



Centre for intelligent electricity distribution
- to empower the future Smart Grid

Mini scenarios and use cases for application of flexible resources in the future power system

CINELDI conference 2019, 9 April

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Agenda

- Future as seen from EU
 - EU Energy Roadmap 2050 and ETIP SNET Vision 2050
- Future as seen from CINELDI – 2030/2040
 - Mini scenarios (Today: Focusing on utilization of flexibility in the future grid)
- Use cases for application of flexible resources

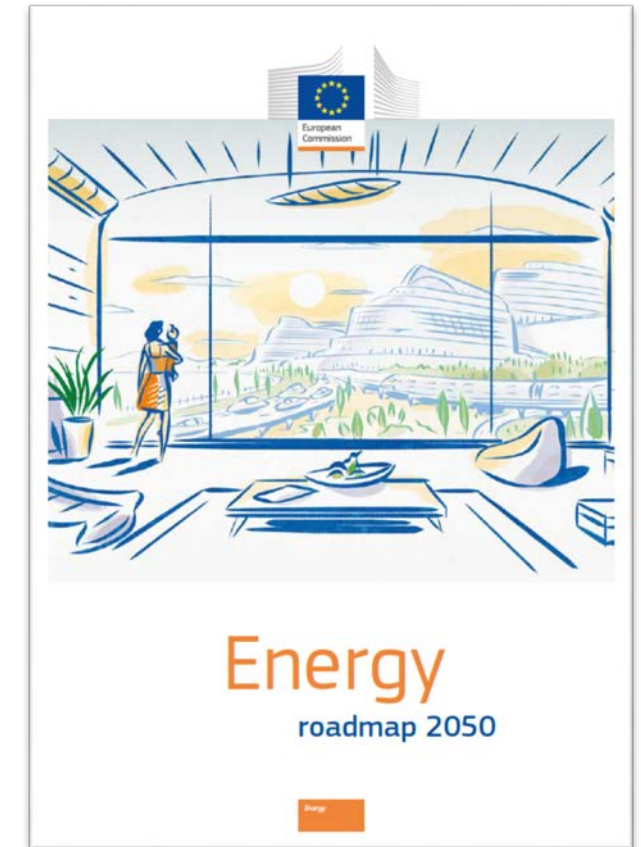
Objective: Give an introduction to different scenarios for the future,
where flexibility plays an important role

Future as seen from EU

EU Energy Roadmap 2050 and ETIP SNET Vision 2050

EU Energy Roadmap 2050

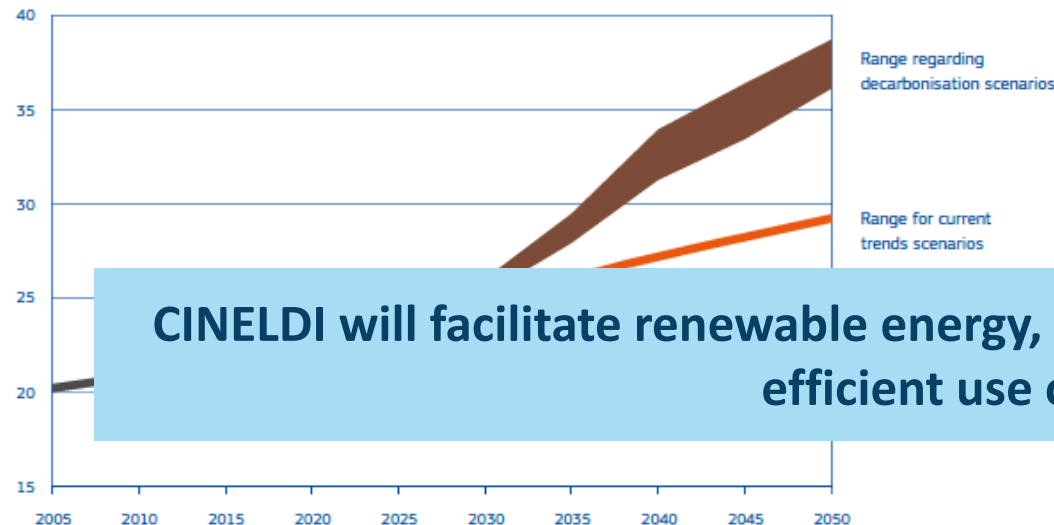
- EU's decarbonisation objective
 - EU has set itself a long-term goal of reducing greenhouse gas emissions by 80-95%, when compared to 1990 levels, by 2050
- 'Energy roadmap 2050' explore routes towards decarbonisation of the energy system.
 - Two current trend scenarios
 - Five decarbonization scenarios



