ENERGY STORAGE IN THE DISTRIBUTION GRID - POTENTIALS AND BARRIERS

Majbrit Høyer – Director, Grid Strategy
Customers & Markets, Distribution

DONG energy

Agenda

- Introduction – the future Danish energy system
- Potential of energy storage in the distribution grid
- Potential barriers for energy storage deployment
- Energy storage in DONG Energy's grid
- Summary

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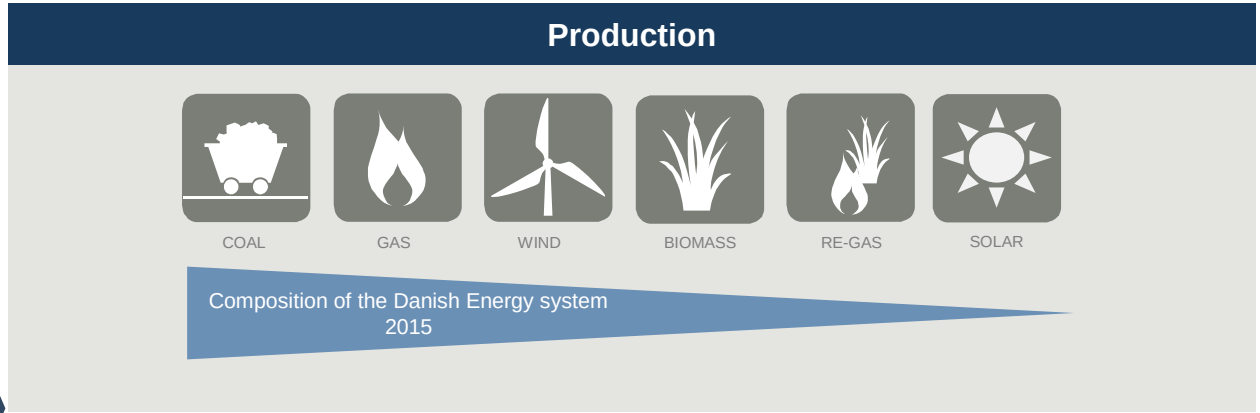
The Future Danish Energy System

Ambitious targets for the future Danish energy system



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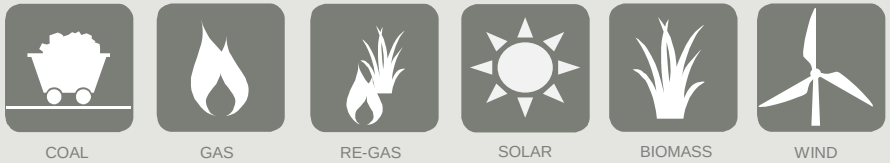
Production



Future composition of the Danish Energy system

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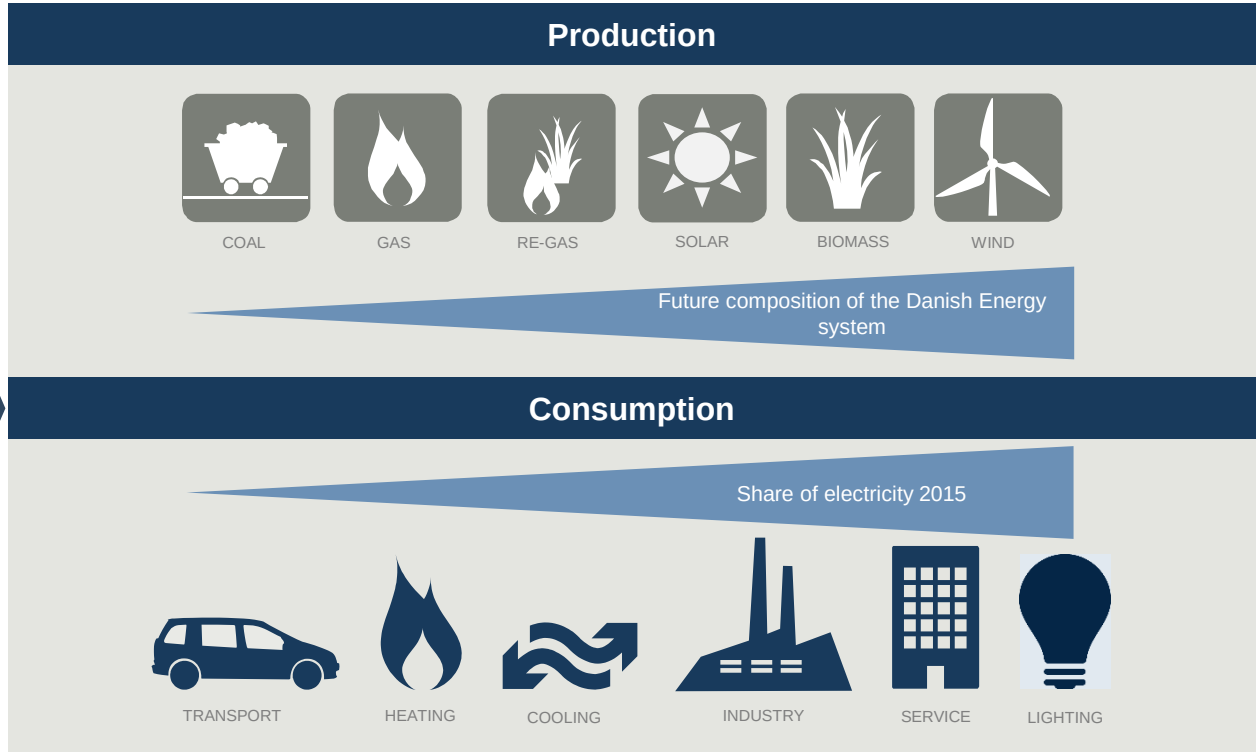

