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Nordic aFRR capacity market

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Helsinki

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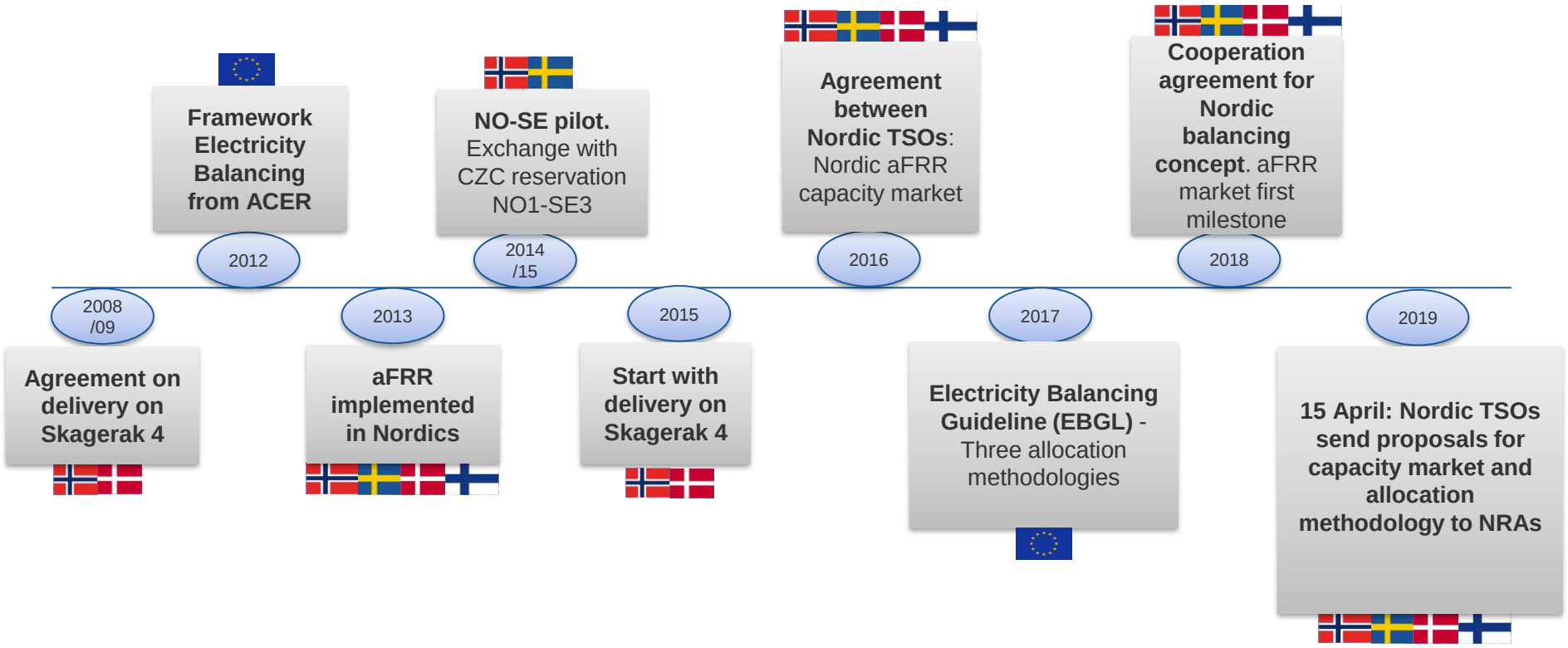
Historical background of aFRR in the Nordics