EU Energy Roadmap 2050

Examples of topics relevant for CINELDI

- Electricity plays an increasing role
 - In all decarbonization scenarios electricity will play a much greater role than now.
 - Electricity could provide around 65 % of energy demand by passenger cars and light duty vehicles.
- Energy savings throughout the system are crucial
 - Primary energy demand drops in a range of 16–20 % by 2030 and 32–41 % by 2050 as compared to consumption in 2005/06.
- Renewables rise substantially
 - In all scenarios: At least 55 % increase in gross final energy consumption in 2050, from today's level at around 10 %.



CINELDI will facilitate renewable energy, electrification of transport and more efficient use of energy

VISION 2050

A SYSTEM OF SYSTEMS



Variety of generation sources in size, both centralised and decentralised, fully or largely circular

VISION 2050

A SYSTEM OF SYSTEMS



NETWORKS

Electricity

Heating & Cooling

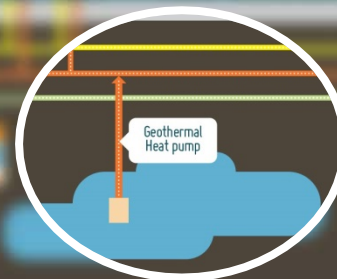
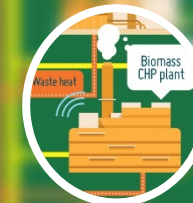
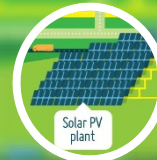
Gas

Data

Variety of generation sources in size, both centralised and decentralised, fully or largely circular

VISION 2050

A SYSTEM OF SYSTEMS



In 2050 the Customer is fully engaged

VISION 2050

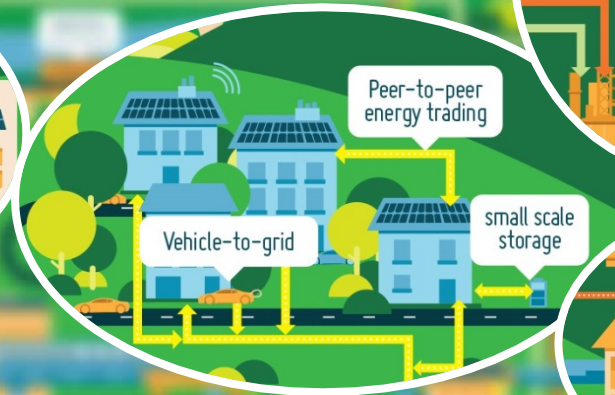
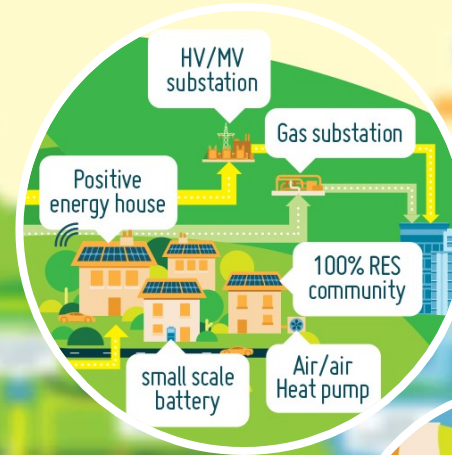
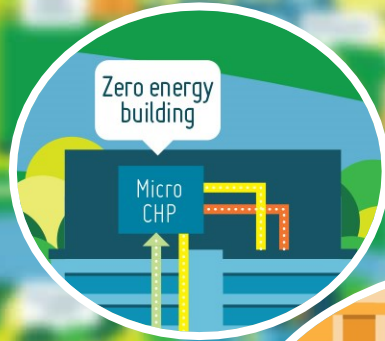
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In 2050 the Customer is fully engaged

