

A decorative graphic on the left side of the slide, consisting of a complex network of thin, light teal lines forming a series of interconnected triangles and polygons, resembling a wireframe or a stylized map of a region.

# FUTURE LAB 2021

## Demand Response

*Erica Schandorff Arberg, 23-02-2022*

GREEN ENERGY FOR A BETTER WORLD  
Energinet creates the foundation in Denmark for  
a safe and efficient green transition

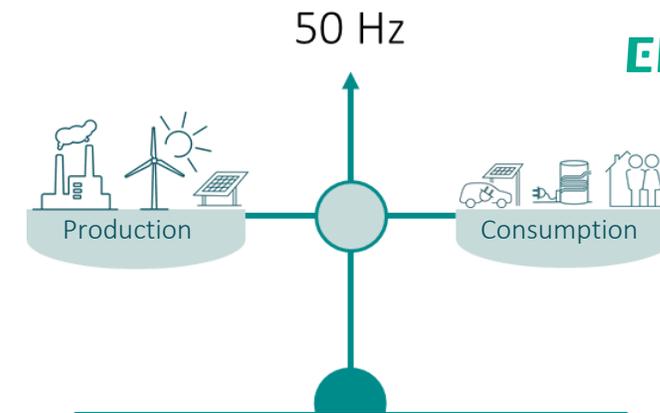
2030

100 % green electricity

70 % CO<sub>2</sub> reduction (compared to 1990)

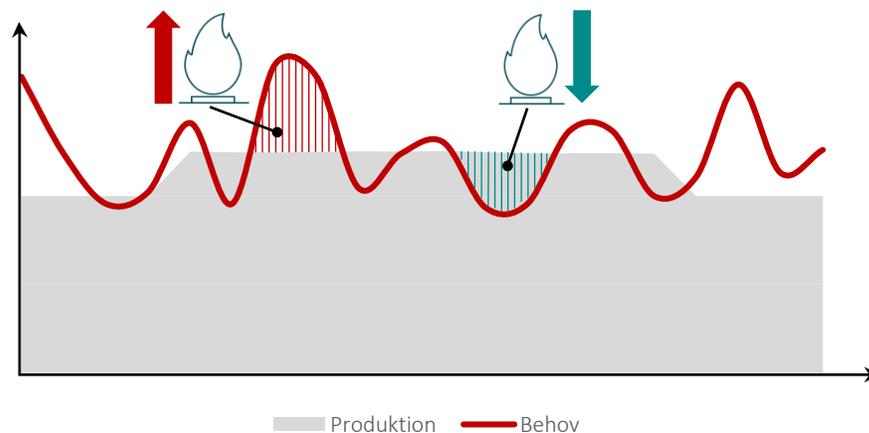
Energinet creates the foundation, the providers creates the solutions

# BALANCING OF THE GRID NOW AND IN THE FUTURE



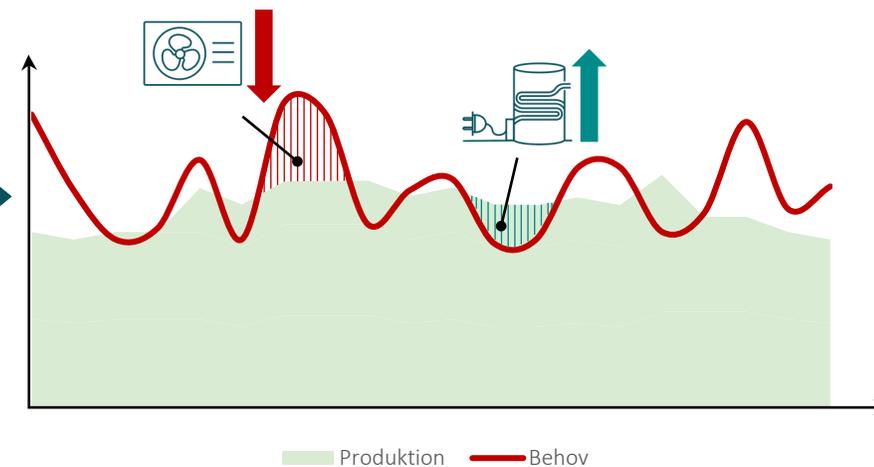
## Traditional power grid

- Adjustable production – Dominates the market and covers imbalances
- Inflexible consumption
- High inertia
- Imbalances: Outage/faults and forecast errors (consumption)