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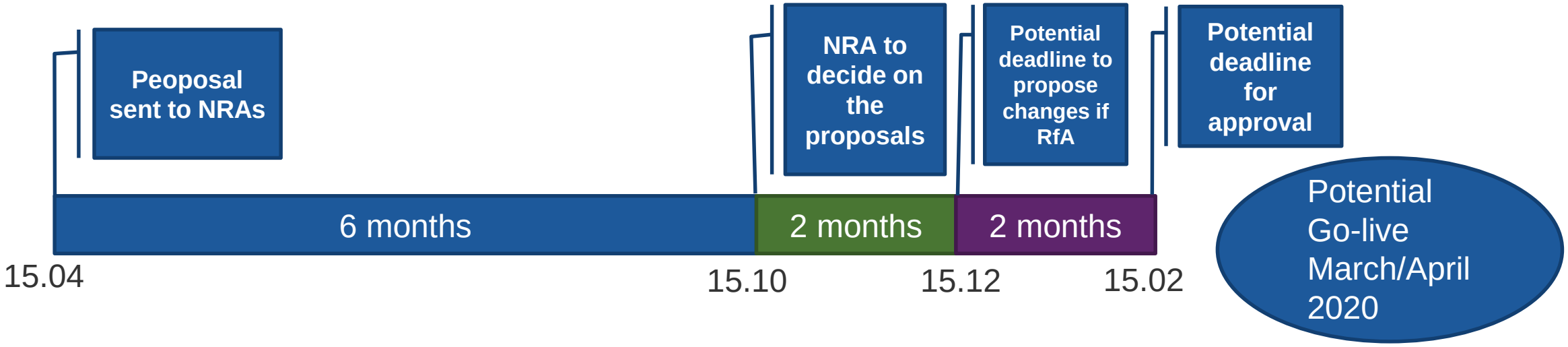
Status proposals for aFRR capacity market and allocation methodology



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A changing power system increases need for reserves in the future

The frequency quality in the Nordic power system has gradually deteriorated

- More renewable generation resulting in more frequent, less predictable and larger imbalances within the operational hour
- More HVDC interconnectors and more frequent changes in cross-border flows
- Closure of conventional thermal power plants (incl. nuclear) reduces system inertia
- Bottlenecks within and between bidding zones prevent efficient use of hydro power for balancing between areas

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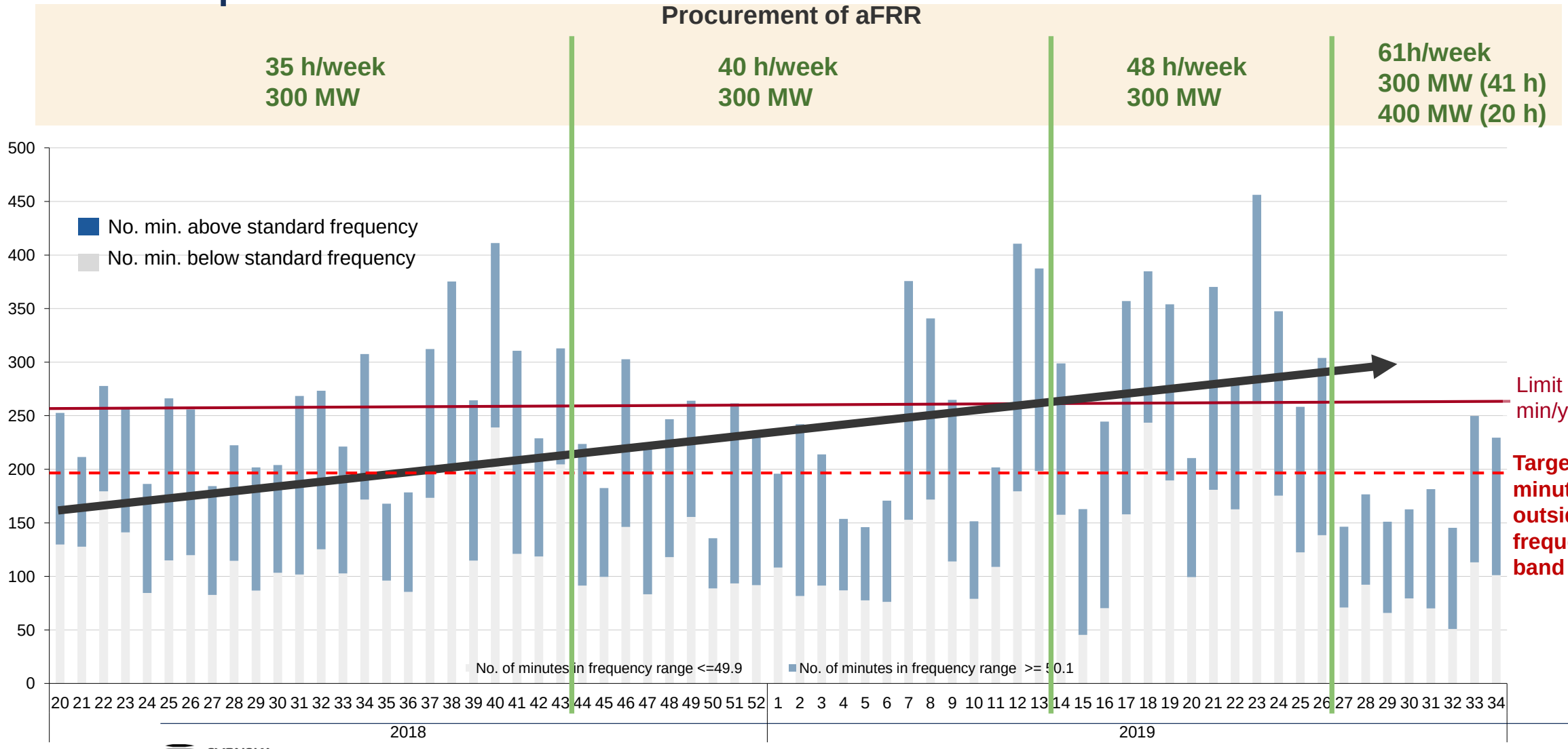
Deteriorating frequency quality and increased aFRR procurement