VISION 2050

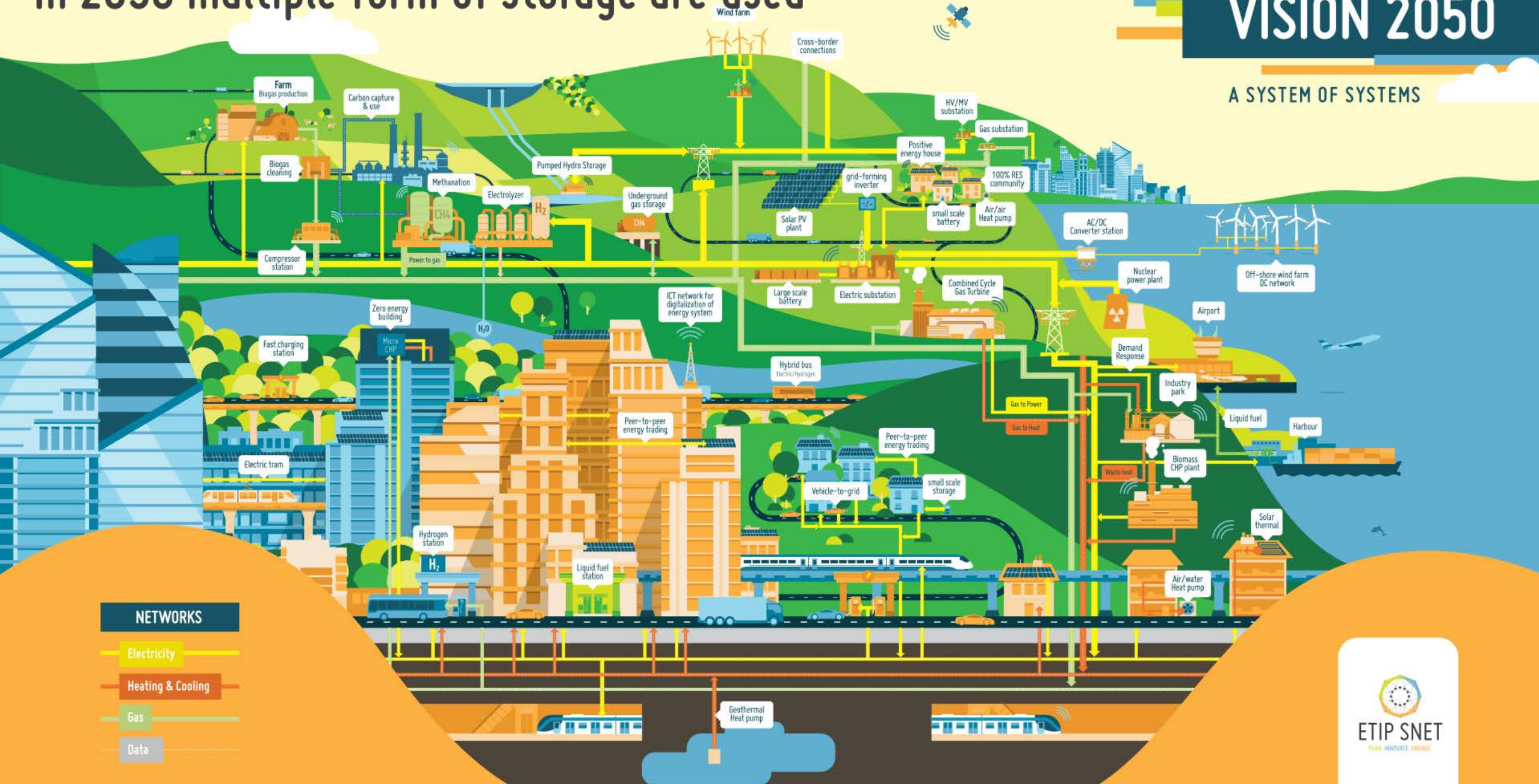
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In 2050 multiple form of storage are used

VISION 2050

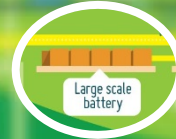
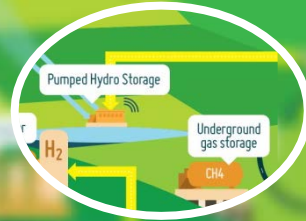
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In 2050 multiple form of storage are used

