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# Status update on East-West energy flows

Webinar for Nordic market participants, 2022-01-20



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# Welcome and introduction

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## Purpose of the webinar

- > To inform about the current status for the East-West flow situation including the new sum allocation for SE3 to DK1 and NO1 that Svenska kraftnät proposes to introduce in the market coupling for day ahead trade
- > To inform about the ongoing consultation for the sum allocation
- > An opportunity for market participants to ask questions

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# Agenda

- > Welcome & Introduction (10:00 -10:05)
- > General status update about the east-west flows and measures Svenska kraftnät is taking (10:05 – 10:30)
  - > Q&A (10:30-10:45)
- > Break (10:45 – 10:55)
- > Information about new sum allocation in market coupling for SE3 to NO1 and DK1 (10:55 – 11:35)
  - > Q&A: (11:05-11:10)
  - > Q&A: (11:35 – 11:55)
- > Summary/next steps (11.55-12.00)



# Practicalities during the webinar

- > The webinar will be held in English – if requested a similar webinar can be held in Swedish
- > The webinar is divided into 2 blocks with information including specific sessions for questions
- > Questions can **only** be asked during the QA session, **please use the chat only for practical issues**
- > During the Q&A session **please use QA section**
  - > We will read them and answer as many as possible orally
  - > If there are questions that we do not have time to answer during the meeting we will come back in writing after the meeting



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# Participants from Svenska kraftnät

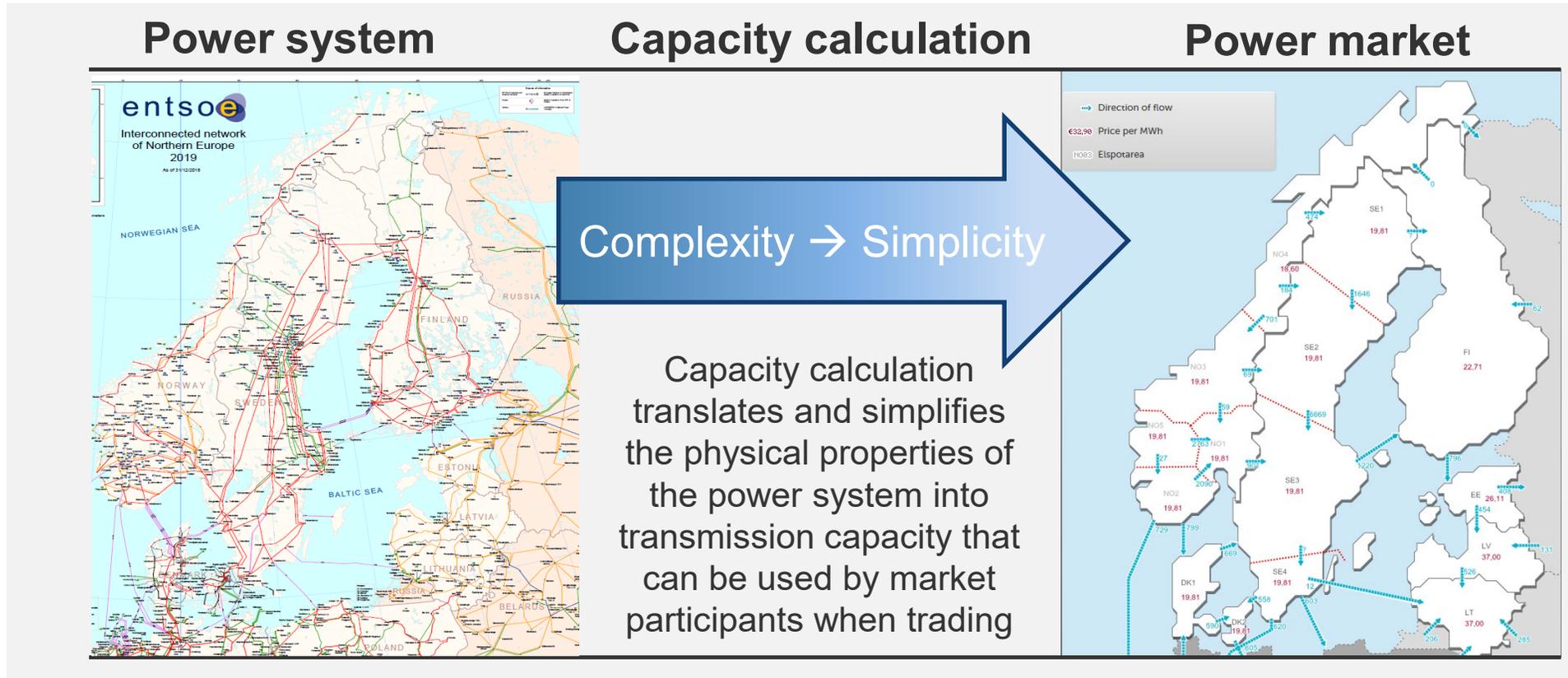
- > Stefan Svensson
- > Mikaela Sjöqvist
- > Erik Ek
- > Ulrika Formgren
- > Rodrigo Gonzalez

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# General status update about the East-West energy flows and measures Svenska kraftnät is taking

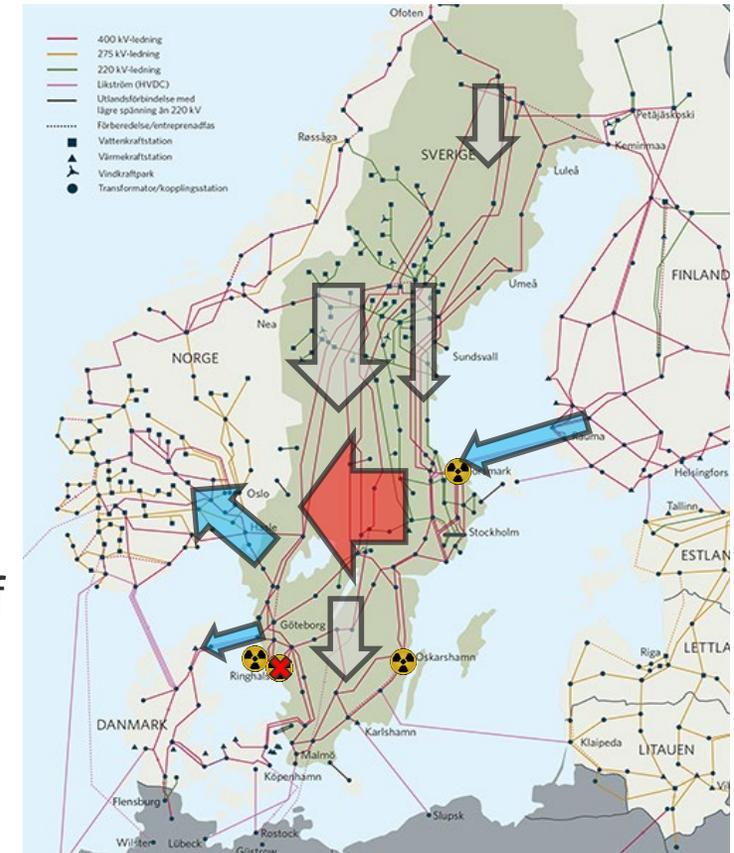
- > Summary: East-West energy flow situation
- > Recent news
- > East-West capacities 15 November 2021 – 14 January 2022
- > Prices and internal SE capacities
- > Planned and implemented measures