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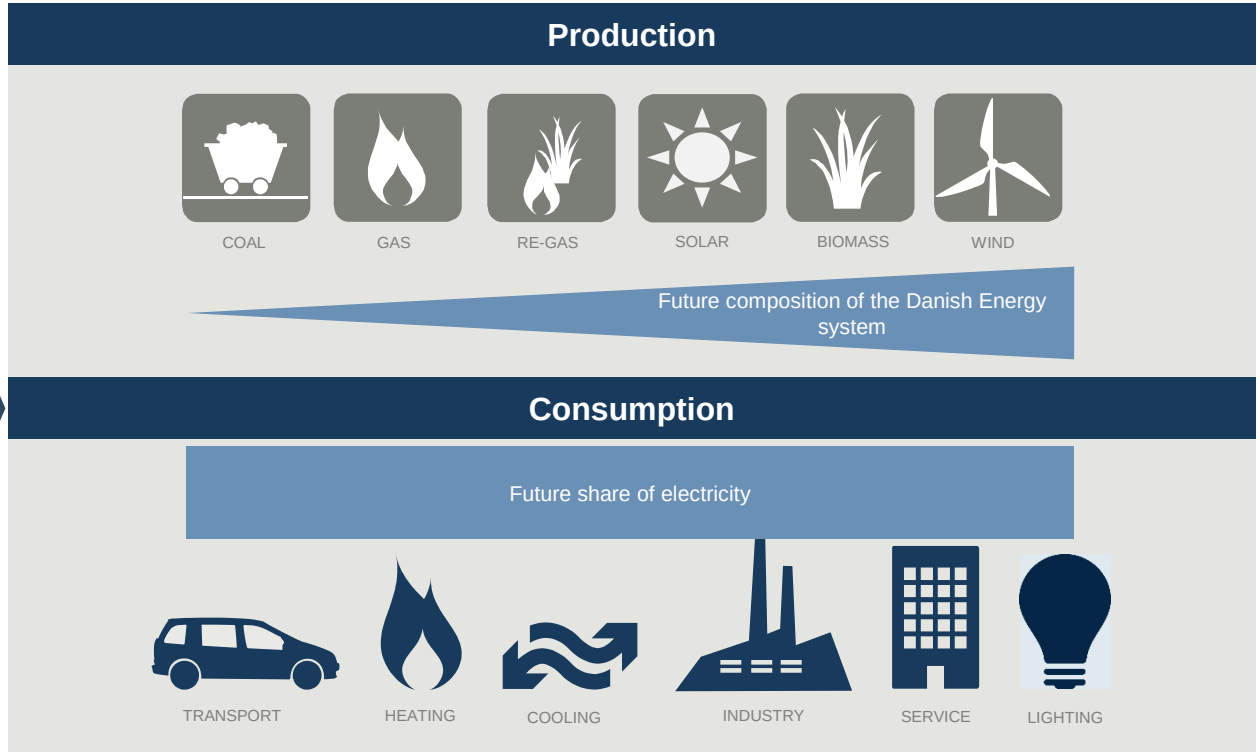