VISION 2050

A SYSTEM OF SYSTEMS

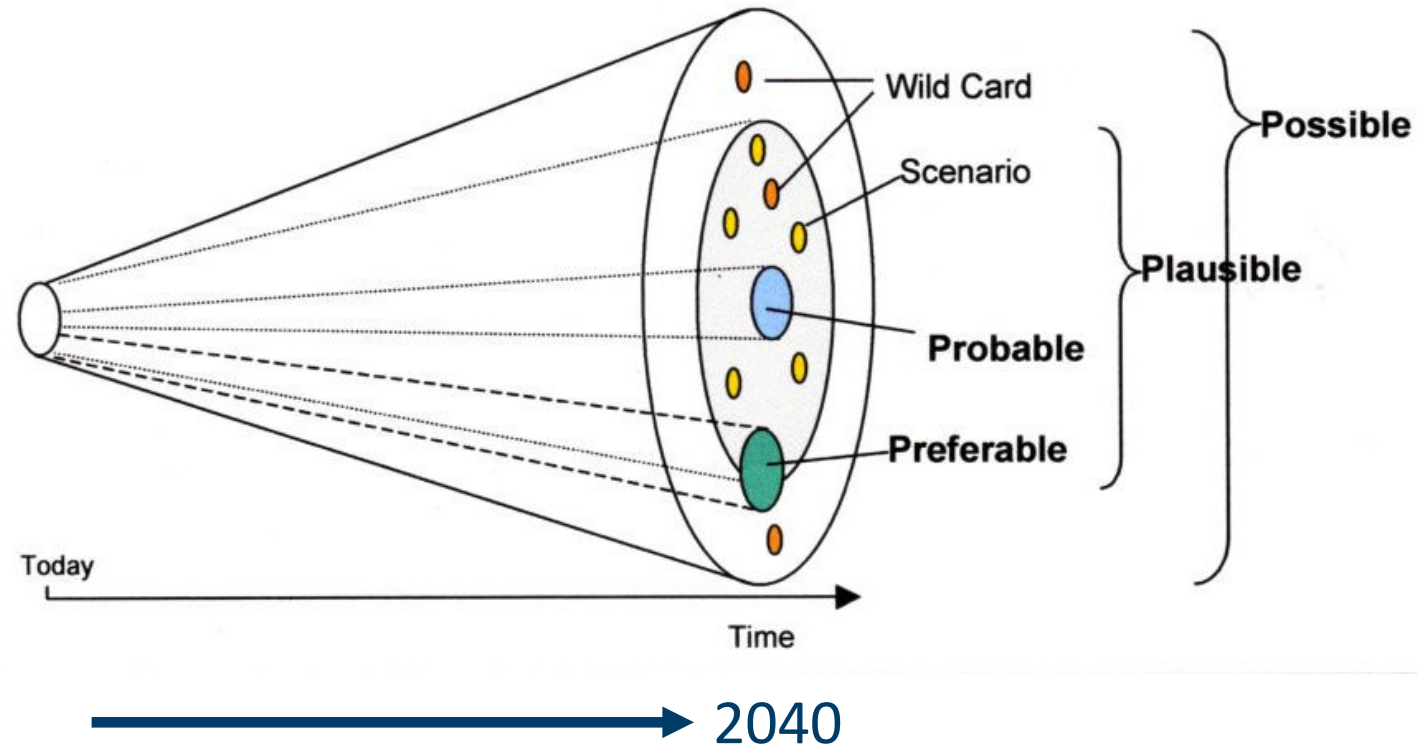


Future as seen from CINELDI – 2030/2040

- Mini scenarios (Today: Focusing on utilization of flexibility in the future grid)

Scenario

= A description of a potential future and the progression towards the given future