## Future power grid

- Fluctuating production – can not necessarily cover imbalances alone
- Flexible demand – can contribute covering imbalances
- Low inertia
- Imbalances: Outage/faults and forecast errors (production and consumption)



## BUSINESS OPPORTUNITY IN FLEXIBILITY

### Consumption

- New business opportunities
- Contribute to higher security of supply
- Promote a flexible image
- Balance a 100% green electricity system



### Power grid

- New balancing sources
- Reduce bottlenecks
- Secure power adequacy and security of supply
- Reduce balancing cost



**FLEXIBILITY IS ESSENTIAL IN A 100%  
RE-BASED POWER SYSTEM**

# IMPLICIT VS. EXPLICIT DEMAND RESPONSE

## IMPLICIT DR

### Definition:

Implicit DR is the consumers reaction to price signals. Consumers adapt their behavior in order to save money on energy expenses.

### Motivator:

Lower energy cost by shifting consumption from peak-hour too off-peak-hour. Easy for the consumer.

## EXPLICIT DR

### Definition:

Explicit DR is committed, dispatchable flexibility that can be traded on energy markets. Explicit DR is usually facilitated by an aggregator.

### Motivator:

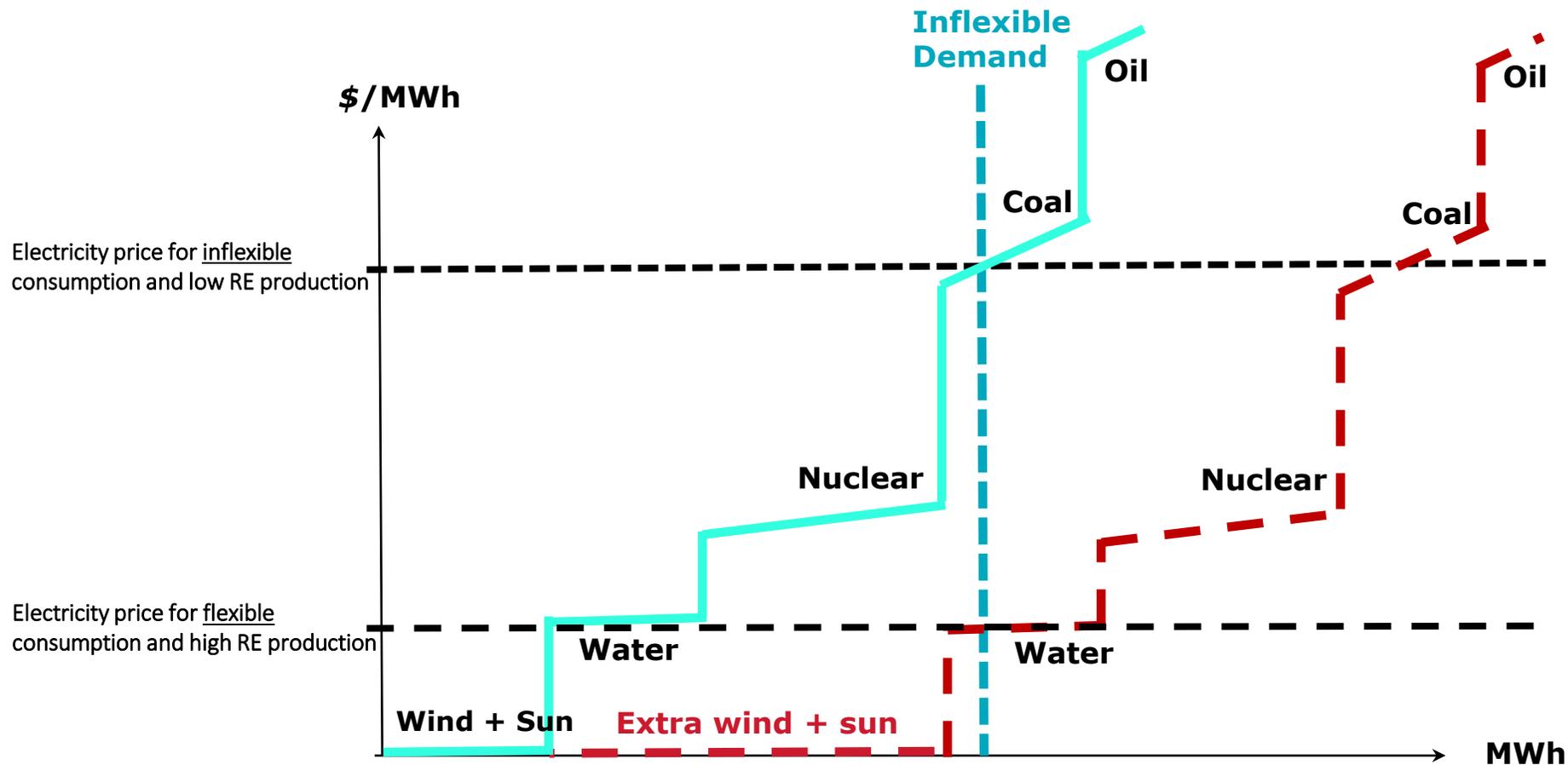
Flexibility is essential for the power grid at any time. This can create a more stable income for the consumer (if they are competitive).