ATV-MEETING, SEPTEMBER 28 : *"STORAGE SOLUTIONS – A MUST FOR SUCCESSFUL CONVERSION TO GREEN ENERGY"* MAJBRIT HØYER – DIRECTOR GRID STRATEGY

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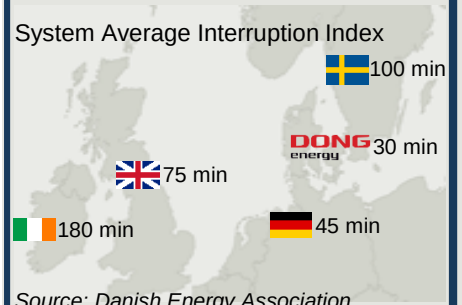
- Potential of energy storage in the distribution grid

DONG Energy's Vision

- Lead the Danish energy transformation
- Maintain the high level of security of supply (≥ 99,994%)

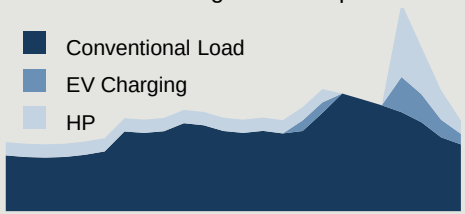
System Average Interruption Index



Source: Danish Energy Association

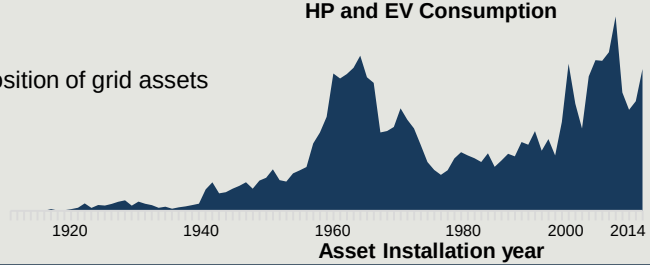
Challenges

- Implementation of Distributed Energy Resources (DERs)
- Electrification from the integration with the heating- and transport-sector e.g. from EVs and HPs



Daily Load Profile with Non-Optimized HP and EV Consumption

- Age composition of grid assets



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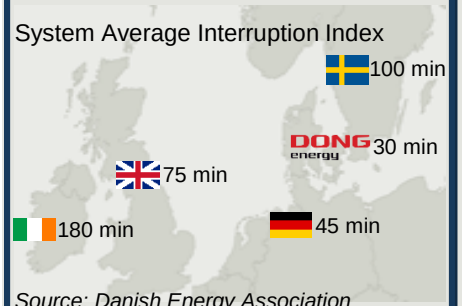
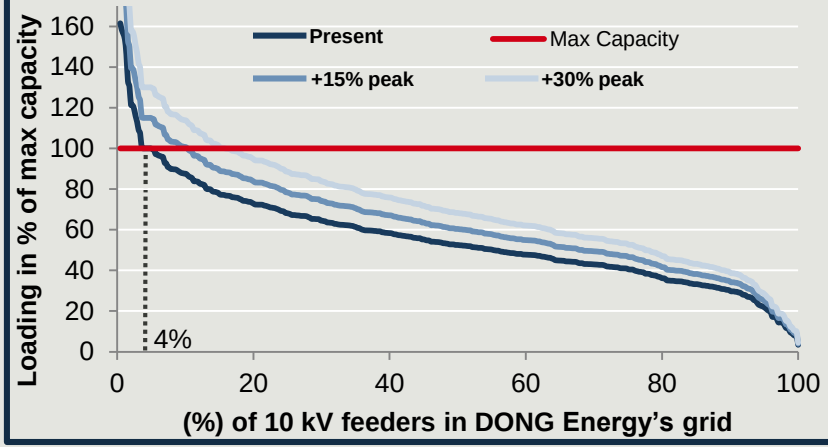


