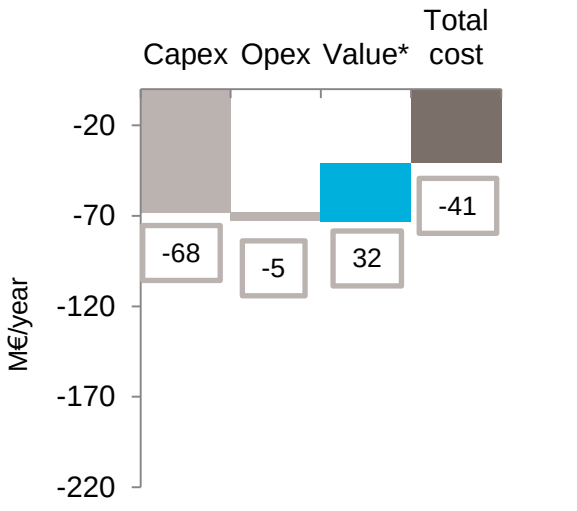
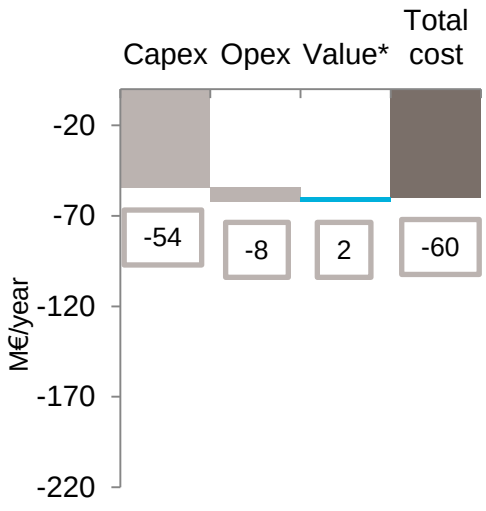


Source of capex/opex: SvK/KTH

New gas capacity

Peak gas plants, 1400 MW



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In case of full phase-out of Swedish nuclear by 2030

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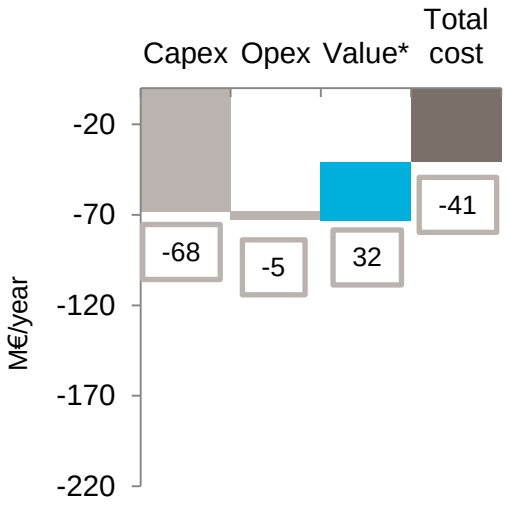

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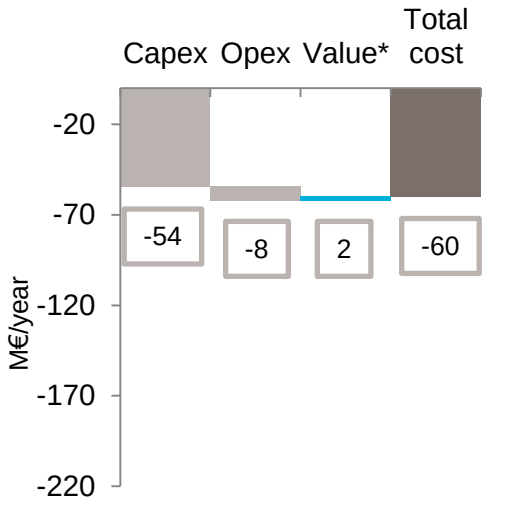
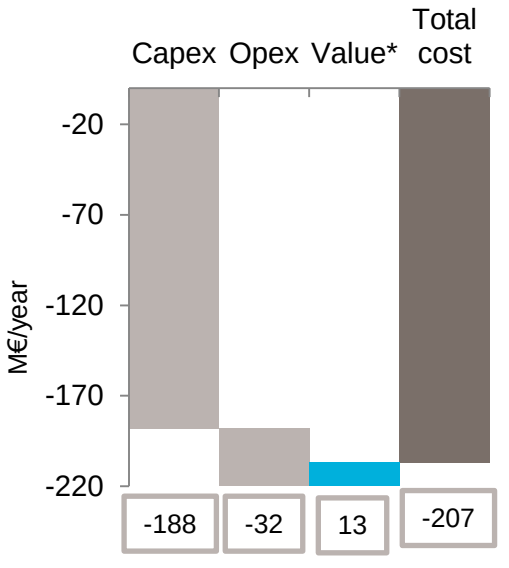


