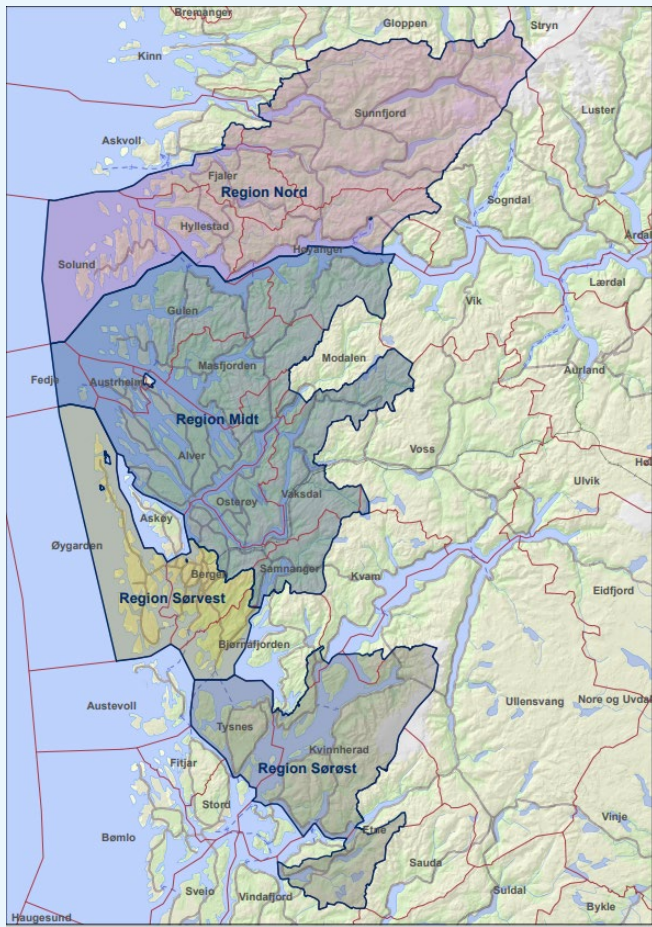


# Flexibility needs of a DSO

Augusta Pithalice, R&D Project lead, BKK AS  
Augusta.Pithalice@bkk.no





## BKK AS

- Electrical grid company in Western Norway
- Around 260 000 customers
- All voltage levels from 145 kV to 230 V
- Around 22000 km



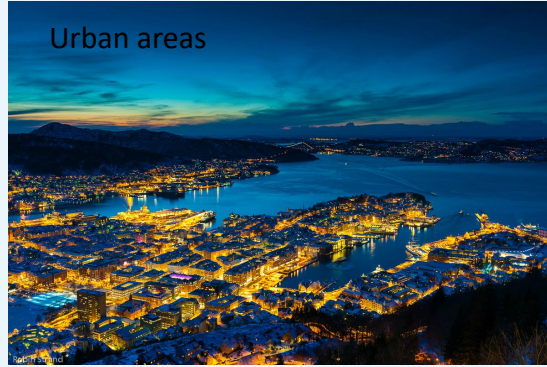


Fjord crossings  
(overhead line)



# Climate and geography

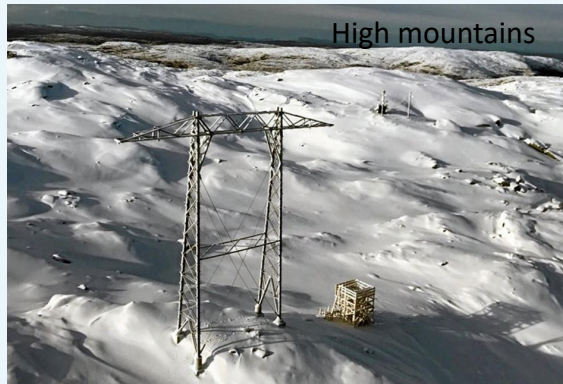
Urban areas



Fjord crossings  
(subsea cable)



High mountains



Narrow valleys



# Regulatory rules in Norway – the separation of grid infrastructure and commercial affairs

## Electric grid companies

- Grid infrastructure
- Monopoly
- Strictly regulated by government rules



## Commercial companies

- Electric power production
- Buying and selling of electricity
- Internet infrastructure
- Commercial charging stations for vehicles, ships, etc.



# AGENDA

## Flexibility needs of a DSO

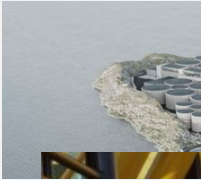
- The why?
- The challenges we face
  - The how?
- Pilots we are working with





TEK.NO

**Oslo ikke lenger på elbiltoppen - Tek.no**  
For første gang er det størst andel nysolgte bil



kan bli verdens første elfly-rute  
være i drift fra 2023.