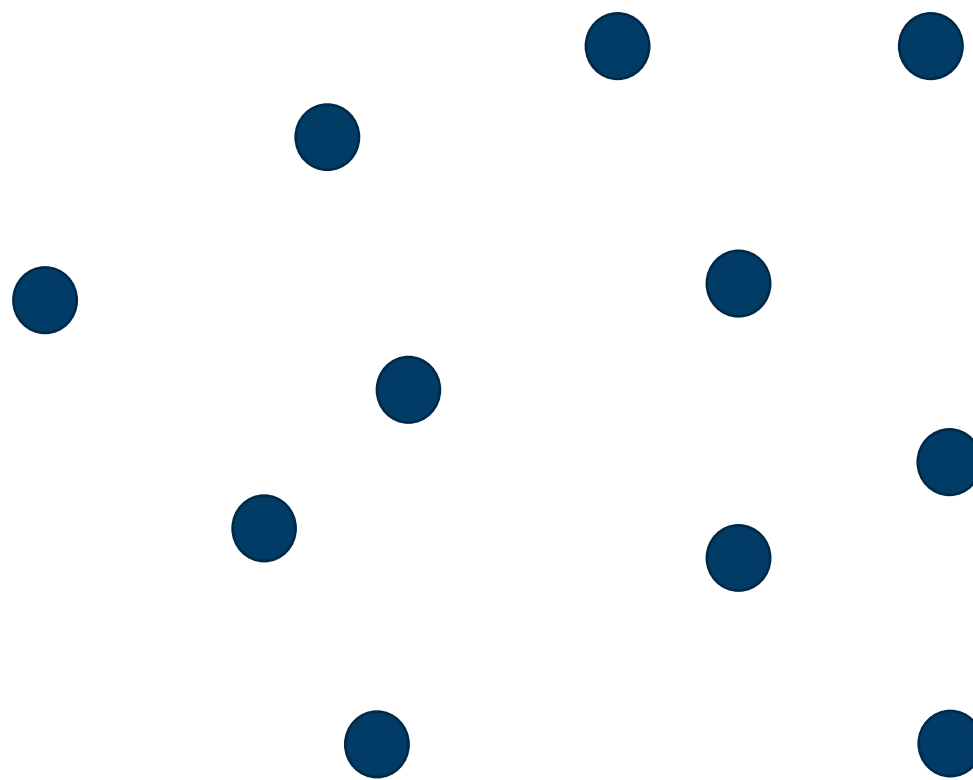


Mini scenarios

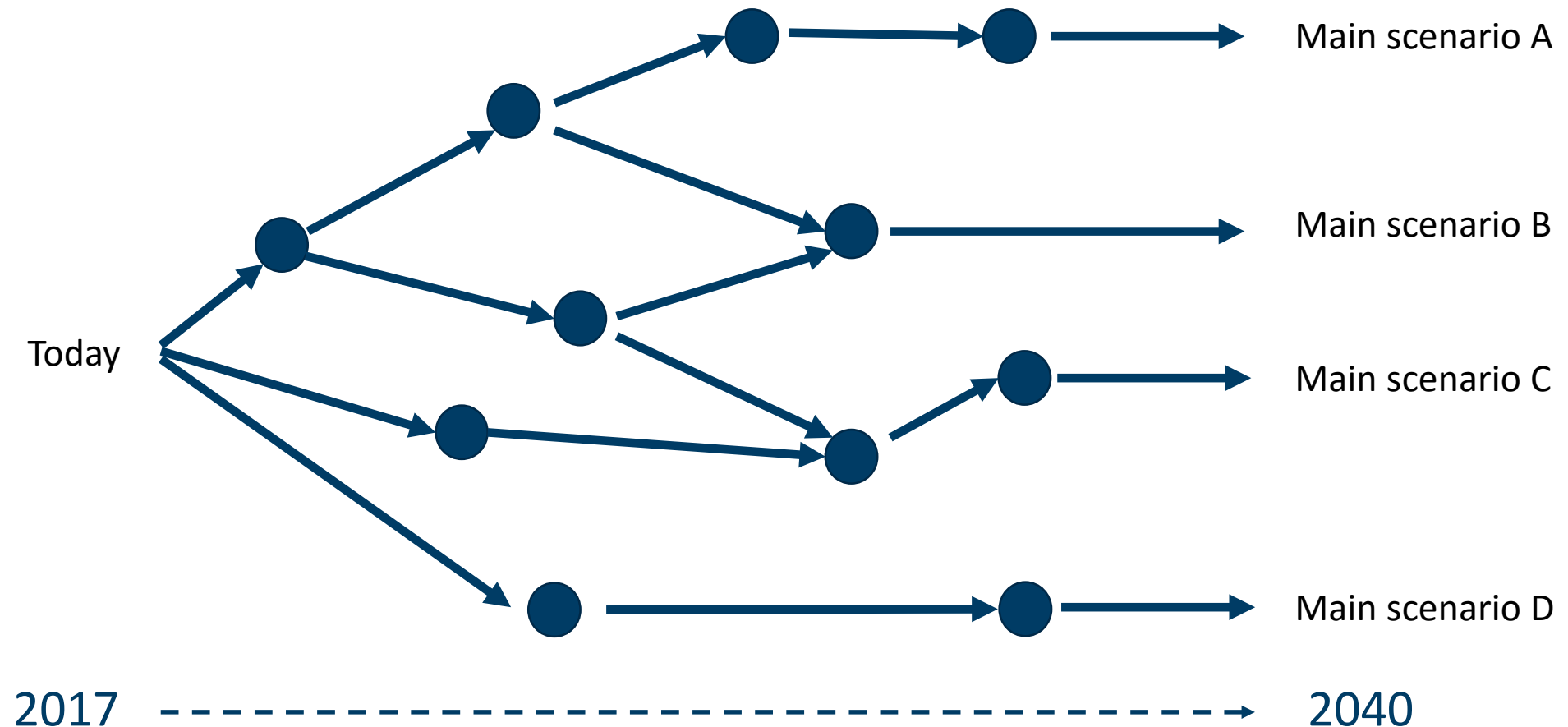


- Mini scenario = a probable event, development or action of significance for the future electricity distribution
- 109 mini scenarios are developed through an interactive process during workshops with CINELDI-partners
- An evaluation has been performed to which degree the mini scenarios are related to flexibility

Mini scenarios



Mini scenarios → Main scenarios



Examples of mini scenarios (1:2)

- **Nr. 10. Title: battery in each home**

- *There are simple and inexpensive battery solutions, and network tariffs provide incentive to peak shaving. Consumers buy battery to be self-sufficient, and batteries become well-spread. There is less need for network reinforcements, and less need for kW delivery. Battery reduces max load, and seen from the net, the customer has constant consumption. The grid companies are getting less voltage problems and can postpone expensive investments in network infrastructure.*

- **Nr. 11. Title: batteries resolves the need for flexibility**

- *Batteries are widely used at home, in car and other road transport, as "cold ironing" power for boats and for microgrid. High power output is required to charge the batteries quickly, while the batteries can also provide flexibility. The grid companies utilize the batteries optimally to equalize the effect and get postponed investment costs in the network.*