# RE & FLEXIBLE CONSUMPTION

Price on day-ahead is affected by implicit flexibility

RE pushes the supply curve (merit order curve) for electricity to "the right", and therefore decreases the price.

Flexible consumption can make the consumption curve more elastic, and hence make it react on prices.  
The flexible consumer would move consumption from hours with high prices, to hours with lower prices.

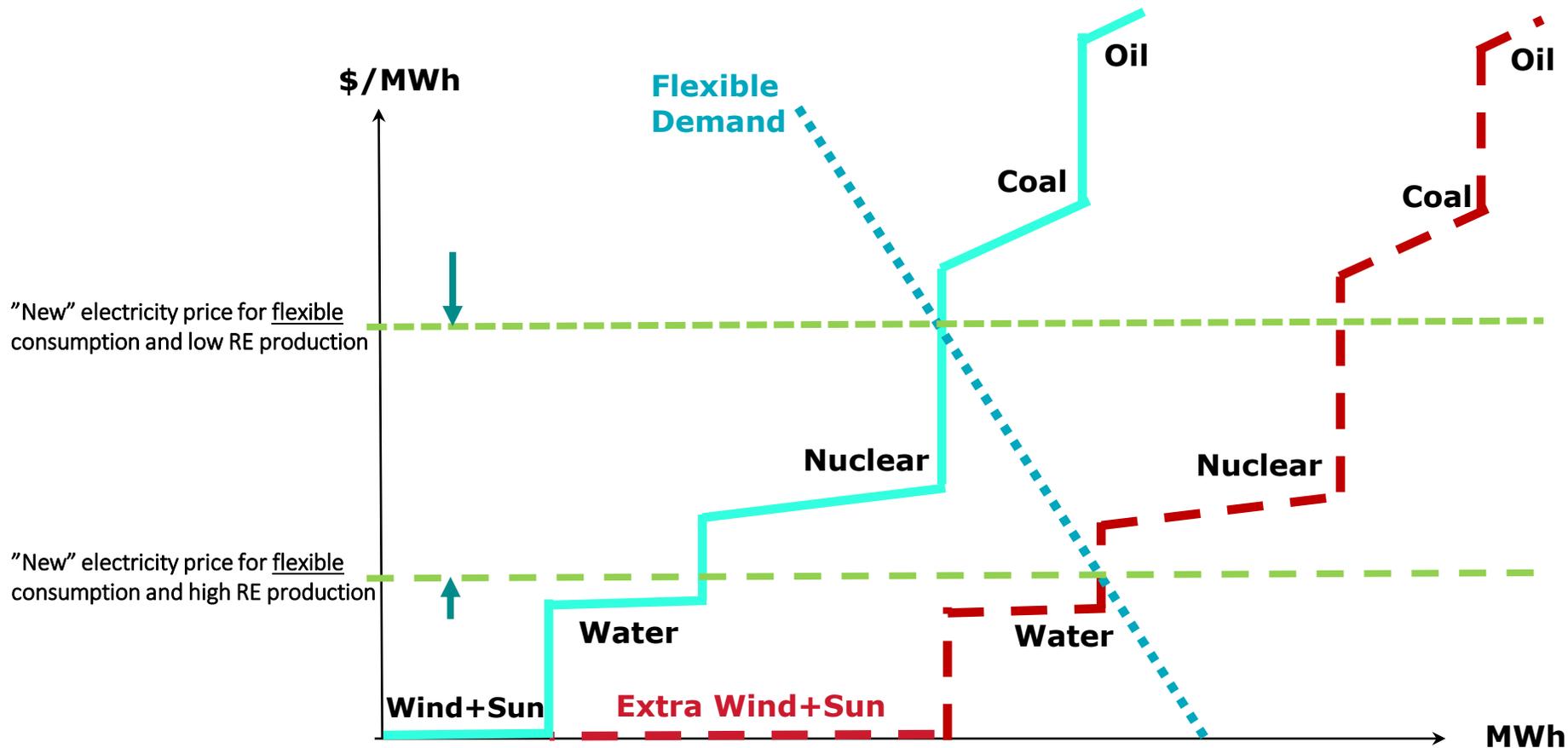


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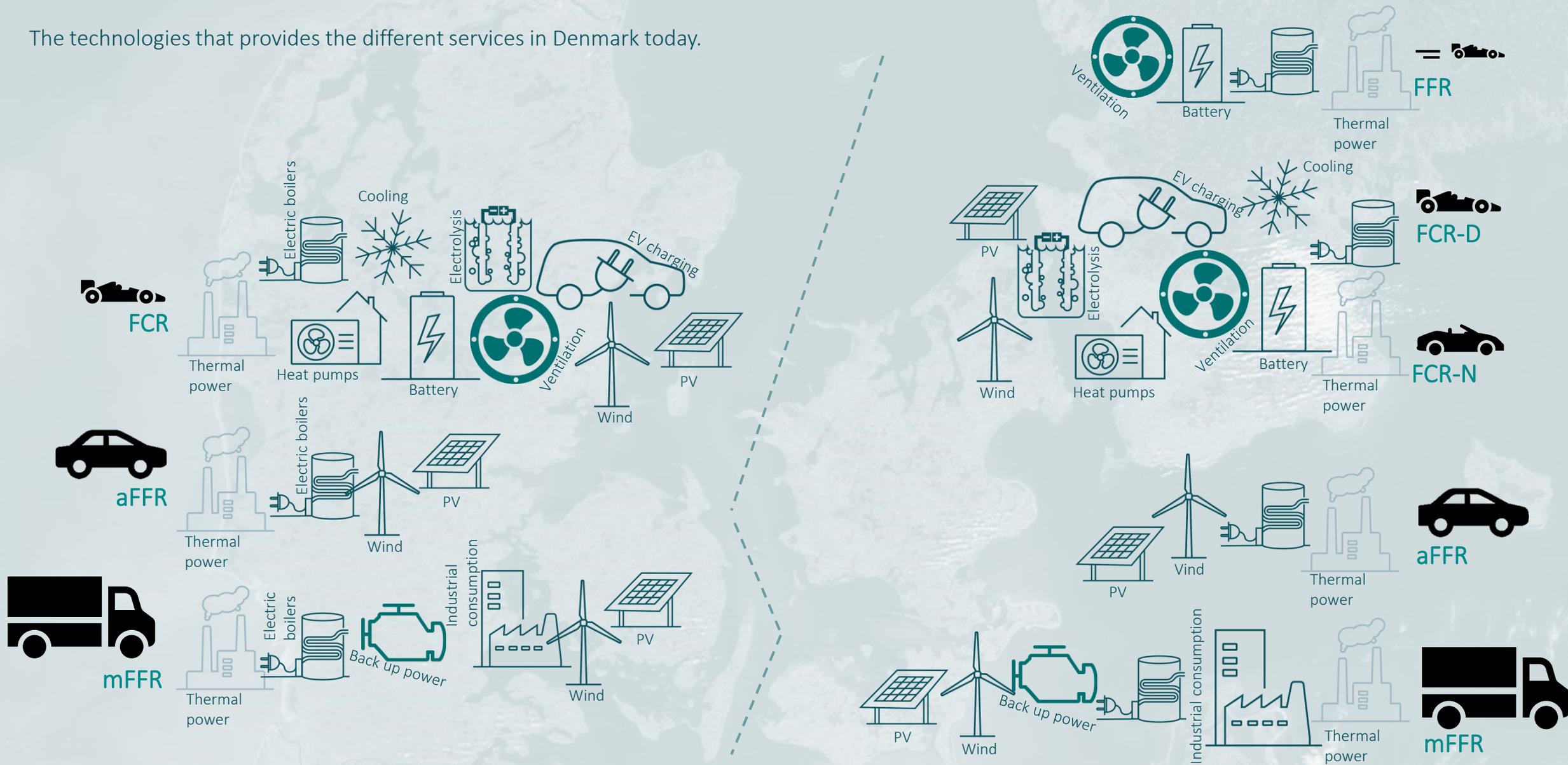
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# ANCILLARY SERVICE : TECHNOLOGY

The technologies that provides the different services in Denmark today.