Source: Danish Energy Association

Challenges at Peak Demand

- Excessive loading of the infrastructure
- **At present: 4% of the feeders are equal to or above max capacity**
- **15%-30% peak increase: 10-16 % of the feeders are equal to or above max capacity at peak demand**



Solutions

- Grid reinforcements

- Smart Control Strategies - Improved asset utilization

- Increased flexibility:
  - Demand side management
  - Energy Storage

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Potential Barriers for Energy Storage Services

Economic Barrier

Energy storage costs are at present still relatively high, which leads to low cost-effectiveness

Regulative Barrier

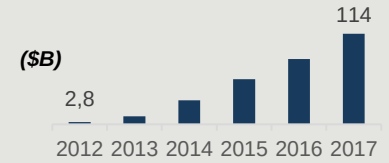
The multifunctionality characteristics of energy storages complicate the rules for ownership and operation

Practical Experience

Global experience is still limited e.g. approximately 21 utility (distribution) owned projects currently deployed in the EU i.e. below 1% of DSOs

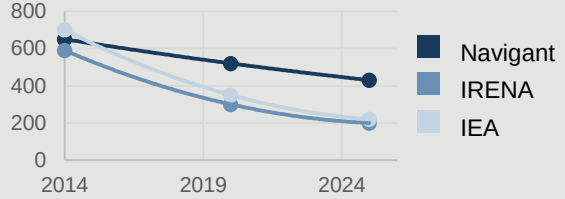
Possibilities

Market potential for energy storage



Source: Department of Energy (US)

Energy storage costs are expected to decrease in the coming years



New market structures and rules may be needed to accommodate and recover the benefits of energy storage systems

Lack of consideration of storage resources amongst utilities, developers and regulators → Experience with energy storage is a key requirement for the large-scale deployment of energy storage

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Energy storage in DONG Energy's Grid

Energylab Nordhavn

- ***"Design and dimensioning of the future cost-effective multi-carrier energy system based on Nordhavn as a globally visible real-life demonstration"***
- Energylab Nordhavn will include:
  - Stochastic production and consumption:
    e.g. PV, EVs and HPs
  - A Battery Energy Storage System (BESS) owned & operated by DONG Energy

BESS in Nordhavn

- BESS expected to be operational early 2017
- Main objectives of BESS project:
  - Test the latest **technology** in energy storage in a realistic environment
  - Demonstrate the potential of utilizing energy storage for **deferral of infrastructural investments** by simulating a lower capacity in the network
  - Demonstrate control protocols and **business models** for an energy storage for both DSO and commercial purposes
  - Use test data to discuss and recommend the best possible **regulatory landscape** for energy storage in the distribution network

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Summary

- The energy system transformation will entail several **challenges** in the distribution grid
- Energy storage could **potentially play a substantial role** in the future grid
- A number of **barriers must be overcome** e.g. cost, regulative landscape and experience with applications
- Energylab Nordhavn will contribute to a **practical experience** with energy storage in the Danish distribution grid

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Thank you for your attention

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Energylab Nordhavn in numbers

Budget

- Total budget 129 mio. DKK
- Research budget approx. 25%
- EUDP grant for industry partners is 40% and for research partners 90%