Examples of mini scenarios (2:2)

- **Nr. 78. Title: DSOs get control**

- *The grid companies get access to controlling consumption behind the meter to their customers. Whether the customer owns the access, but gives the grid company control, or by the fact that the grid company owns the access (various offers to customers, regulated through agreements). The network companies take advantage of flexibility for the best of the grid.*

- **Nr. 80. Title: Well-functioning aggregation market**

- *Aggregator services are used to a greater extent and utilize the flexibility of customers (water heaters etc.). Active customers as a resource for the network, well-functioning flexibility market. Can postpone investments in the network.*

What can be the consequence(s) of the selected mini scenarios?

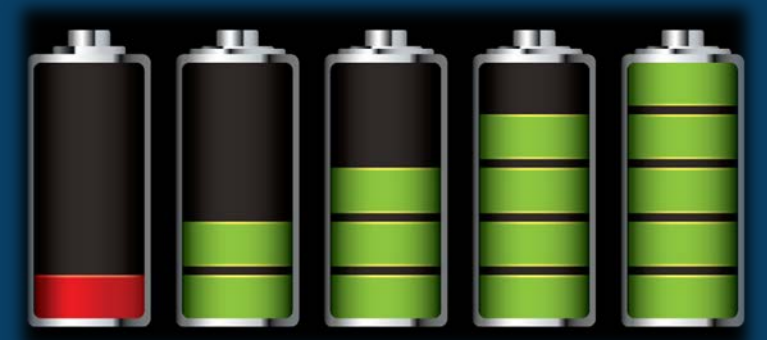
- Challenges

- Congestions
- Voltage violations
- Increase of peak load/feeding
- Unpredictable power flow
- Decreased inertia

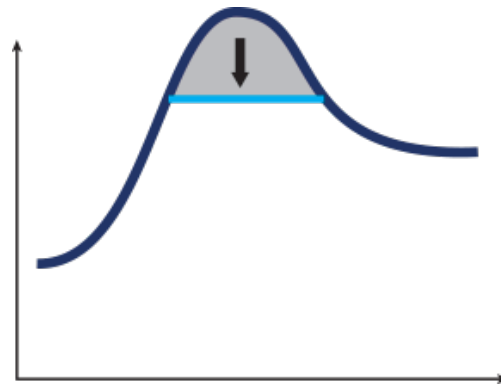
- Opportunities

- New active power resource for ancillary services (both up and down)
- Reduction of losses due to optimisation of the Power flow
- Reduced voltage violation