# The capacity calculation; the connection between the physical properties of the power system and trade



# Summary: East-West flow situation

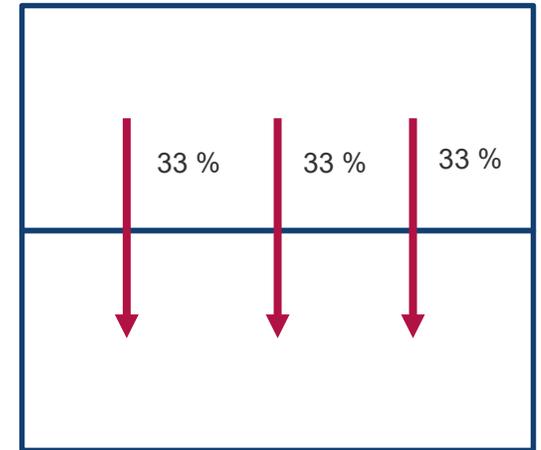
- > The power system is undergoing two major changes; reallocation on production in Sweden and new export capacities
  - > Phase-out of production (mainly on the West Coast) and more production surplus in northern Sweden and FI (+1600 MW)
  - > More export capacity from NO->DE and NO->GB (+2800 MW)
- > This induce an East-West flow that results in changes of transmission capacities to and from SE3



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# Summary: Transmission capacity is a dynamic parameter

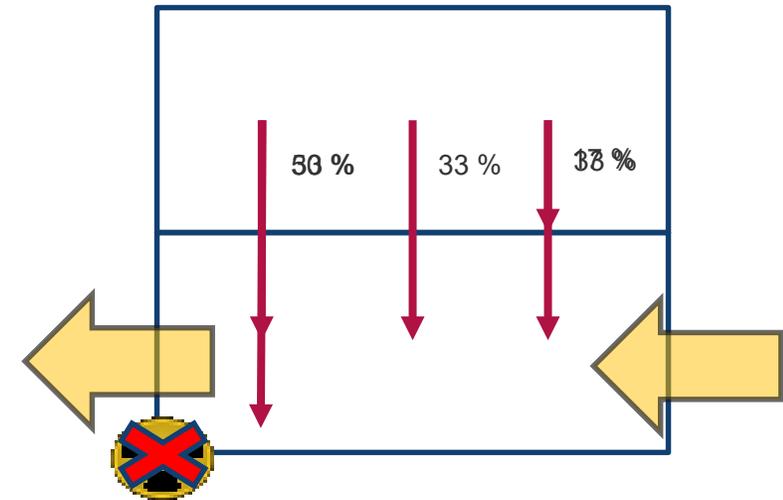
- > Transmission capacities depends on the flow scenario and flows depends on localization of load and power generation **and resulting export/import flows**
- > Operational security must always be respected, different elements (internal and cross-border) are boundary setting for different flow situations
- > Increasing number of possible flow scenarios leads to a larger variation on DA-capacities



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# Summary: Transmission capacity is a dynamic parameter

- > Example with three 1000 MW lines
- > If all are used evenly (33 % each) in the flow scenario the total capacity is
  - >  $3 \times 1000 = 3000 \text{ MW}$
- > If the flow scenario shifts, the distribution shift as well (50%, 33%, 17%) and the capacity is reduced to
  - >  $1 \times 1000 + 0,67 \times 1000 + 0,33 \times 1000 = 2000 \text{ MW}$



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# News regarding East-West energy flows

## - Measures

- > **10 December:** More predictable flows during winter-time makes optimised capacities between day/night-times possible
- > **14 December:** New allocation method to increase utilisation on western capacities from SE3
- > **17 December:** Additional measures taken to alleviate congestions and continue to optimize capacities

### Nya tillgängliga kapaciteter under vintern

10 dec, 2021

Kraftsystemet är inne i en stor omställning som ger upphov till nya elflöden som belastar transmissionsnätet på fler sätt än tidigare. För att garantera driftsäkerheten har Svenska kraftnät under året behövt anpassa överföringskapaciteter genom Sverige som påverkar handel mellan de nordiska länderna. Idag publicerar Svenska kraftnät nya kapacitetsnivåer för att optimera handelsmöjligheterna under vintern.

### Svenska kraftnät föreslår ny åtgärd för att öka tillgänglig handelskapacitet

14 dec, 2021

Svenska kraftnät har ansökt om att införa så kallad summaallokering för SE3, DK1 och NO1. Syftet är att öka tillgänglig handelskapacitet mellan dessa områden. Genomförande av förslaget kräver gemensam prioritering av TSO:er och elbörsen.

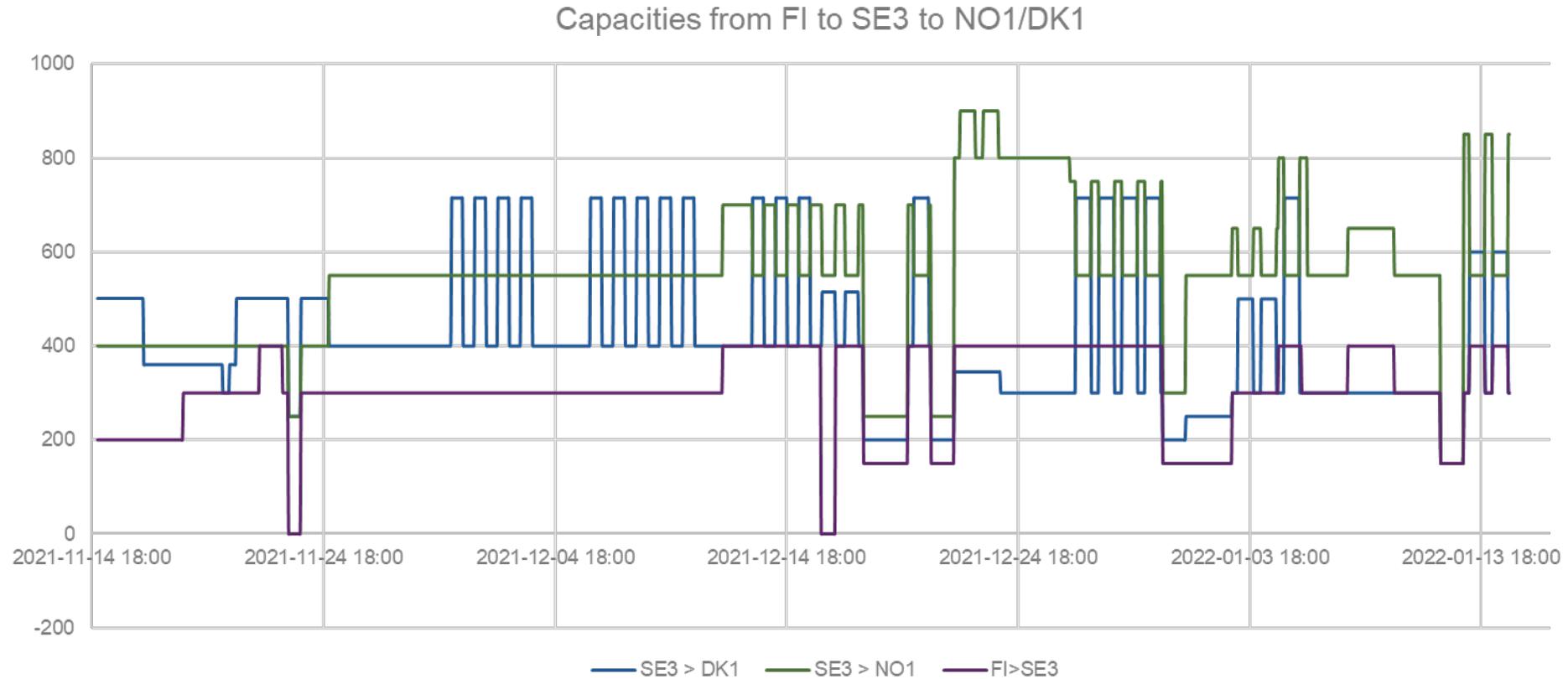
### Svenska kraftnät optimerar tillgänglig kapacitet i transmissionsnätet

