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## MEMO

# ESTABLISHING THE NEW BIDDING ZONE, DK3

## 1. Background

The purpose of this paper is for the Danish Ministry of Climate, Energy and Utilities and Energinet to jointly determine the market design for Bornholm Energy Island by establishing a new bidding zone, DK3.

On Bornholm Energy Island, the planned electricity infrastructure and expected wind turbine capacity deviates from the requirements in article 14 (1) of the Electricity Market Regulation (EU) 2019/943 (hereinafter the 'Electricity Market Regulation') if Bornholm Energy Island is a part of the DK2 bidding zone. The article states that bidding zones must not contain structural congestions.

Therefore, Energinet requested the Danish Utility Regulator to approve a report that identified structural congestions of the grid between at Bornholm Energy Island and the island of Zealand, which constitutes the majority of the DK2 bidding zone today, cf. Article 14 (7) in the Electricity Market Regulation. The report is found in Appendix 1.

The report from Energinet on structural congestions in DK2 contains Energinet's documentation that expected and predictable structural congestions have been identified on the connection between Bornholm Energy Island and Zealand.

On 16 December 2022, the Danish Utility Regulator approved Energinet's report on structural congestions in DK2 between Zealand and Bornholm Energy Island.

The approval implies that the Danish Ministry of Climate, Energy and Utilities and Energinet must jointly revise the bidding zone with a view of handling the structural congestion by no later than mid-June 2023, cf. Article 14 (7) of the Electricity Market Regulation. Subsequently, the European Commission and ACER must be notified, and Member States can submit comments on the decision.

## 2. Possible new bidding zone areas

Initially, the Danish Utility Regulator's decision means that the Climate, Energy and Utilities Ministry and Energinet must jointly revise the bidding area in order to handle the structural congestion identified between Zealand and Bornholm Energy Island. The second option in Article 14.7 of the Electricity Market Regulation, is to prepare an action plan, which is a plan for improving the grid in such a way that the structural congestions are restored. An action plan must be completed by 2025 – i.e. before Bornholm Energy Island is established.

In the report on structural congestions in DK2, Energinet showed that congestions occur structurally between Bornholm Energy Island and Zealand. This means that part of the bidding zone boundary between DK2 and Bornholm Energy Island (DK3) must be located here. In addition, the rest of the bidding zone may include either only Bornholm Energy Island or Bornholm Energy Island and the rest of Bornholm, cf. Figures 1 and 2. At present the local generation and consumption on the island of Bornholm is a part of the DK2 bidding zone.

A precondition for Bornholm Energy Island and the rest of Bornholm to be able to be a part of the same bidding zone is that they are connected without any congestion between them, as there will otherwise be a structural capacity constraint internally in the newly established DK3.

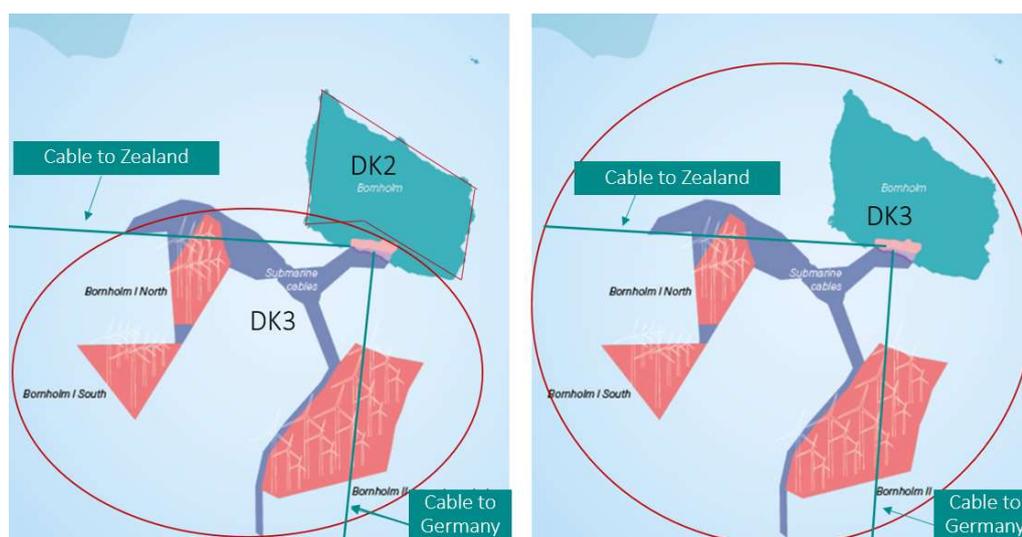


Figure 1. DK3 is Energy Island Bornholm

Figure 2. DK3 is Energy Island Bornholm and Bornholm

Energinet is currently analysing the future security of supply situation on Bornholm in connection with the commissioning of Bornholm Energy Island and possible future reinvestment of the cable system to Sweden which today is the main supply corridor for the island of Bornholm. Energinet expects to connect the existing local Bornholm AC grid with Bornholm Energy Island without causing structural capacity limitations on the connection between them.