# CASE STUDY EV AGGREGATOR I

In cooperation with a Danish company, True Energy, it has been investigated how the charging of electric vehicles could become flexible.

- On/off control
- Only grid to vehicle

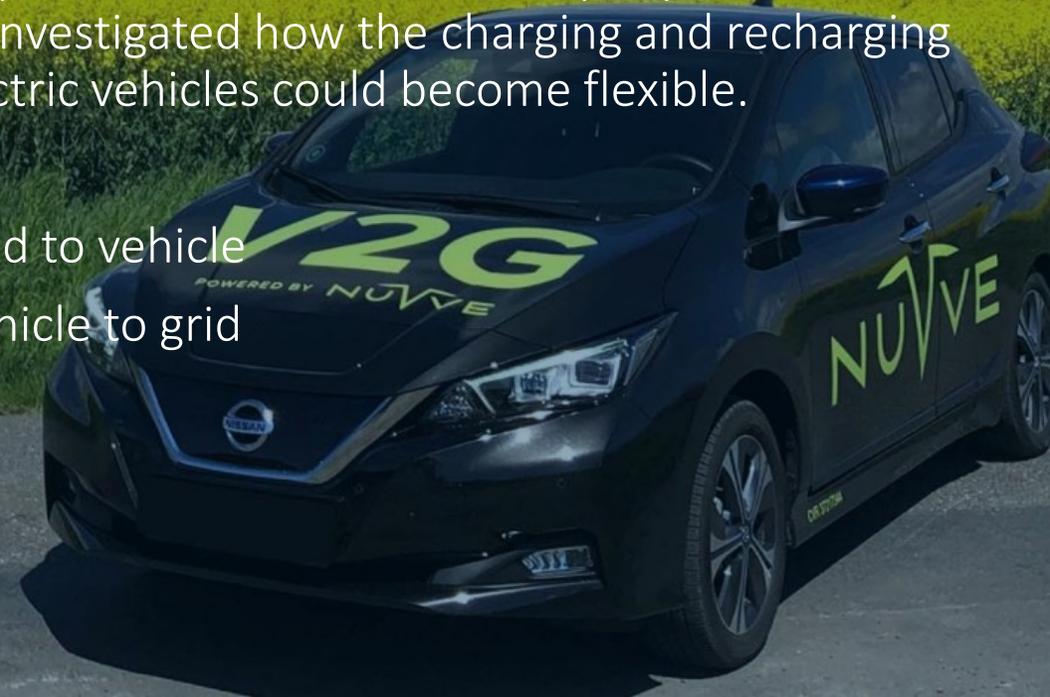
True Energy can provide FCR-N, FCR-D and FCR in Denmark today. They provide flexibility to the electricity grid, which is a business opportunity for them.

# CASE STUDY EV AGGREGATOR II

## We Make Electric Vehicles Greener

In cooperation with a Danish company, Nuuve, it has been investigated how the charging and recharging of electric vehicles could become flexible.

- Grid to vehicle
- Vehicle to grid



# CASE STUDY SHOPPING MALL

In cooperation with a Danish company, Siemens, it has been investigated how the consumption in shopping centers, airports, hospitals and offices could become flexible.

Aggregating ventilation and air conditioning in the buildings have been investigated.

Case study shows good possibilities.

**SIEMENS X ENERGINET**



# THE CASE



## SMALL BID SIZES



Small bid sizes in the ancillary service markets are necessary as the aggregated portfolios of demand response are quite small today.

It is expected to be a minor problem in the future as the interest in demand response is increasing in Denmark.

## ASYMMETRIC PRODUCTS



Demand response is best suited to provide either upregulation or downregulation in most of the time. It is difficult to provide both at the same time.

## INDEPENDENT AGGREGATOR



Coupling to a Balance Responsible Party (BRP) is expensive. Energinet is in the process of creating a possibility for aggregators to participate in the markets directly.

## SHORT MARKET TIME UNIT



Electric vehicles are mainly available during the night. Flexibility in shopping malls or offices are limited to the opening hours.

The market time unit must therefore be short for demand response to participate.