17 dec, 2021

Svenska kraftnät har sjösatt ett flertal åtgärder för att på kort sikt öka tillgänglig handelskapacitet med bevarande av systemstabilitet. Bland annan byts begränsande apparater ut, systemvärn projekteras, utökad mothandel undersöks och en ny modell för handel introduceras.

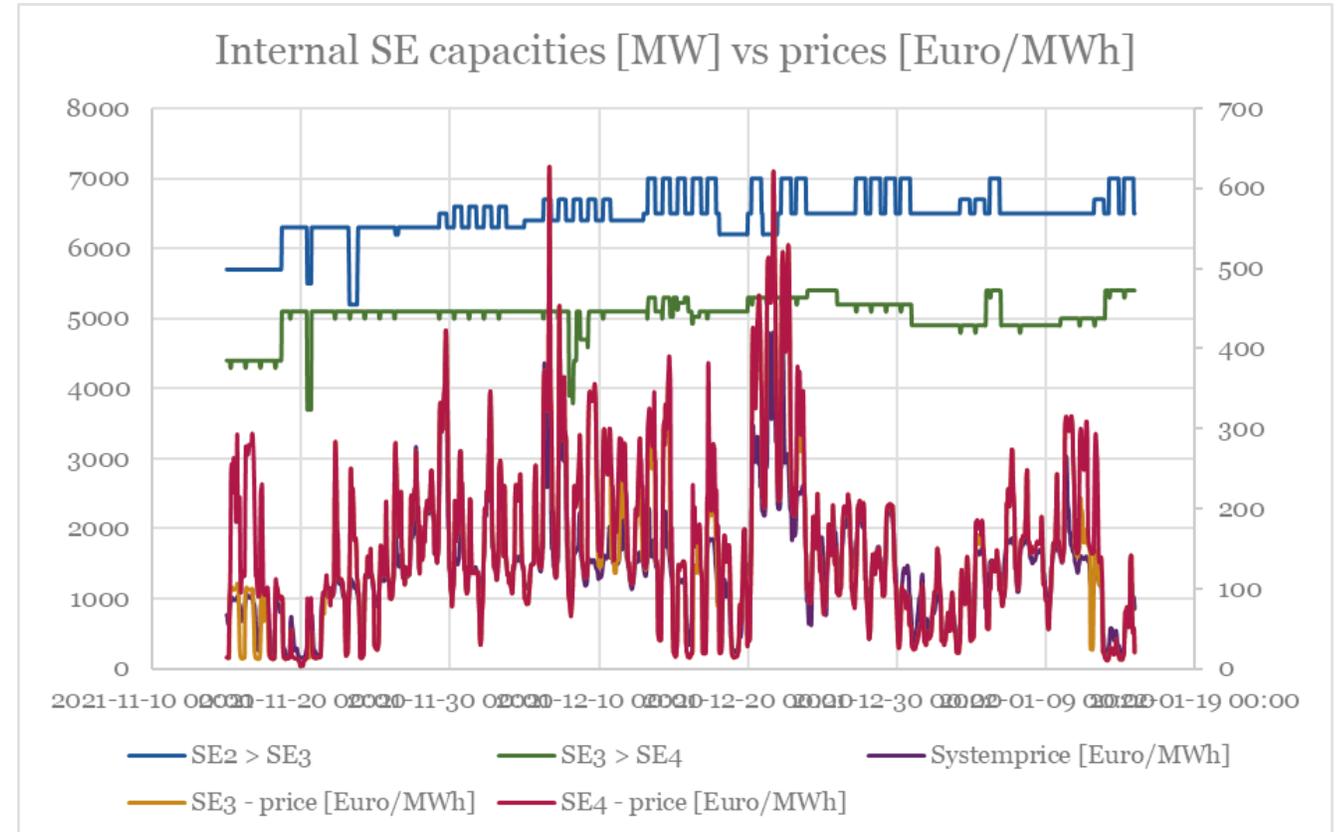
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# East-West-capacities through SE3: 15 Nov 21 - 14 Jan 22