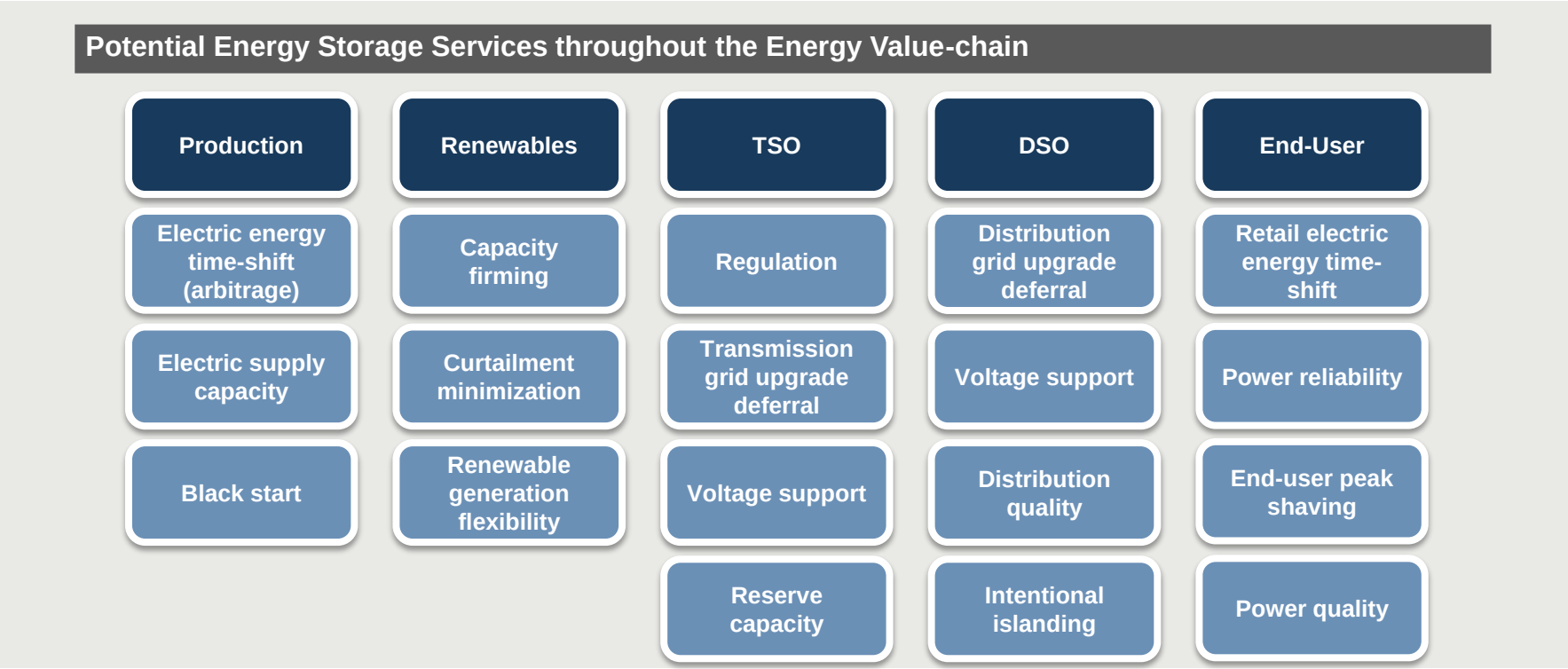
DONG Energy's contribution

- In total 15 mio. DKK
- Receive 40% grant from EUDP
- About 6 mio. DKK is for new hardware, especially a battery installed in 10 kV grid

Time Schedule & Organization

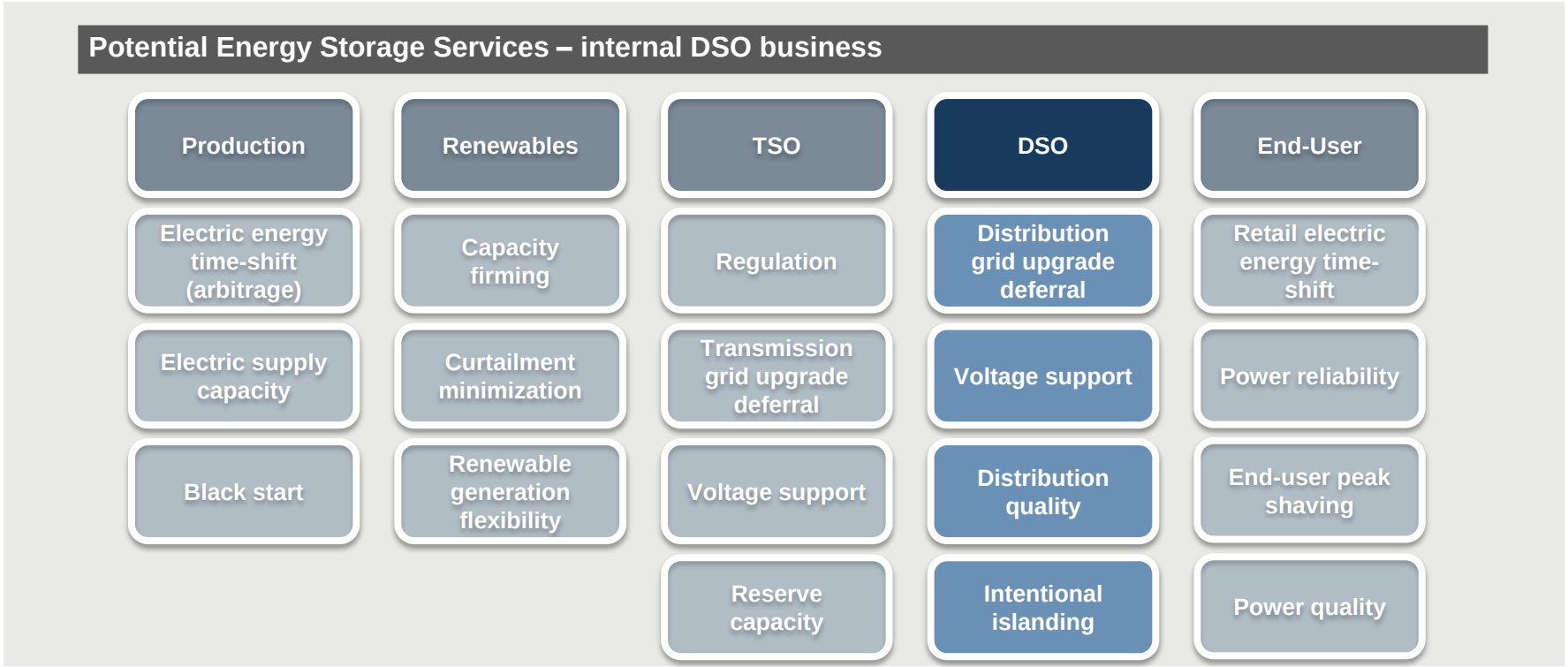
- Started: 1 April 2015
- Project Period: 4 years
- DTU CEE provides Project Manager and Project Secretariat

