Research on the future intelligent, flexible and robust distribution grid – with special focus on potential for demar response from household customers

IEA DSM, Bergen, 16th April 2018

Hanne Sæle

Agenda

- About FME CINELDI
  - Research centre for intelligent electricity distribution
- Potential for demand response among Norwegian households
  - Research project: Modelling Flexible Resources in Smart Distribution Grid – ModFlex
- Summary

Centres for Environment-friendly Energy Research (FME)

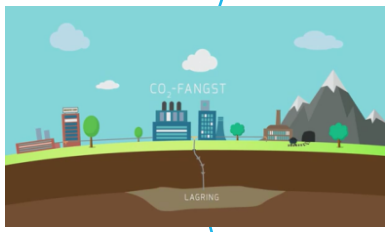
- The scheme is the most prominent tool for long term energy research in Norway.
- The research activity is carried out in close cooperation between prominent research communities and users.
- The main objective of the Centres for Environment-friendly Energy Research is:
  - to conduct concentrated, focused research of high international calibre in order to solve specific challenges in the energy sector in Norway, and
  - to promote innovations and industrial development.
- Typical budgets: 300 – 400 mill NOK (30 – 40 mill €) over eight years with 50 % funding from the Research Council of Norway

Centre for intelligent electricity distribution – CINELDI

Centre for an Energy Efficient and Competitive Industry for the Future **- HighEFF**

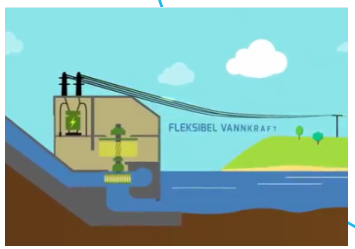
Mobility Zero Emission Energy Systems **- MoZEES**

Norwegian CCS Research Centre **- NCCS**



Research Centre for Sustainable Solar Cell Technology **- SUSOLTECH**

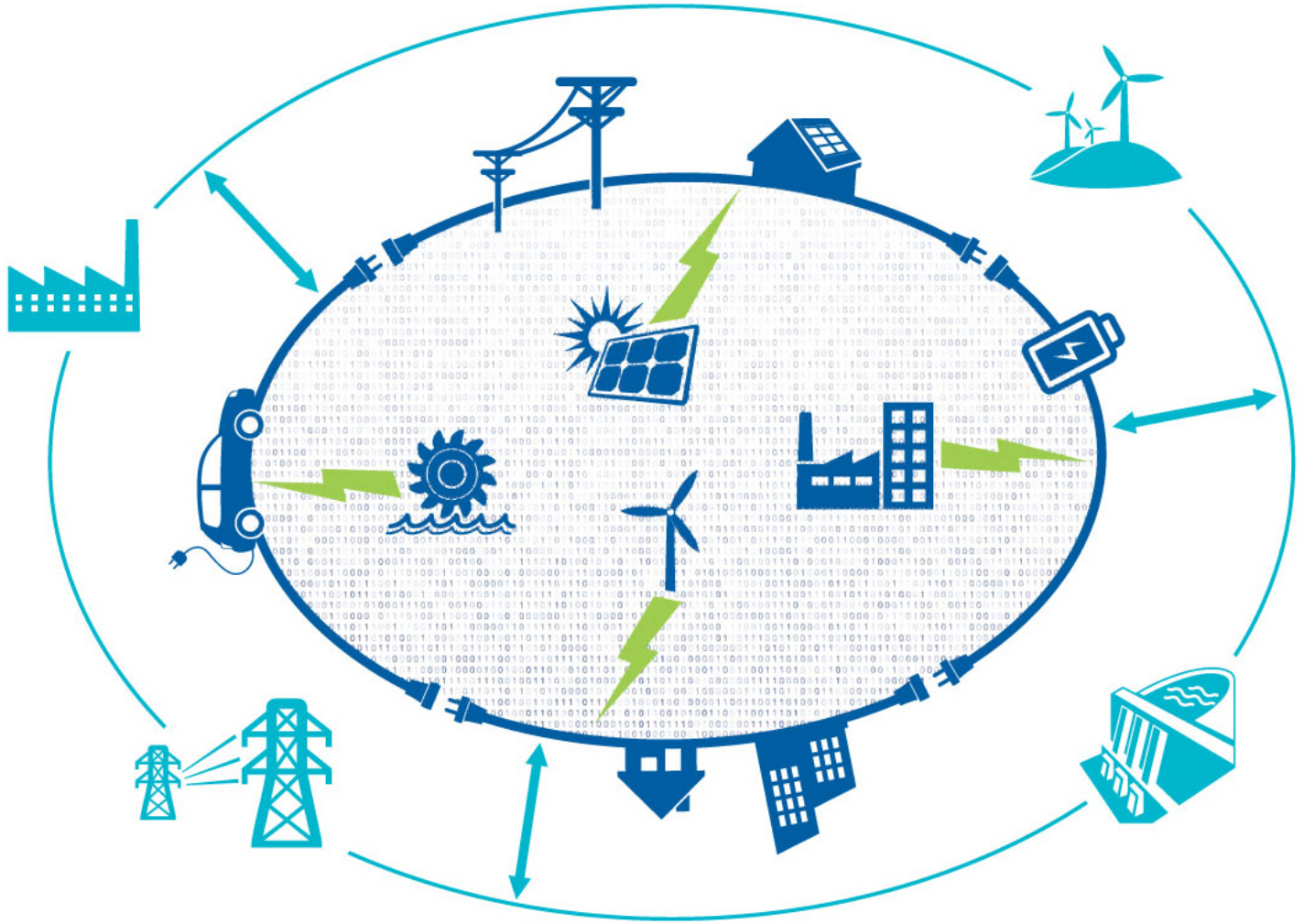
Norwegian Research Centre for Hydropower Technology **- HydroCen**