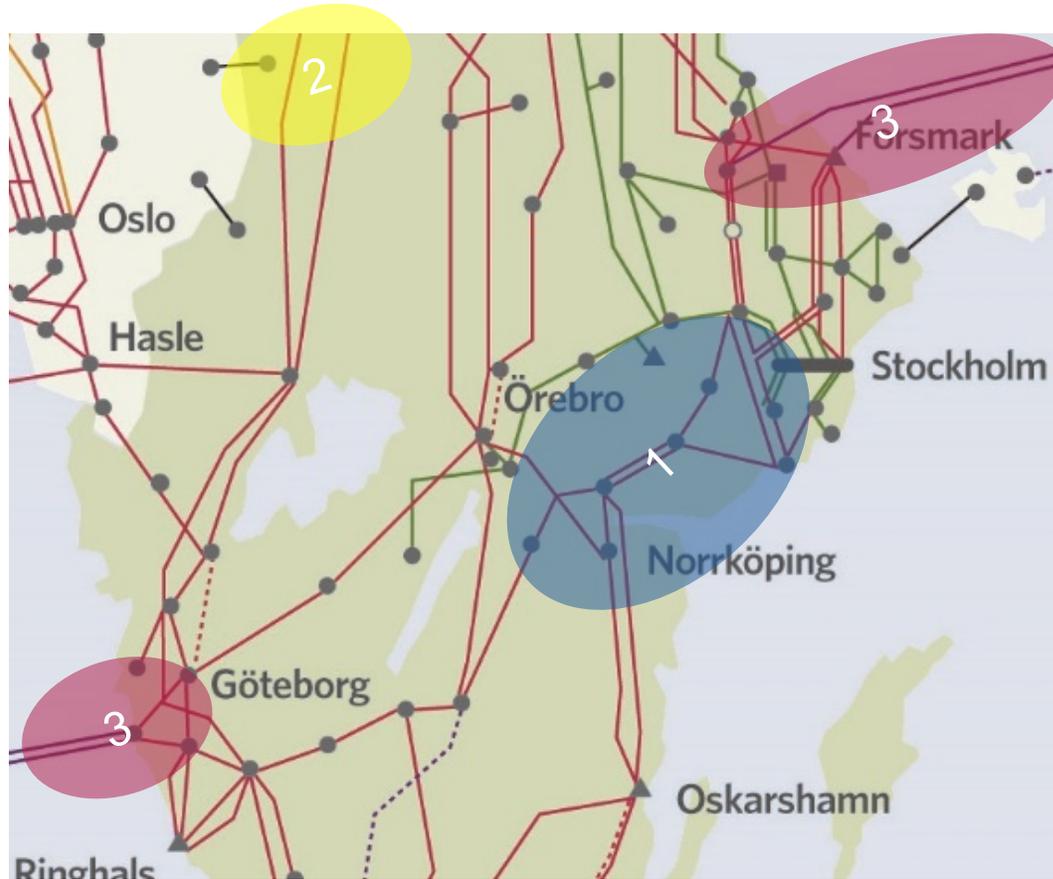


# Price spikes and internal SE capacities winter 2021

- > Low correlation between north>south capacities with price spikes this winter
- > SE prices depend mainly on the Europe electricity prices

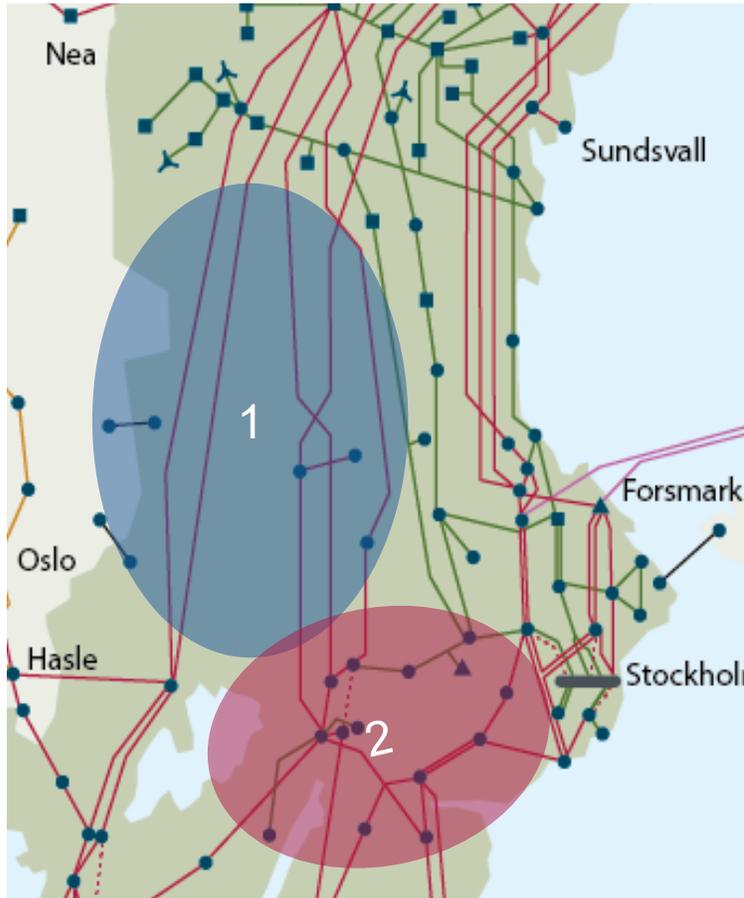


## Short-term measures: East-West energy flows



1. Upgraded breakers/current transformers >100 MW in September/October, additional upgrades planned for spring 2022
2. Increased rated current → approx. 100 MW in December, additional measures considered
3. EPC to be implemented during 2022. Additional system protection to increase available capacity to be investigated during 2022

# Long term measures: East-West Energy flows



1. Upgrading of existing series capacitor stations

2. Installation of static and dynamic voltage regulation. In total 800 MW 2027/2028, time plan is now under reconsideration

Grid reinforcements will stepwise increase capacities, included in investment program NordSyd

More information will be available in future reports (System development plan etc.)

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## Questions and answers

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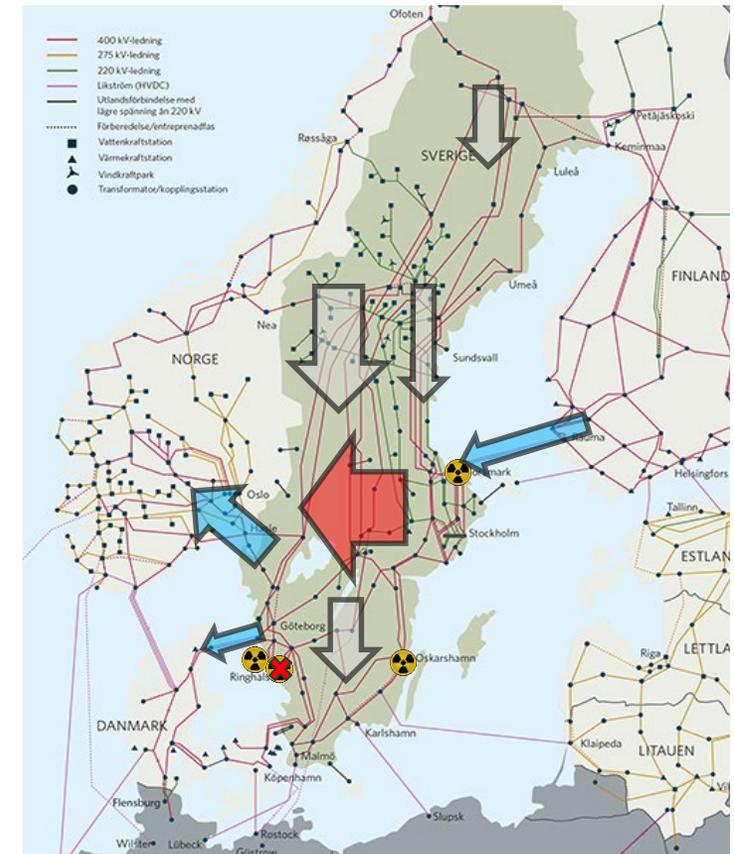
10 min break

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# Proposal for a sum allocation for SE3 to NO1 and DK1 in market coupling for day ahead trade