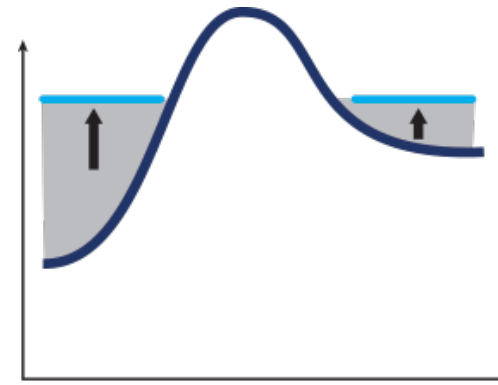
Use cases for application of flexible resources



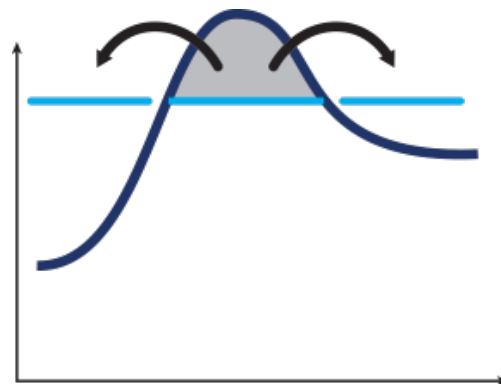
Flexibility as seen from the grid



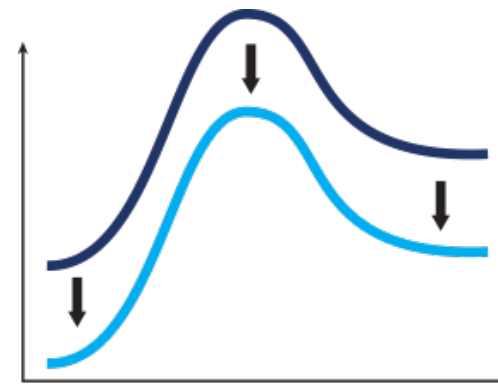
Peak clipping



Valley filling



Load shifting



Energy conservation

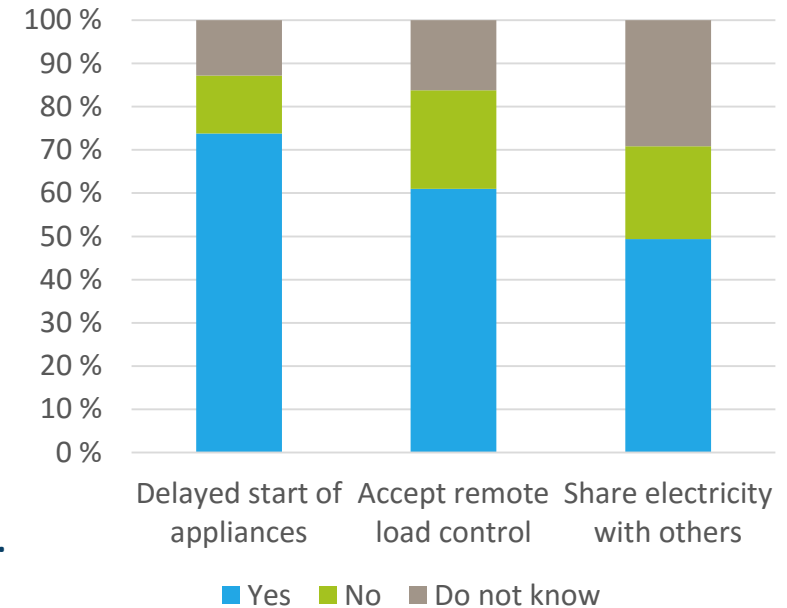
Potential for household flexibility

- Work performed:

- A survey among a representative sample of Norwegian households (2017)

- Significant results:

- 3 out of 4 are willing to delay the start of washing machine, dishwasher etc.
- 2 out of 3 will accept remote load control of their water heater.
- 50% will share the available electricity with others, by manual reduction.