JERNBANEMAGASINET.NO

**Batteridrevne tog er nærmere enn d**  
Jernbanemagasinet



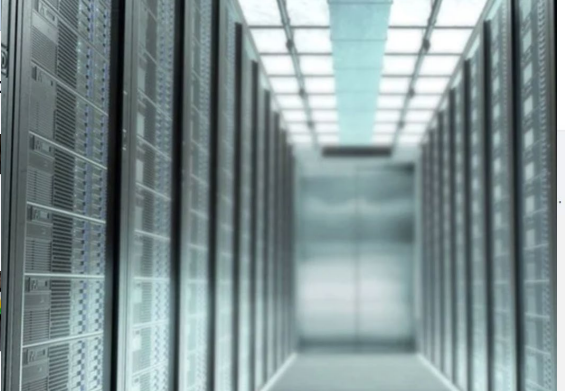
TU.NO

**Aidaperla skal seile utslippsfritt inn til Bergen i 2020 med norske batterier**

Prisene har falt 87 prosent i dette tiåret – og 18 prosent bare i fjor.



**kord i Bergen - snart går hver femte bil på**



TU.NO

**Trosset steinras og virus: Nå er verdens raskeste el-katamaran klar til bruk**

le vanlig



TU.NO

**Entreprenører bestiller elektriske gravemaskiner etter krav fra utbyggere**



TU.NO

**Ti nye, fullelektriske trolleybusser er på vei til Bergen**  
Småsær bergensk busstradisjon skal få nytt liv.

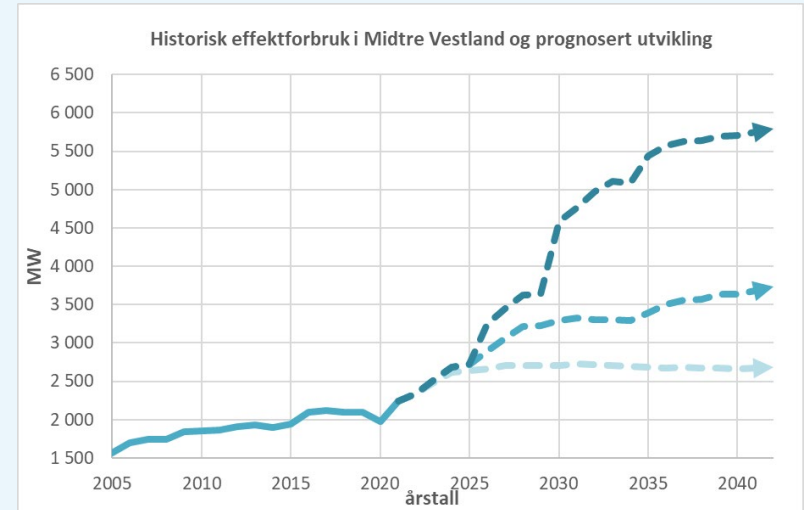
er hentet en elektrisk borerigg f...

# Background

## Huge consumption plans launched in a short time

- The last ten years has seen a consumption growth of about 1.5% per year
- During the next ten years, there can be growth of about 10% per year
- Two-thirds of the consumption growth is because of the new industries, one-third is related to electrification of the petroleum industry

## Historical consumption and the forecast



Source- Regional Kraftsystemutredning for Midtre Vestland 2022 - 2042

# Challenges for the grid operation...

- In 2021, the maximum load was around **2 200** MW
- Around 2035, the expected maximum load is close to **5 000** MW
- Its an increase around **3 000** MW → 150 %

This cannot be solved by simply expanding more grid and capacity. What's the solution?









## One of the alternatives - Demand response

Its the ability and willingness of a customer or a producer to adapt the consumption or the production of electricity to provide a service to the power system  
(Source - CINELDI)

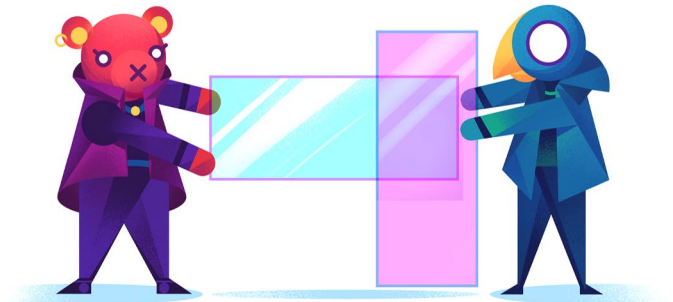
Example – Cutting off certain loads during peak load hours