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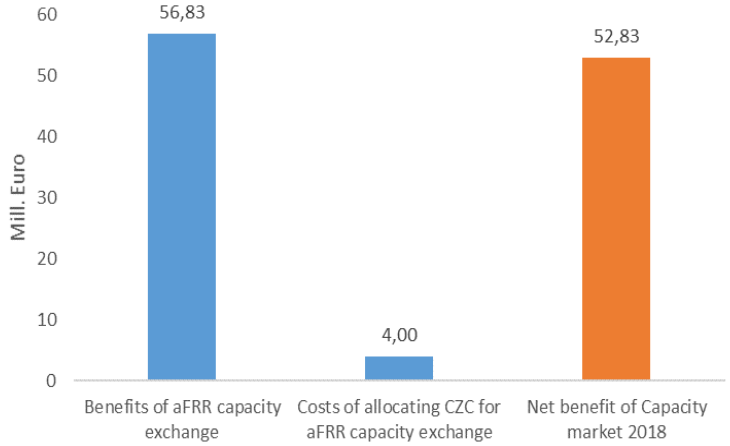
Motivation for aFRR capacity market

- aFRR is expected to have a **more important role** in the balancing of the Nordic system in the future
- **Early implementation** is important to **incentivize investments** in more capability among potential market players
- Great **potential for benefits** from exchange as there are large geographical differences with respect to access to aFRR resources and prices



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Motivation for aFRR capacity market

- Without ability to allocate CZC for exchange of balancing capacity, we cannot efficiently utilize the distribution of reserves in the Nordic region
- Some areas have a shortage of reserves today and need for access to aFRR is expected to increase in the future, i.e. SE3,SE4
- Alternatives to allocation are very costly
  - TSOs are forced to reduce transmission capacity for energy market players in certain hours to have access to enough reserves. No other options are available to avoid reduced operational security (no reserves for countertrade)
  - Measures to increase capability in these areas will be very costly compared to application of a well-designed allocation method

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Capacity market will be accompanied with improved dimensioning methodology

- More accurate determination of needed volume of reserves in each bidding zone
  - Dynamic method based on historic imbalances applied daily (D-2) for each hour

- With introduction of an activation market in the future TSOs can take into account the expected volume of free bids when deciding how much of needed volume should be procured prior to the energy market