The identification of costs and savings associated with connecting the local grid with the energy island is made by Energinet and will be available in 2024. The reason why the business case is expected to be ready in 2024 and not earlier is that the coupling requires new technology, and therefore extensive market dialogue is necessary.

This means that Energinet expects Bornholm Energy Island and the rest of Bornholm to be in the same bidding zone, DK3, but no final decision has been made yet.

### 3. How will electricity prices be affected on the island of Bornholm?

To assess how the electricity price on Bornholm will be affected if Bornholm becomes a part of DK3 together with Bornholm Energy Island, Energinet has run market simulations for 2030 and 2040. Furthermore, Energinet has used 35 historic climate years, from 1982 to 2016 and ENTSO-E's (Distributed Energy from TYNDP2020) to create the projection of renewable energy deployment.

This gives a total of 70 different years, which have been simulated, i.e. 35 climate years for 2030 and 2040.

The simulations show that the electricity price on Bornholm will virtually be the same if Bornholm continues to be part of DK2, compared to Bornholm being a part of DK3 together with Bornholm Energy Island, cf. Figure 3. This applies to both the simulations for 2030 and the simulations for 2040, where the electricity price show the same pattern in each year.

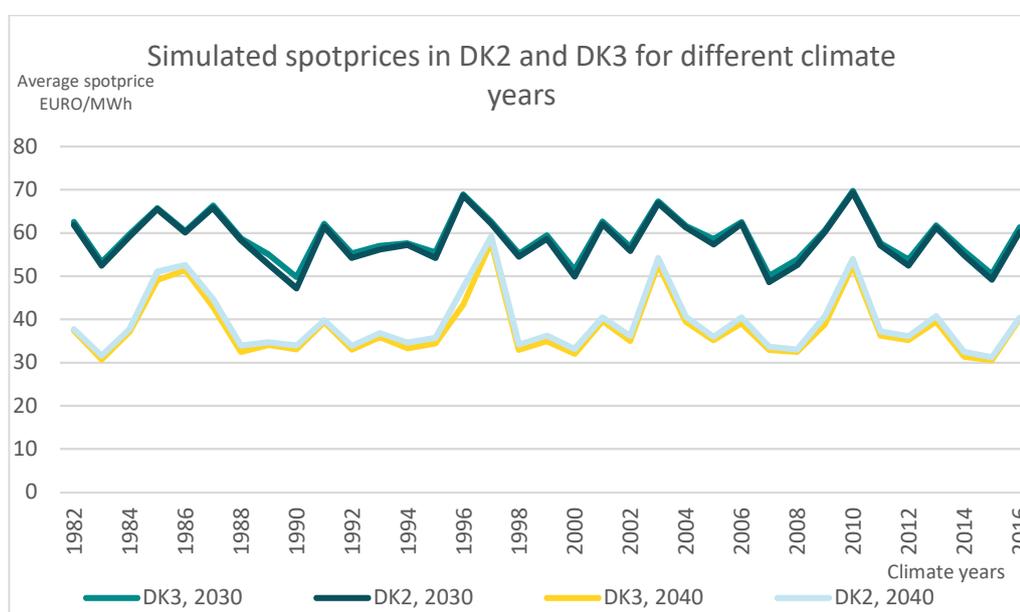


Figure 3. Simulated variation of yearly average power prices in DK2 and DK3 for 2030 and 2040 respectively.

In 2030, the average hourly price for 35 climate years is estimated to EUR 58,7/MWh in DK3, while it is estimated to be slightly lower for DK2 to EUR 58,0/MWh, see table 1. For a standard household with an annual electricity consumption of 4,000 kWh, this means an additional cost for the wholesale electricity price of 21 DKK per year.

The year 2040 shows the same pattern as for 2030, cf. table 1. The electricity prices are virtually identical for the island of Bornholm independent of which of the two bidding zones they belong to. In this scenario, the electricity price in DK3 will on average be lower compared to DK2, see table 1, hence on average, the electricity price is lower on the island of Bornholm if they are part of the DK3 bidding zone.

Table 1 Average electricity price in 2030 and 2040 for 35 climate years

Electricity prices at Bornholm	Bornholm is a part of DK3	Bornholm is a part of DK2
Electricity price in year 2030	58,67 EUR/MWh	58,03 EUR/MWh

Electricity price in year 2040	37,84 EUR/MWh	39,33 EUR/MWh
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In DK3, the electricity price is estimated on average at EUR 37.8/MWh and at EUR 39.3/MWh in DK2 in 2040. A Bornholm household with a consumption of 4,000 kWh annually saves DKK 45 by being in the same bidding zone as the Bornholm Energy Island in 2040.

The decisive factor determining whether the average electricity price is highest in DK2 or DK3 in the simulations is the relative speed of RE deployment in the individual countries north and south of the Bornholm Energy Island, as it is decisive for the flow direction to and from Bornholm Energy Island and thus the price in DK3.