Potential Energy Storage Services



Source: Based on data from EPRI, IRENA, DOE, and IEA

Potential Energy Storage Services



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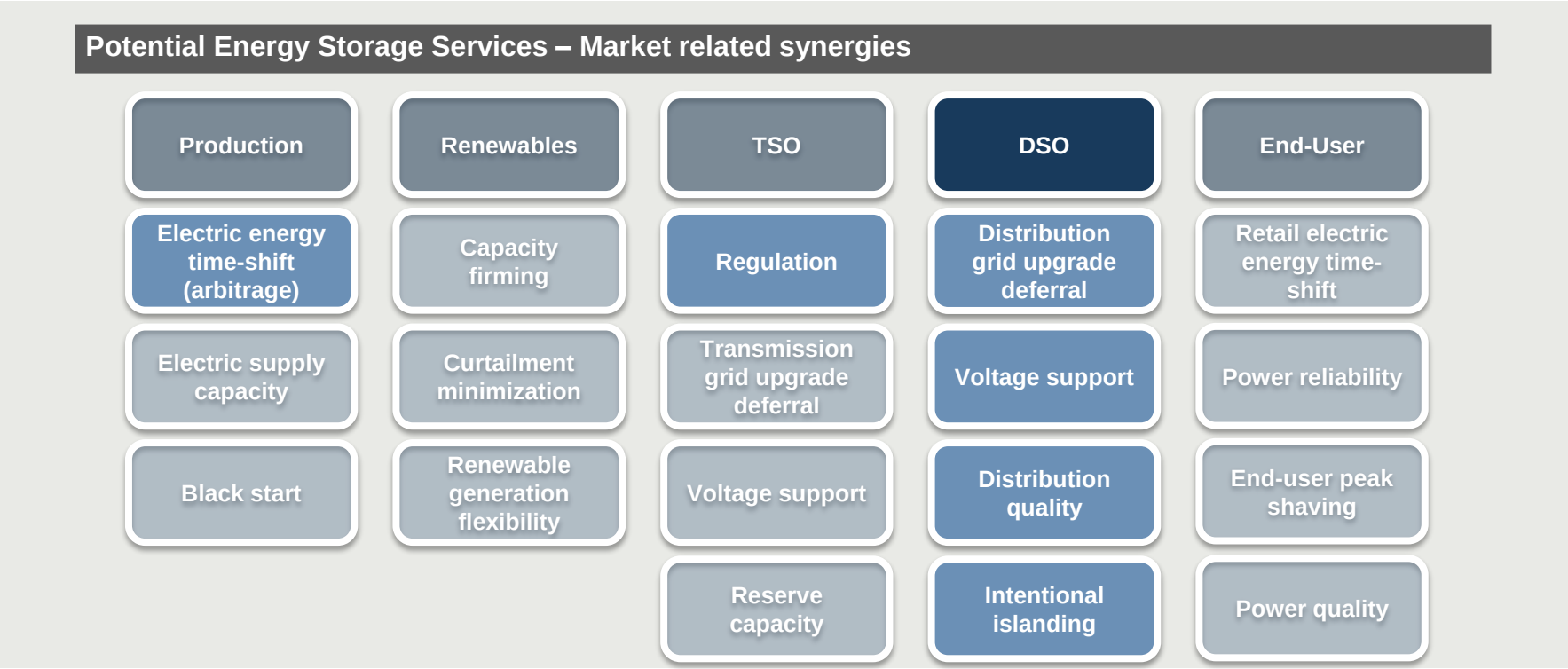