Reference in CINELDI: A chronicle describing the households customers' evaluation of their potential for flexibility, published in Dagens Dagens Næringsliv 21 September, [Gemini.no](https://www.gemini.no) and [KS Bedrift Energi](https://www.ks-bedrift.no).
Report from CINELDI-ModFlex: SINTEF Report no. xx

Use cases for application of flexible resources

- Visions and scenarios give a direction towards the future
- Flexible resources are evaluated as an **important source** that can be included in cost efficient operation of the power system.
- The use of flexibility need to be coordinated – to avoid conflict of interests
 - For example if activating a flexible resource in one grid makes problem for another grid
- CINELDI will use the visions and scenarios for development of future ancillary services, with use of different types of flexibility

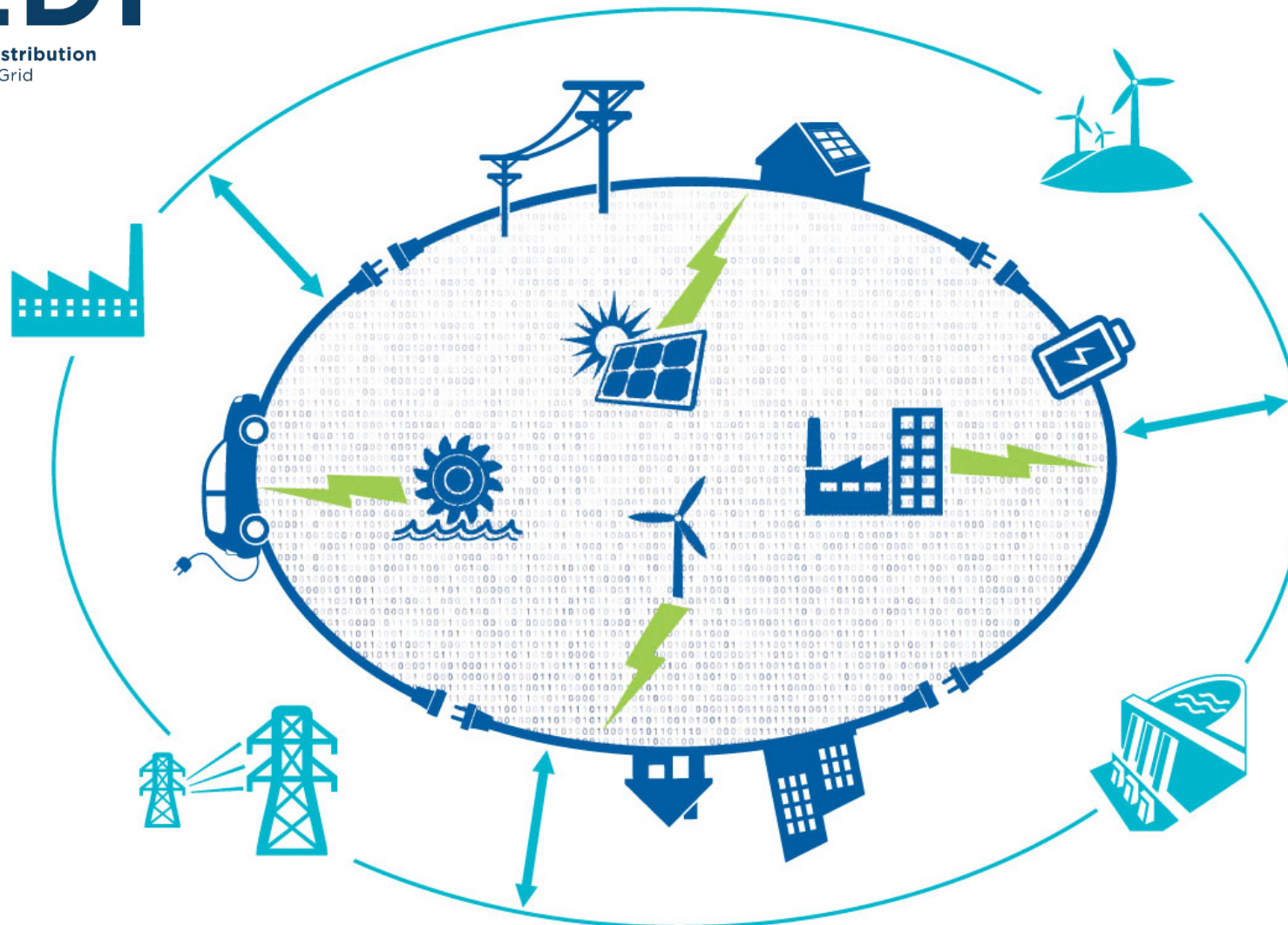
Summary



- The future is electric, with new technology and engaged customers
 - This indicate both a need and a potential for flexibility
- The mini scenarios give examples of a possible future – 2030/2040
- Mini scenarios will be used as basis for development of future ancillary services where flexible resources are included
- Examples of use cases that will be developed are:
 - Voltage regulation, Handling bottlenecks in the grid, Balancing services (market)

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