# Summary: East-West energy flow situation

- > The power system is undergoing two major changes; reallocation on production in Sweden and new export capacities
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  - > More export capacity from NO->DE and NO->GB (+2800 MW)
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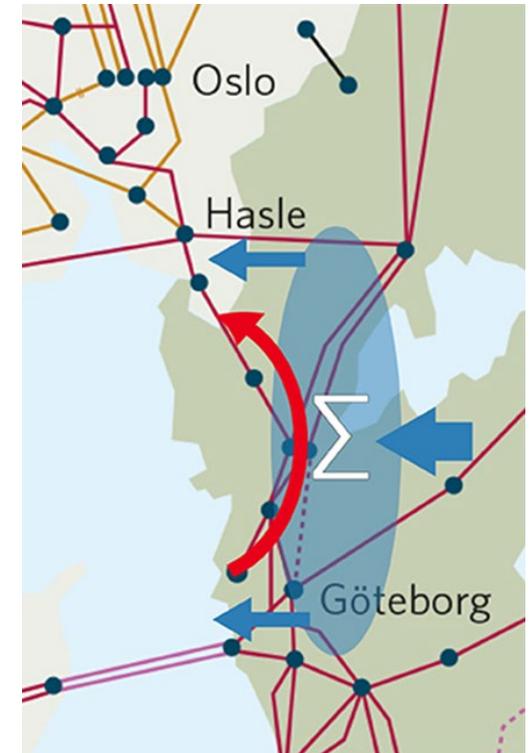
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Example on board to explain the concept

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## New East-West energy flows has significantly reduced capacities for trade to and from SE3 compared to historical values

- > Export to NO1 and DK1 from SE3 is affected by east-west energy flows
  - > Certain amount of transit through SE3 can be defined ←
  - > Today this amount has to be divided and specifically allocated to SE3-DK1 and SE3-NO1 respectively in the market coupling for day-ahead trade ⇄
  - > Svenska kraftnät see operational situations with unused capacities → use of available capacity can be made more efficient by introducing a functionality for sum allocation in the market coupling
- more trading possibilities respecting operational security are possible between SE3, DK1 and NO1



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# Request for change has been sent to the market coupling for day ahead trade

- > First aim is to introduce this functionality in market coupling for day ahead trade
- > Go Live is expected during spring 2022
- > Implementation require joint prioritization of TSOs and power-exchanges in Europe

- Due to the new operational situation on the Swedish West Coast the introduction is possible
- More flexible capacity allocation than in plain NTC
- Under historical conditions the optimisation function would not have had the same relative effect

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## Questions and answers

# Mechanics and configuration of a sum allocation from SE3 to NO1 and DK1 – How does it work?

Example: without sum allocation

Secure capacity for import to SE3 is:

- SE3<NO1: 2120 MW
- SE3<DK1: 715 MW

Total capacity for export without the sum allocation is defined based on elements inside SE3, in this example:

1251 MW { SE3>NO1: 750 MW  
SE3>DK1: 501 MW

*Without the sum allocation the maximum export capacity is set for each border, non-used capacity for one of them can not be used by the other. The sum allocation allows one border to utilise the capacity not used on the other border and its import flow.*

# Mechanics and configuration of a sum allocation from SE3 to NO1 and DK1 – How does it work?



Maximum export on each line is dependent on the export flow on the other one

If a sum allocation is included, this can be taken into account in the optimization:

Sum allocation (i.e. total possible export from SE3):  
750 MW + 501 MW = 1251 MW  
Capacity SE3>NO1: 1251 + import flow from DK1 to SE3 (715) = 1966 MW (SE3+transit)  
Capacity SE3>DK1: 1251 + import flow from NO1 to SE3 (750): **715 MW** (SE3+transit)

*Upper limit secure capacity for border SE3>NO1: "maxNTC"*

*Upper limit secure capacity for border SE3<DK1: "maxNTC" (in this case boundary setting)*

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# Svenska kraftnät has performed analyses of the introduction of the sum allocation

- > Analyses encompasses the period between April 4-9 (period 1) and July 26-27 (period 2) 2021
- > Market simulations performed by NordPool
- > Analysis of data performed by Svk

# Increased capacities for trade if a sum allocation is introduced

Period	Border	Upper limit secure capacity for border	Capacity Historic NTC [MW]	Sum allocation SE3 perspective [MW] (i.e. total export from SE3)	Capacity: Sum allocation + transit [MW] (potential maximal capacity for each border)	Capacity change with sum allocation (sum all+transit)/historic NTC)
1	SE3>DK1	715 ( <i>maxNTC</i> )	501	1251	715*	143 %
2	SE3>DK1	715 ( <i>maxNTC</i> )	250	650	715*	286 %
1	SE3>NO1	2095 ( <i>maxNTC</i> )	750	1251	1966**	262 %
2	SE3>NO1	2095 ( <i>maxNTC</i> )	400	650	1365**	341 %

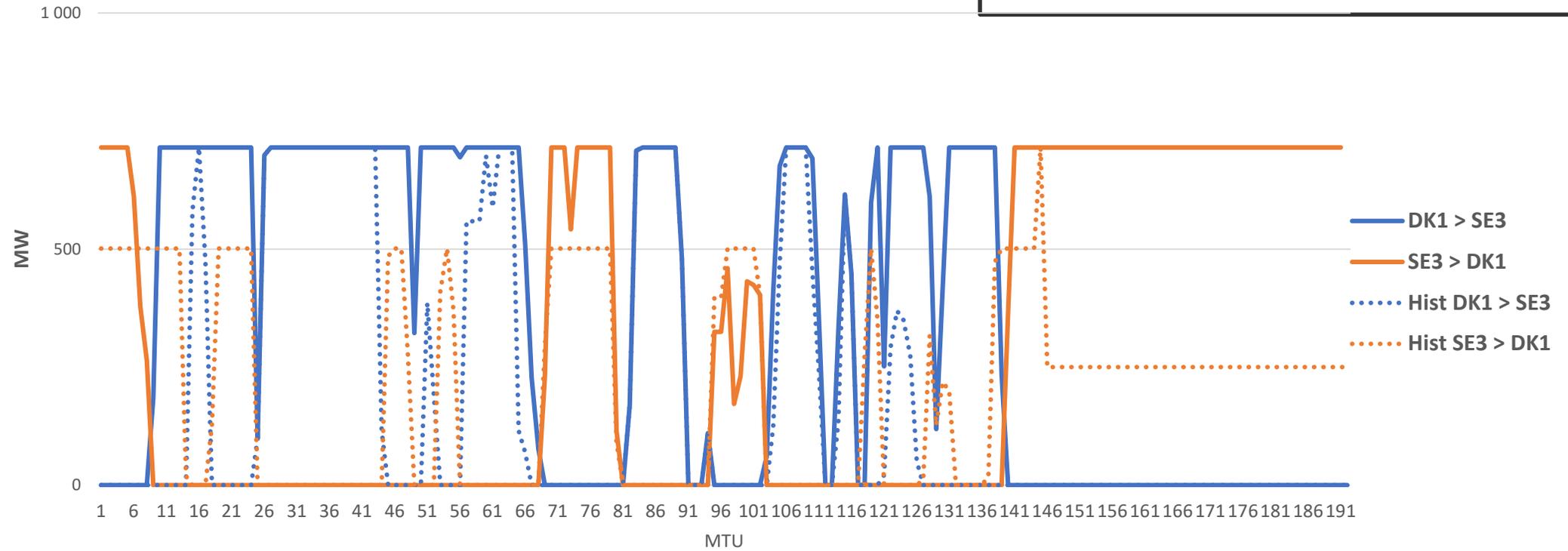
Period 1: April 4-9, 2021  
 Period 2: July 26-27, 2021