The sooner that Denmark and the rest of the Nordic region expands renewable energy, compared with Germany and the rest of Europe, the more likely it is that the price in DK3 is the highest price of DK2 and Germany (when the wind power generation is below 0.8 GW on the Bornholm Energy Island). All else being equal, this means that on average, the electricity price in DK3 will be higher than the electricity price in DK2 if renewable energy expansion in the Nordic countries is relatively quicker than south of Denmark.

The uncertainties of the simulations taken into account, it must be expected that the electricity price at Bornholm will be roughly the same regardless of the bidding zone in which they are included.

This also means that the offshore developers are expected to receive the same day-ahead price regardless of whether DK3 is defined as Bornholm Energy Island or both Bornholm Energy Island and the rest of Bornholm.

The choice of future expansion of renewables on and around Bornholm is also not expected to be significantly affected. It is difficult to imagine incentives for additional renewable development as long as the connections away from the Bornholm Energy Island are not changed, unless new consumption such as PtX is developed to consume the excess electricity generation.

#### 4. Socioeconomics of the two different bidding zone configurations

In order for there to be a difference in the socioeconomics of Bornholm Energy Island being part of either DK2 or DK3, there must be differences in the electricity prices under the two different bidding zone configurations.

The conclusion from simulations of 70 different climate years in the previous section showed that there are no significant differences in electricity prices in the two scenarios. This means that the bidding zone configuration is not expected to affect the economy, and thus there is no difference between the economics of the two scenarios.

#### 5. Boundaries between bidding zones, DK3

To demarcate DK3, it must be outlined which grid elements are in DK2 and in DK3. This is done by identifying the grid elements where the bidding zone boundary are located. In Bornholm Energy Island context, this is at least one of the following two grid elements:

1. HVDC-cable from Energy Island Bornholm to Zealand
2. HVDC-cable from Energy Island Bornholm to Germany

This is independent of whether DK3 should contain all of Bornholm or solely Bornholm Energy Island, cf. Figures 4 and 5. The two boundaries are sufficient if all of Bornholm is to be part of DK3.

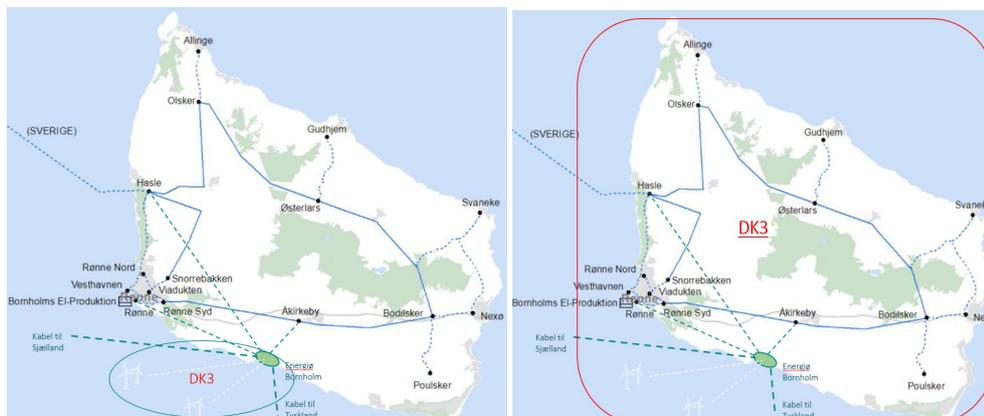


Figure 4. DK3 is Energy Island Bornholm

Figure 5. DK3 consist of Energy Island Bornholm and Bornholm AC-grid

If DK3 is to be Bornholm Energy Island alone, the bidding zone limitation must also apply to the grid parts that connect Bornholm Energy Island to Bornholm.

Energinet notes that at present there are three connection points between the planned Energinet grid of the Bornholm Energy Island and the Bornholm AC grid in play, Hasle, Rønne, Åkirkeby. Energinet expects connection to one or more of the points. The bidding zone boundaries will thus be on the grid elements between Energy Island Bornholm and to one or more of the three connection points.

In case that DK3 consists of Bornholm Energy Island and the island of Bornholm, then the AC cable to Sweden is expected to be a reserve supply for local consumption on the island of Bornholm and will not be represented in the market coupling, thus there will not be a bidding zone border from DK3 to southern Sweden (SE4).

## 6. Conclusion

Energinet expects Bornholm Energy Island and the Bornholm AC grid to be connected. This implies that no congestion is expected between Bornholm Energy Island and Bornholms AC-grid. This allows DK3 to contain both Bornholm Energy Island and the rest of the island of Bornholm.

From a TSO perspective, it is appropriate to divide bidding zones where there are structural congestions. In this context, this means that DK3 should contain both Bornholm Energy Island and the rest of Bornholm, thereby moving the existing generation and demand on the island of Bornholm from DK2 to DK3.

Market simulations in this memorandum show that on average, the electricity price on Bornholm will not be dependent on whether Bornholm is part of DK3 together with Bornholm Energy Island or if Bornholm stays in DK2. This also means that there is not any considerable difference between the economy in the two bidding zone configurations.

On this basis, Energinet recommends that the new bidding zone, DK3, will contain both Bornholm Energy Island and the rest of the Bornholm grid.