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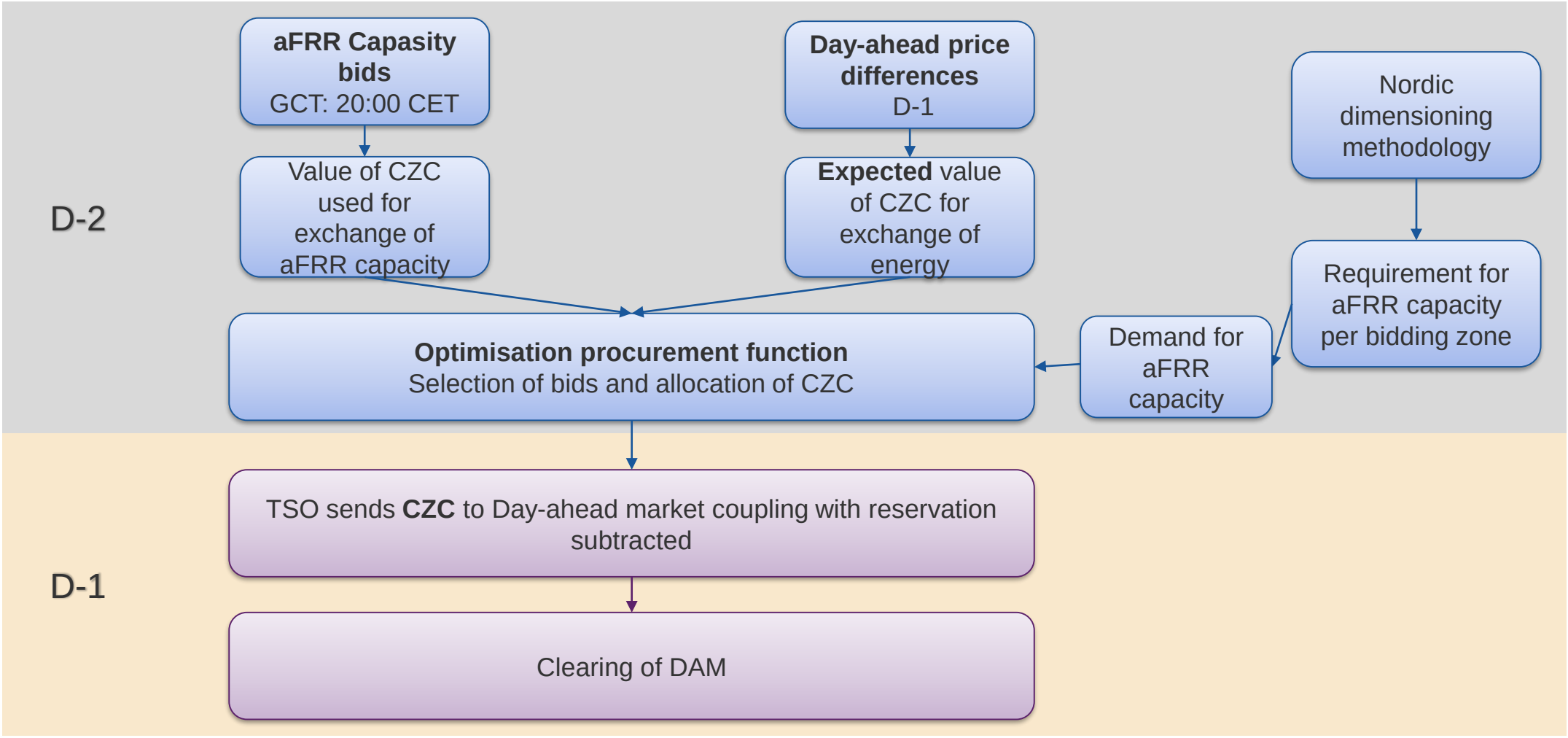
CZC allocation methodology – three options

	Co-optimised allocation	Market based allocation	Economic efficiency analysis
Market value for CZC for energy exchange	Actual	Forecast	Forecast
Market value for CZC for aFRR capacity exchange	Actual	Actual	Forecast
Procurement frequency Contracting period	Daily – Simultaneously clearing of DAM and aFRR capacity market	Daily to weekly – Procurement before NTCs are determined for energy market	Typically for longer periods, week or years

Market-based considered the most well-functioning approach that can be applied in the near future.