Source of capex/opex: Elforsk

New bio capacity

Condensing bio power plant, 1400 MW



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Peak load reduction Could not be measured according to same criteria

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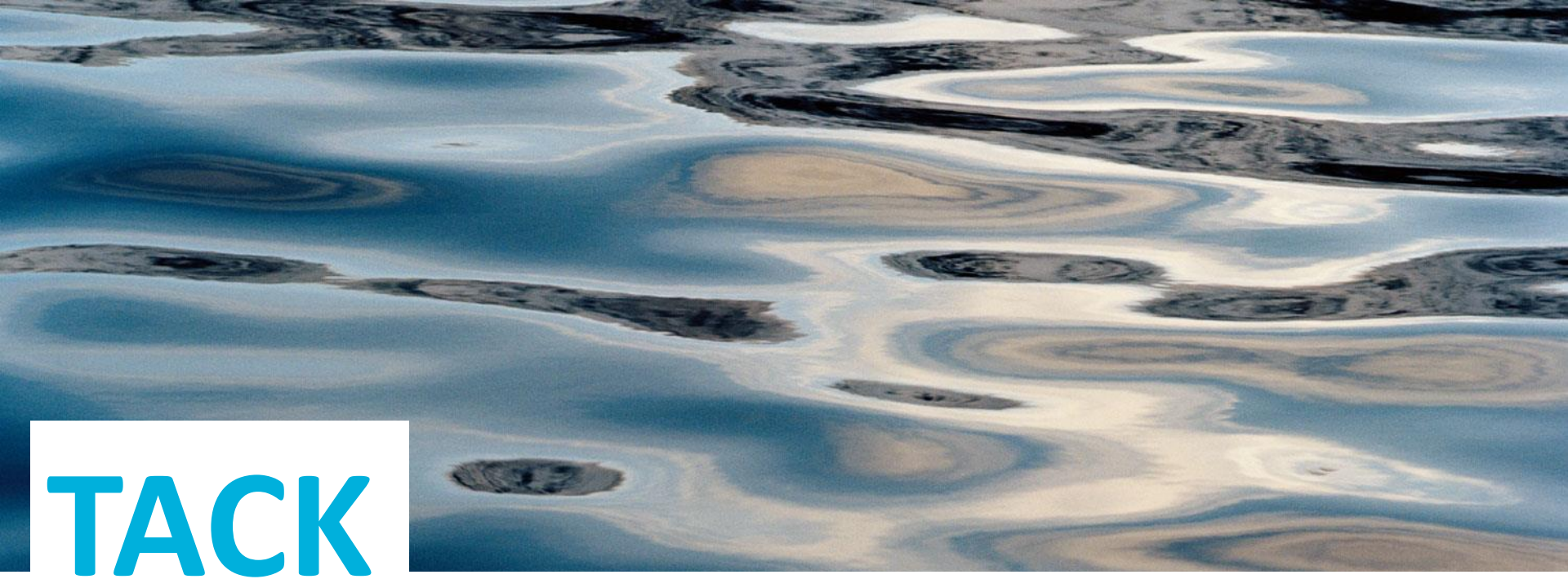
Nordic power market works well with significantly less Swedish nuclear in 2030

- 8 out of the 10 existing nuclear reactors can be phased out before significant capacity challenges arise
- Some measures needed if full nuclear phase-out – the most cost efficient are:
  - Increased transmission capacity
  - Market driven demand response
- No need to introduce new measures now
  - Have trust in the market
  - Do not prolong the elcert scheme
  - Strive for an efficient EU-ETS market

Foto: Svenska Kraftnät



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