\* 715 MW is defined by *maxNTC* SE3 to DK1  
 \*\* requires 715 MW import from DK1 to SE3

# Flow analysis SE3-DK1

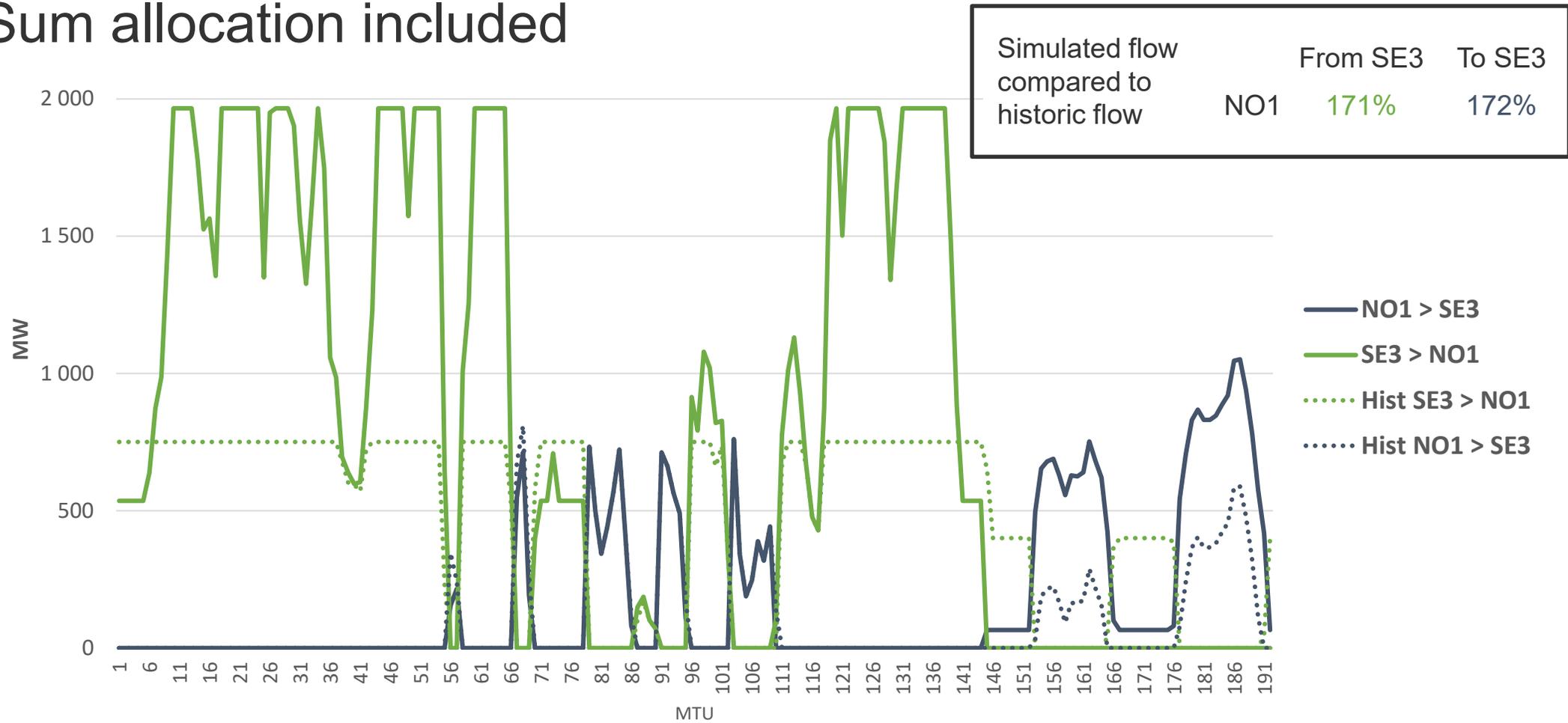
## Sum allocation included

Simulated flow compared to historic flow	DK1	From SE3	To SE3
		132%	187%



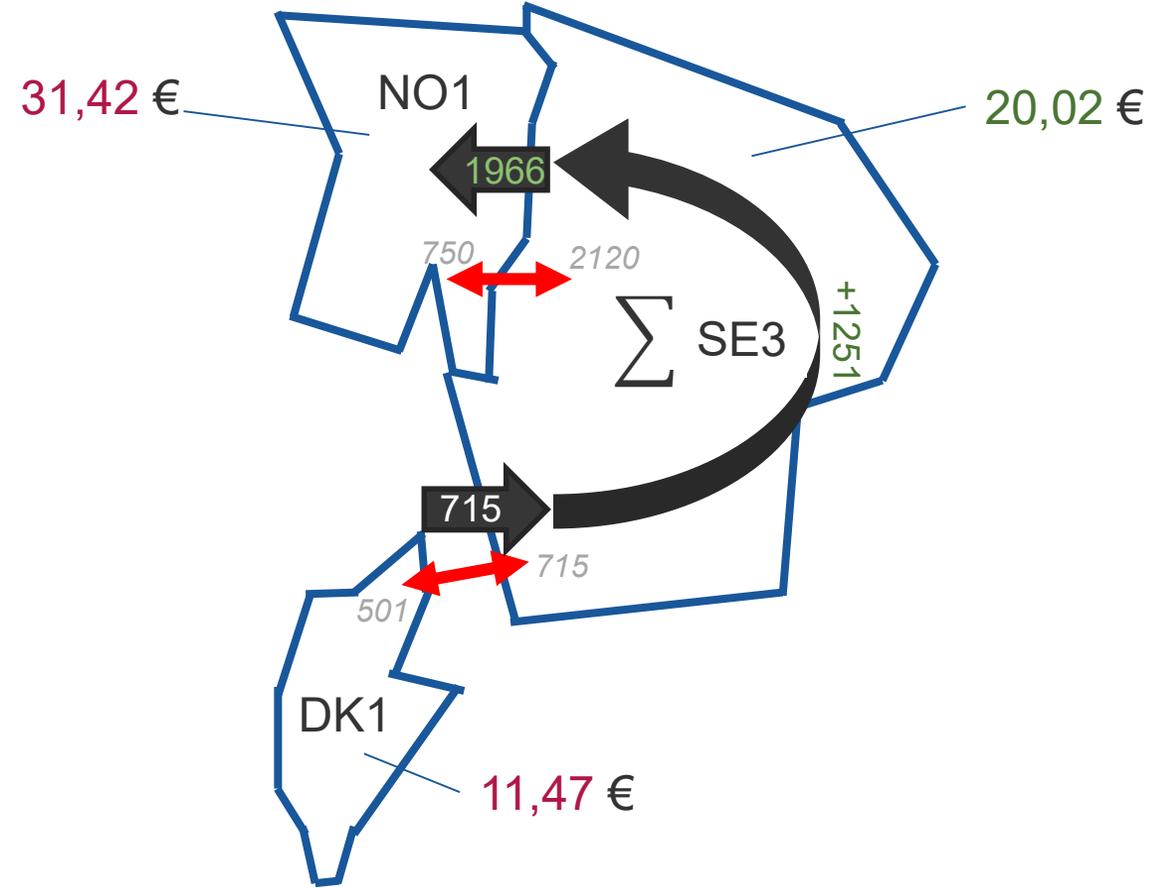