Flexible resources can be consumers, production from renewable sources, storage (batteries, electric cars, boilers)



# Flexibility - Challenges

- Actual available end-use flexibility is situation based. It varies with prices, temperature, load conditions, access to substitutes
- End-use flexibility can therefore not appear as an available stable and quantifiable resource without this being put into a specific supply situation





# Alternatives?

- Power tariffs
- Disconnection tariffs
- Special agreements
- Bilateral agreements
- Auction/Tender
- Flexibility markets



# Alternatives?

- Power tariffs
- **Disconnection tariffs**
- Special agreements
- Bilateral agreements
- Auction/Tender
- Flexibility markets



## DISCONNECTION TARIFFS (FLEXIBLE CUSTOMERS)

- Already in use for many years now
- Customers sign an agreement with certain terms for shutdowns when the grid is heavily loaded (or when there is a need)
- Customers have a lower tariff than the other normal customers

### Types of agreements

- Shutdown instantaneously, indefinitely
- Shutdown instantaneously, for maximum of 14 days/ year
- Shutdown instantaneously, for a maximum of 4 hours/ day

No proper system to control / monitor



# Alternatives?

- Power tariffs
- Disconnection tariffs
- **Special agreements**
- Bilateral agreements
- Auction/Tender
- Flexibility markets





## Connection to the grid with specific terms

- Guidelines for BKK (as of today)
- Not obligatory for both parties
- Connection with ordinary terms and conditions will always be our standard solution
- Only applicable to high-voltage customers or low-voltage customers who are only one connected to the station
- Technical requirements (remote controlled switch)
- Two main situations –
  - temporary solution until a planned grid reinforcement is in operation
  - long term, Indefinitely

# CONNECTION WITH SPECIFIC TERMS

## **As a temporary solution until a planned grid reinforcement is in operation**

- The customer is allowed to connect to the grid earlier than otherwise possible
- Must expect shutdowns in this temporary phase
- When the planned grid investment comes to operation, the customer must pay the connection charges
- The customer must commit to pay connection charges already now

## **Long term, indefinitely**

- Most relevant in cases where it is extra costly to establish redundancy
- The customer can connect to the grid without paying the connection charges for the redundancy
- In these cases, the customers must have an alternative power supply





TERMS WE  
SHOULD  
SET

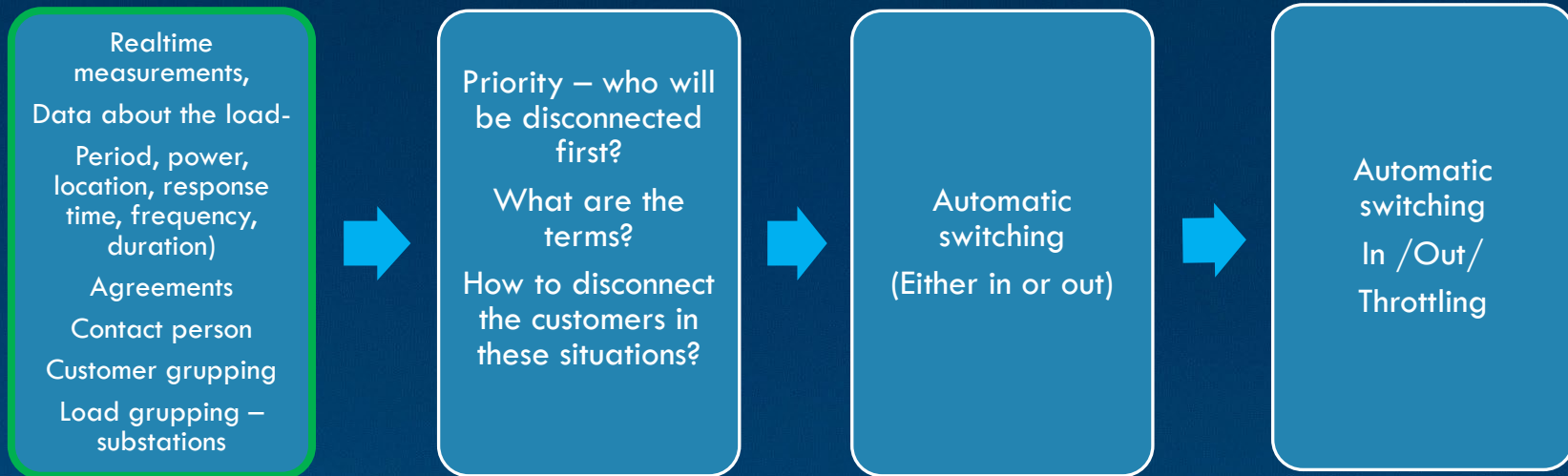
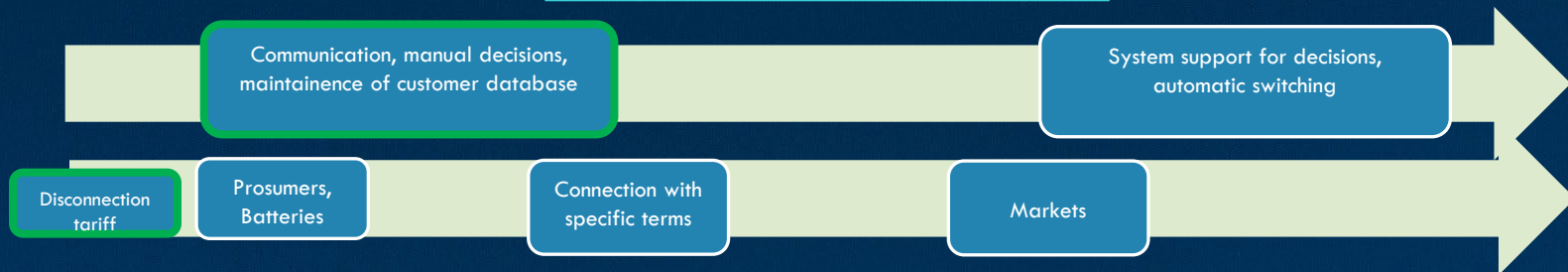
**Only applicable as an alternative to full redundancy**