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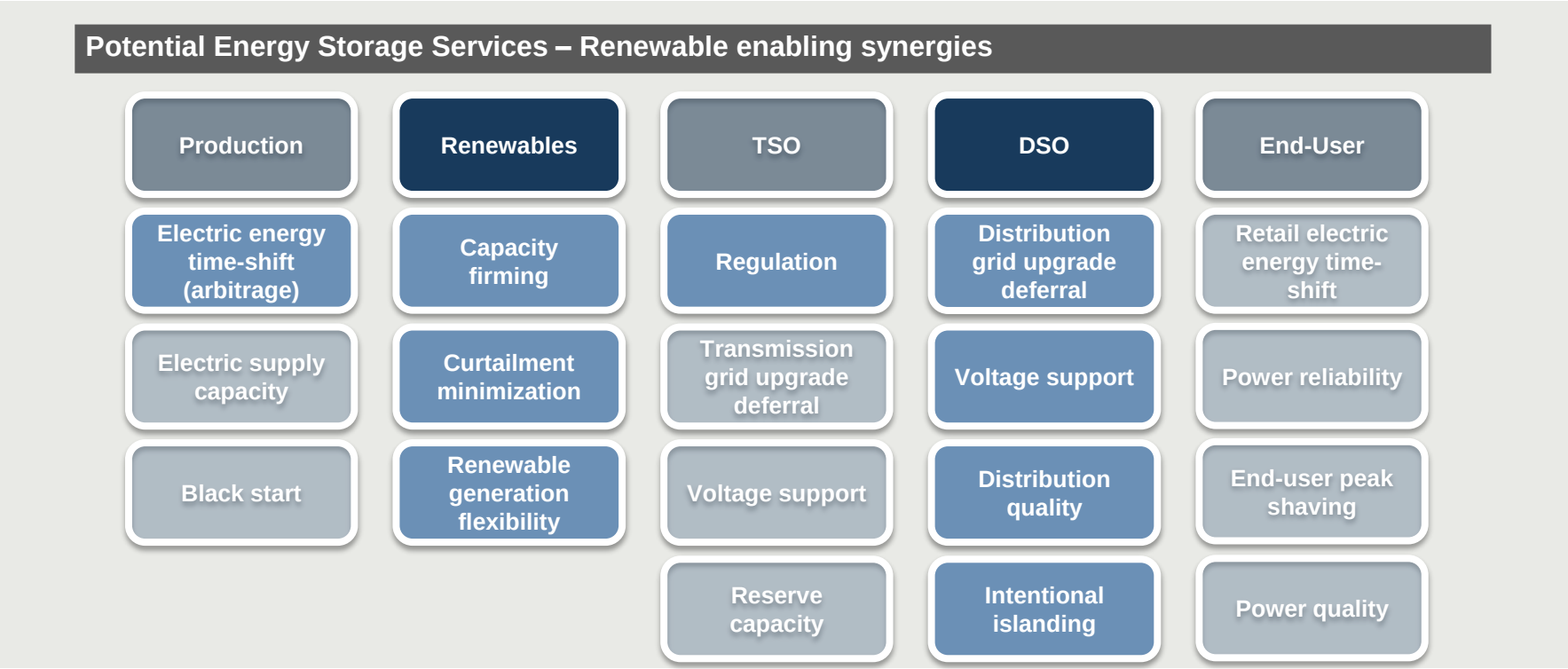

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