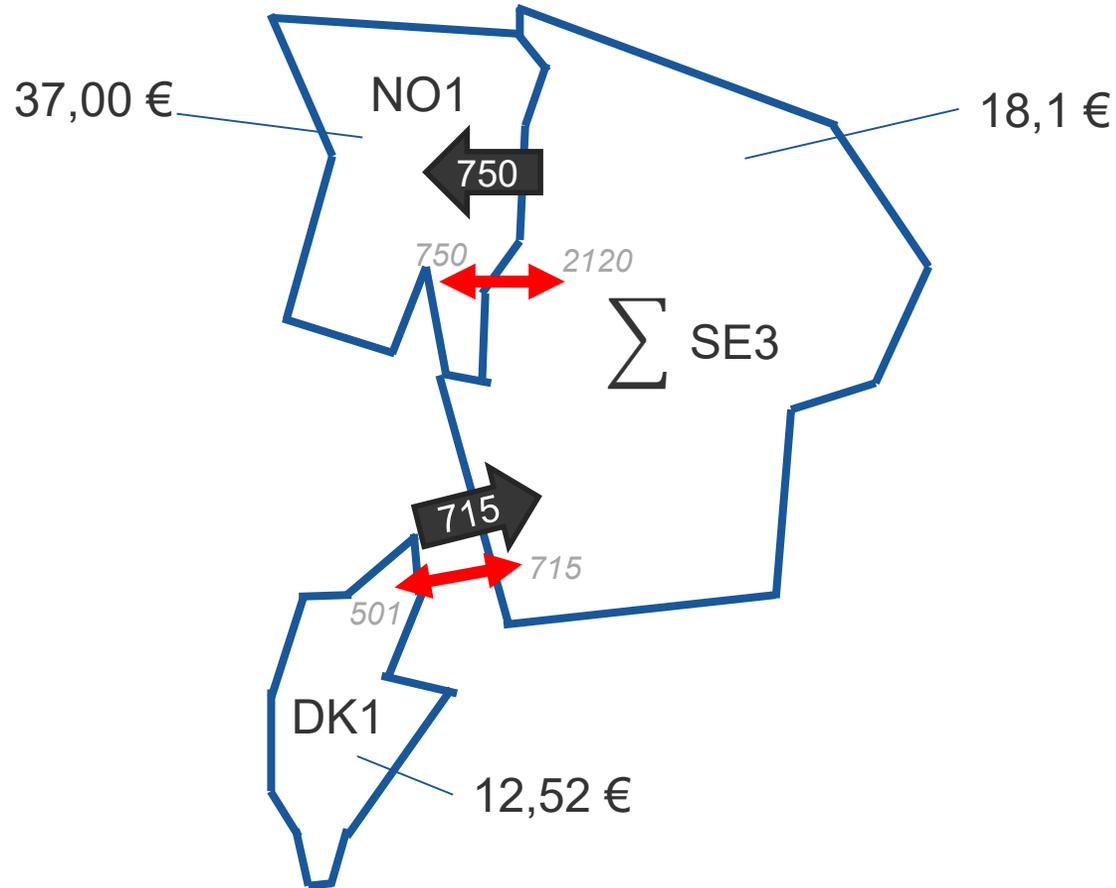
# Flow analysis SE3-NO1

## Sum allocation included



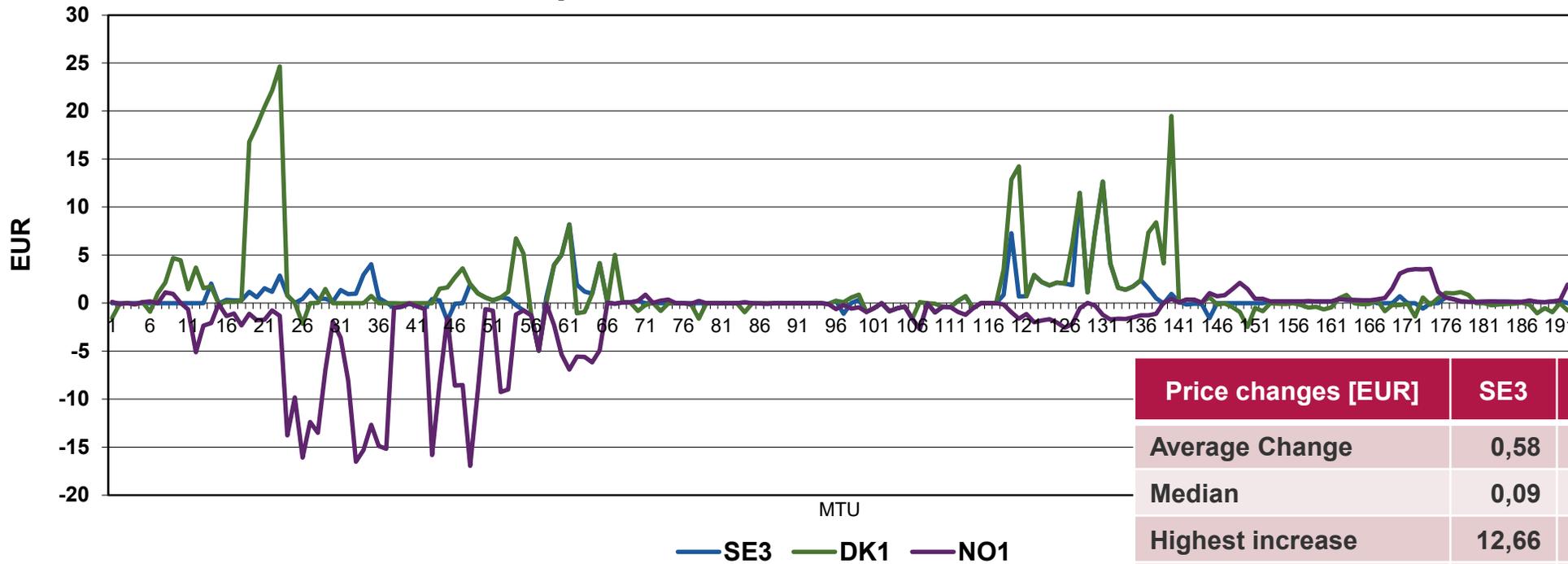
# Flow analysis: historic compared to simulated

Historic – without sum allocation      MTU 62      Simulated – with sum allocation