- Instantaneous shutdown when the main supply is disconnected
- The shutdown time will be as long as the grid component is disconnected
- No restrictions on the shutdown time
- No agreements on a warning time before shutting down, including planned shutdowns
- Withdrawal



Monitoring of these flexible resources

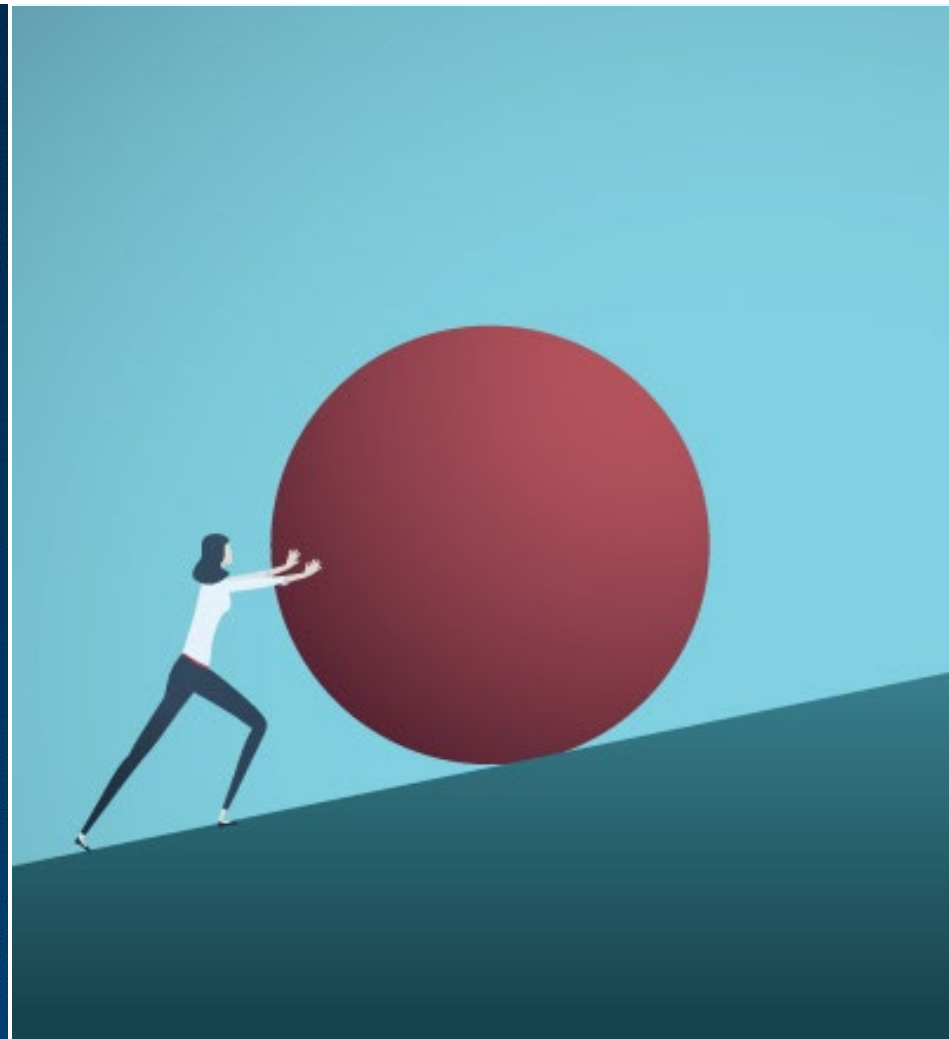
## Control system for flexible resources