Proposal for market based-allocation methodology



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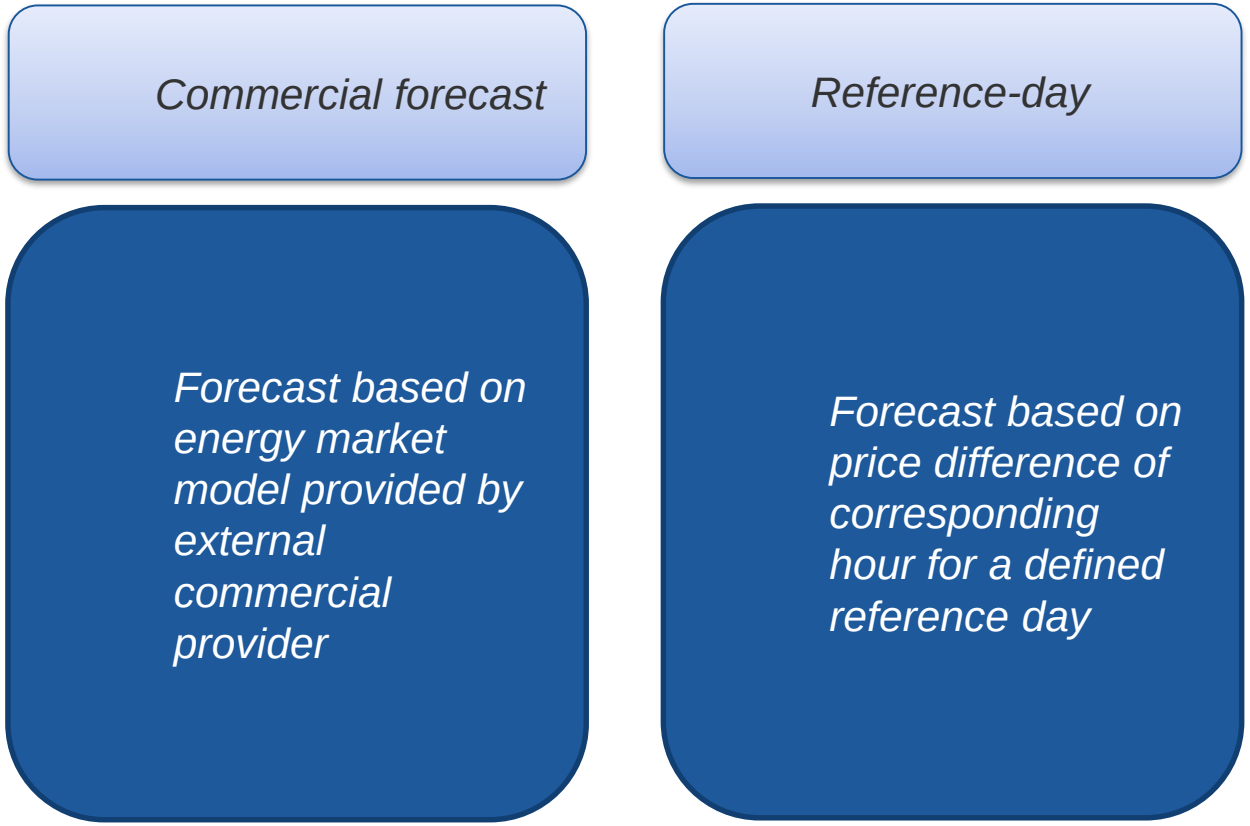
How to forecast the market value of CZC for energy exchange?

Two options presented in consultation:



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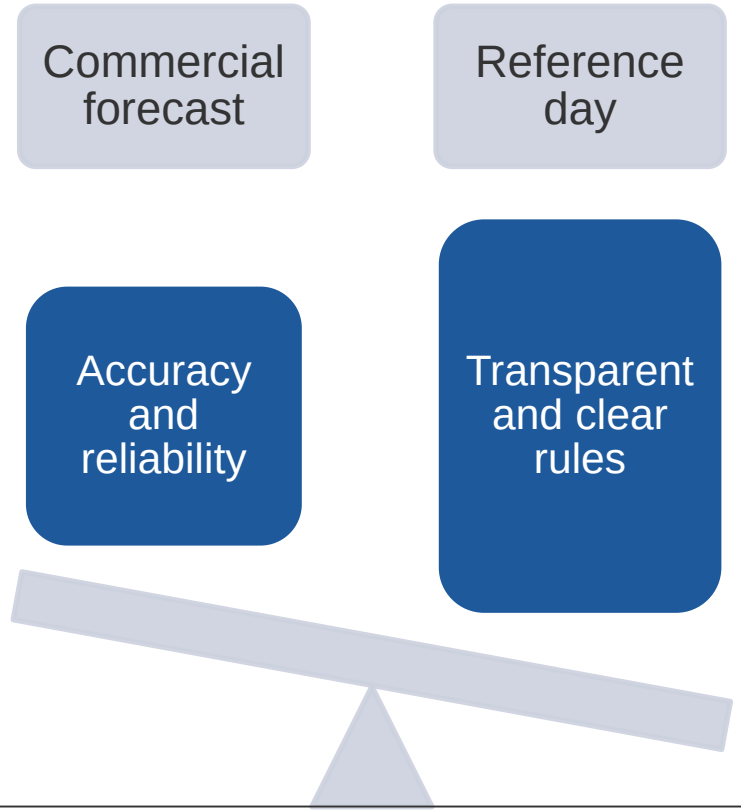

Two options presented in consultation – <u>Reference day method</u> selected based on the feed-back

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Reference day method

Average absolute forecast error	Weekday							
Hour	1	2	3	4	5	6	7	Total
1	0,3	0,4	0,4	0,3	0,3	0,3	0,4	0,4
2	0,4	0,4	0,4	0,4	0,3	0,4	0,4	0,4
3	0,4	0,4	0,4	0,4	0,3	0,4	0,4	0,4
4	0,4	0,4	0,4	0,4	0,3	0,4	0,4	0,4
5	0,4	0,4	0,4	0,3	0,3	0,4	0,4	0,4
6	0,5	0,4	0,5	0,4	0,3	0,4	0,4	0,4
7	0,9	0,6	0,7	0,6	0,6	0,8	0,4	0,7
8	1,4	1,3	1,3	1,3	1,2	1,3	0,4	1,2
9	1,6	1,5	1,6	1,7	1,5	1,5	0,4	1,4
10	1,4	1,2	1,4	1,5	1,4	1,3	0,4	1,2
11	1,2	1,2	1,3	1,3	1,1	1,0	0,3	1,1
12	1,1	1,1	1,1	1,1	1,0	1,0	0,3	1,0
13	1,0	1,0	1,0	1,1	0,9	0,9	0,3	0,9
14	1,0	1,0	1,1	1,0	0,8	0,8	0,3	0,9
15	1,0	1,0	1,0	0,8	0,8	0,7	0,3	0,8
16	0,9	0,9	0,8	0,9	0,8	0,7	0,3	0,7
17	1,0	1,0	1,0	1,1	1,0	0,8	0,3	0,9
18	1,2	1,3	1,2	1,4	1,2	0,9	0,3	1,1
19	1,1	1,1	1,1	1,3	1,1	0,9	0,4	1,0
20	0,9	0,9	0,9	0,9	0,8	0,6	0,4	0,8
21	0,6	0,6	0,5	0,6	0,5	0,4	0,3	0,5
22	0,4	0,4	0,4	0,4	0,4	0,3	0,3	0,4
23	0,4	0,4	0,3	0,3	0,4	0,4	0,3	0,3
24	0,4	0,3	0,3	0,3	0,3	0,4	0,3	0,3
Total	**0,8**	**0,8**	**0,8**	**0,8**	**0,7**	**0,7**	**0,3**	**0,7**

Absolute forecast error per hour and weekday. Average over for all connections of proposed Nordic capacity market and all hours between 01.01.2016-31.12.2018. Euro

- **Reference day = previous day** have proved to yield the least forecast errors

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Proposal to start applying the method conservatively

- Early implementation should allow for gaining experience and careful evaluation
- Allow stepwise improvements of the methodology
- Proposal to start with restrictions on the exchange of aFRR capacity
  - Maximum CZC available for aFRR exchange = 10% of NTC
  - Value of CZC in the congested direction = forecasted price difference plus 1 Euro markup
    - Uncertainty of forecast is handled in favour of energy market