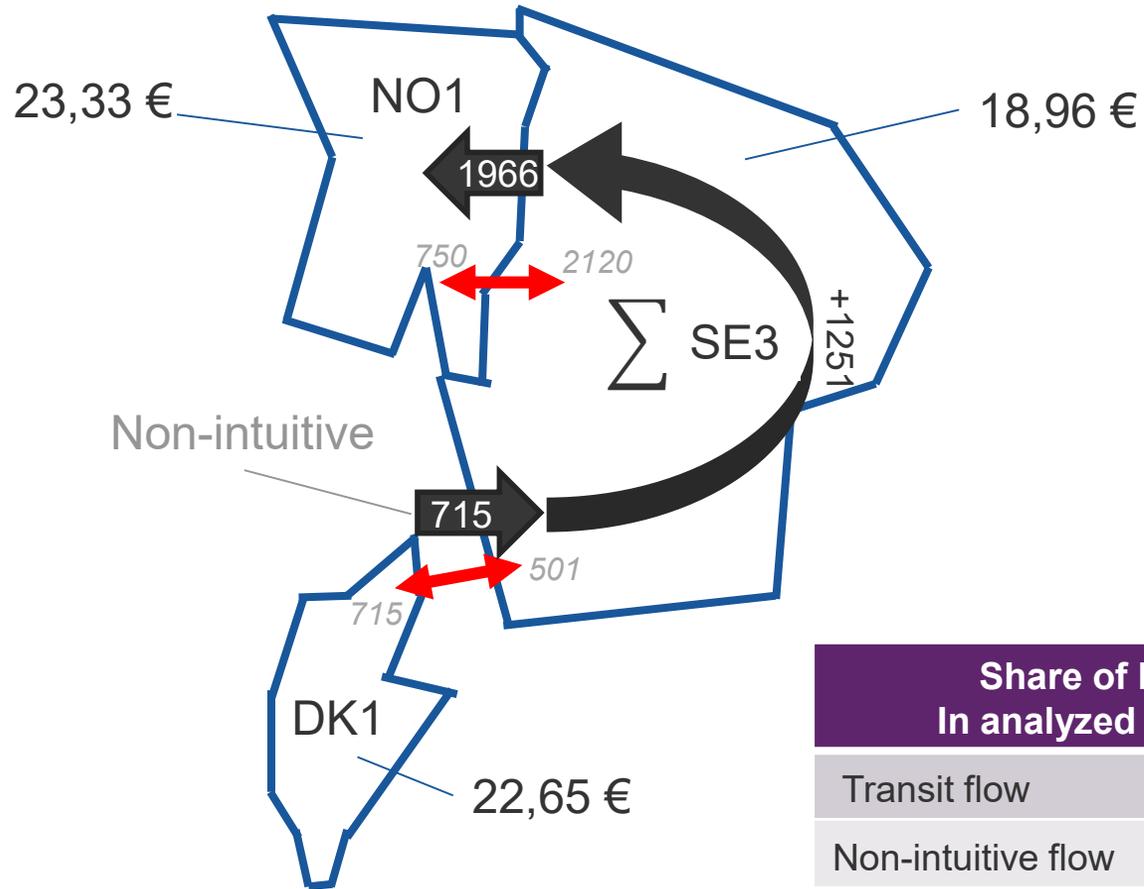
# Increased trade capacities due to the sum allocation result often in larger flows but often in small price change

Difference in price between simulation and historic



Price changes [EUR]	SE3	DK1	NO1
Average Change	0,58	1,49	-1,65
Median	0,09	0,00	-0,05
Highest increase	12,66	24,64	3,57
Biggest decrease	-4,95	-4,95	-16,95

# Non-intuitive flows – why do they occur?

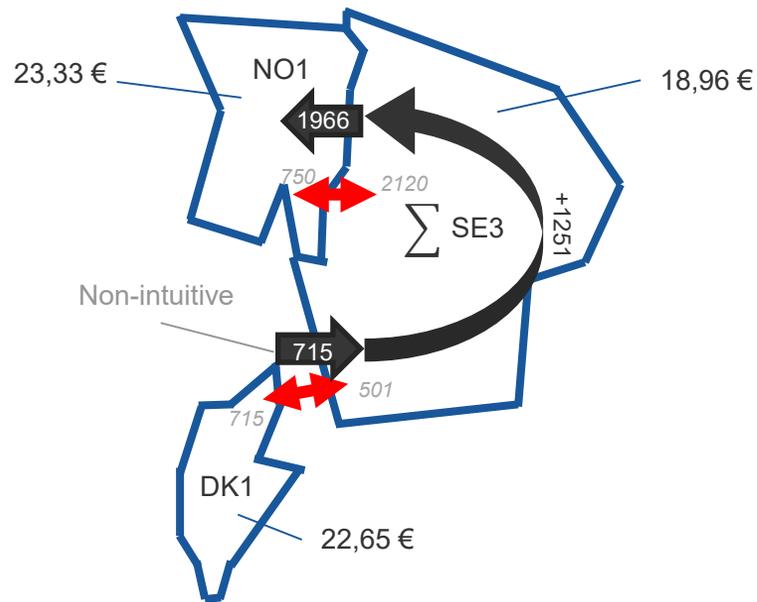


- Total socioeconomic welfare increases due to transit flow
- Transit flows may cause non-intuitive flow

Share of MTU In analyzed period	
Transit flow	48%
Non-intuitive flow	12%

First step is implementation in DA time frame – will in some cases limit trading possibilities in ID time frame

### DA outcome



### Initial ID trading capacities

SE3>NO1: 0 MW

SE3>DK1: 0 MW

NO1>SE3: 3872 MW

DK1>SE3: 0 MW

Transit flow required to maintain operational security

Not having the functionality makes the market outcome space smaller, i.e. the ID market has tighter boundaries than the DA market

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# Risk associated with the implementation

- > Sum allocation in DA but not ID means different topologies that could create arbitrage in ID
  - > Non-intuitive flows may occur
  - > To remain inside operational security limits ID capacities have to be set to ensure firmness of DA transit
    - Arbitrage possibilities will generally not occur
- > The different topologies in DA and ID impact operations as physical flow is the result of day ahead and intraday trading
  - > Svenska kraftnät operational department assessed this not to increase the operational risk

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# Risk associated with the implementation

- > Information to the market
  - > The sum allocation will not be explicitly visible from capacities provided to the market, additional NUCS to display the function. But will be published transparent like all other Virtual areas used in a similar way.
- > Svenska kraftnät has already decided to request a change in the market coupling for the European day ahead trade
  - > Ongoing consultation to inform the market about the ongoing process
- > The change is only relevant before FB implementation → limited benefits if delayed implementation

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# Benefits

- > Possible to increase trade possibilities significantly without increasing the operational risks
  - > See analyses for quantification

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# Ongoing consultation

- > To get stakeholders feedback on the proposal for a new sum allocation Svenska kraftnät has organized an open consultation
- > **Please provide input before 31 January 2022!**
- > More information available on our web site: [www.svk.se](http://www.svk.se)

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## Questions and answers

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# Summary

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