# The challenges

- Establishment of agreements (connection with specific terms)
- Missing system and tools (agreements)
- Automated solutions – manual handling of disconnections
- Communication with customers – Do they understand the consequences?
- Process - in BKK
- Cost benefit – Grid investment vs. Flexibility



## MARKET BASED FLEXIBILITY

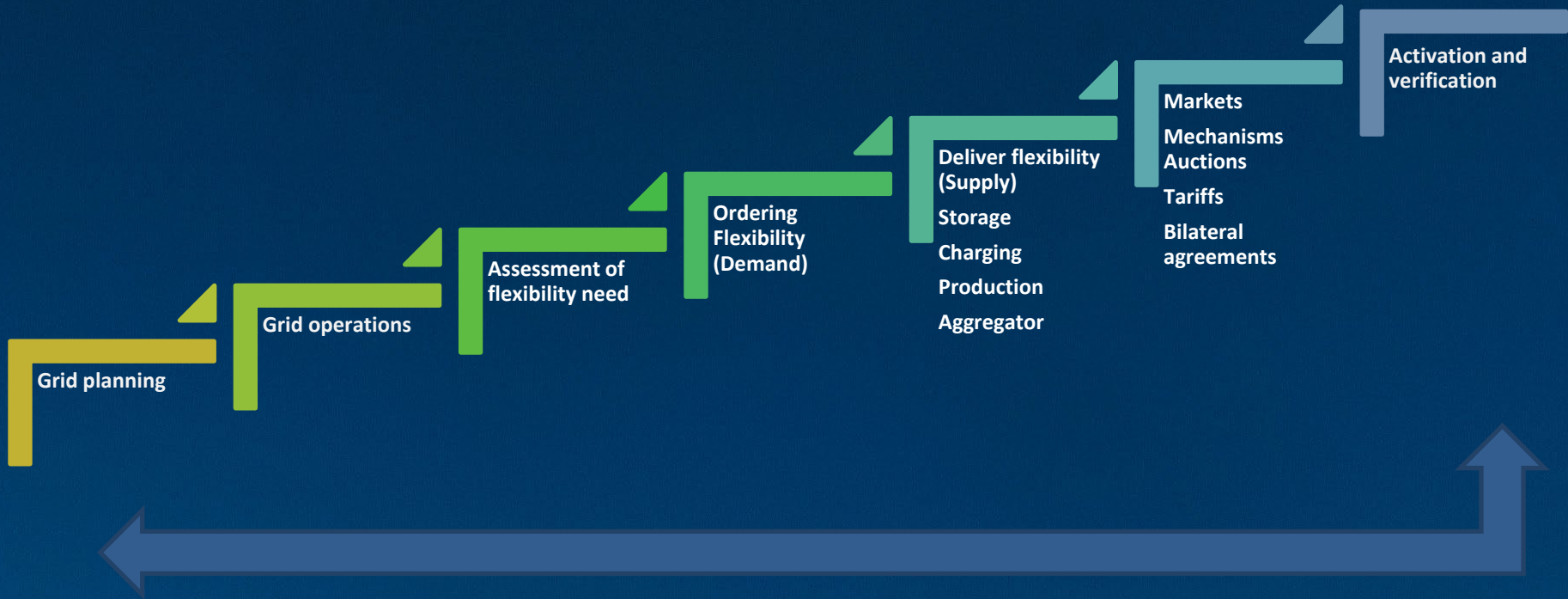
Manage the growth in grid loads during peak hours to delay investing in reinforcements using market based flexibility

### Pilot in concept phase

- Førde city center experiences heavy loads several days per year and this requires changes in the regional grid to maintain redundancy
- Who can offer the flexibility in the area?
- Industrial customers, Aggregators
- What can we do if customers are not available when needed?
- Incentives
- Cost- and risk analysis







Source  
THEMA Rapport 2020- 04 (BKK og Tibber)

# Competence shift towards digitalization

- ICT skills – Data management
- Analysis skills
- Knowledge sharing between DSOs, TSO, research institutions
- Educating the customers
- Suppliers



Any questions?  
Thanks for your attention  
and time!