Norwegian Centre for Sustain Bio-based Fuels and Energy **- NorSusBio**

The Research Centre on Zero Energy Neighbourhoods in Smart Cities **- ZEN**

CINELDI will ensure that we are building the smart energy system of the future



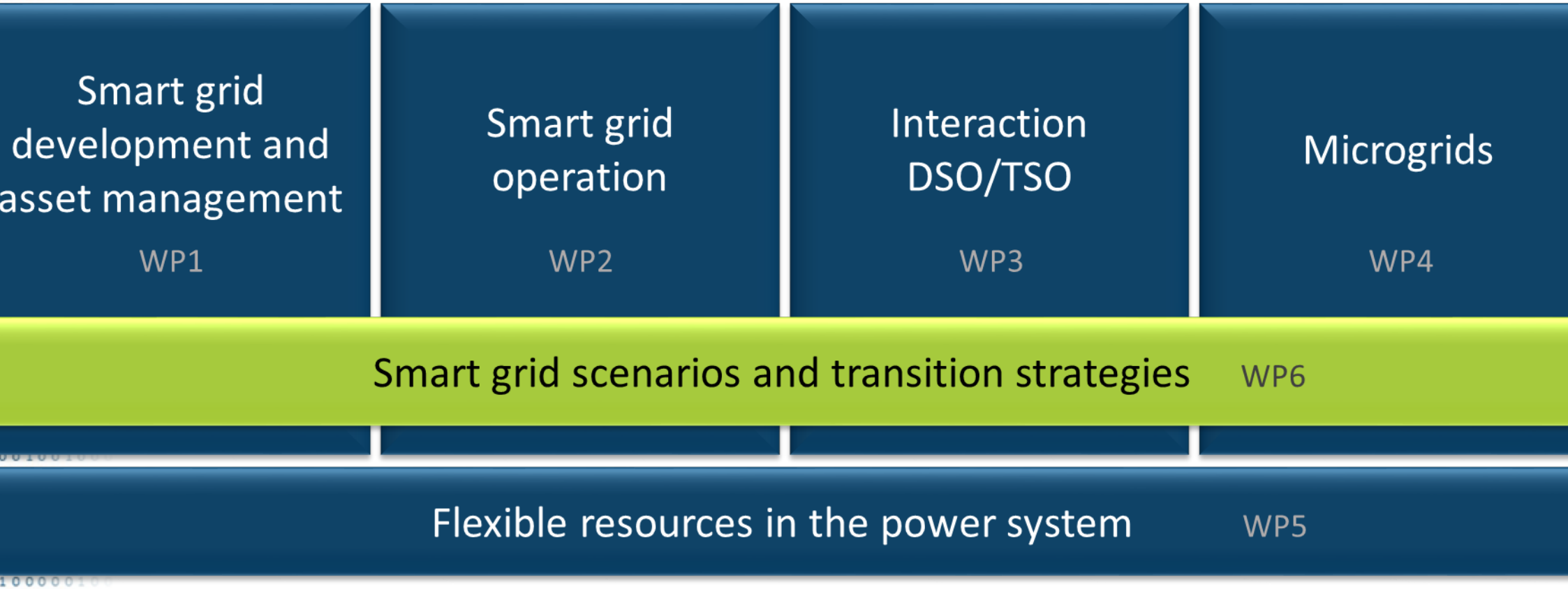
CINELDI Objective

- To enable a cost-efficient realisation of the future flexible and robust electricity distribution grid
- This will pave the ground for increased distributed generation from renewable resources, electrification of transport, and more efficient energy use

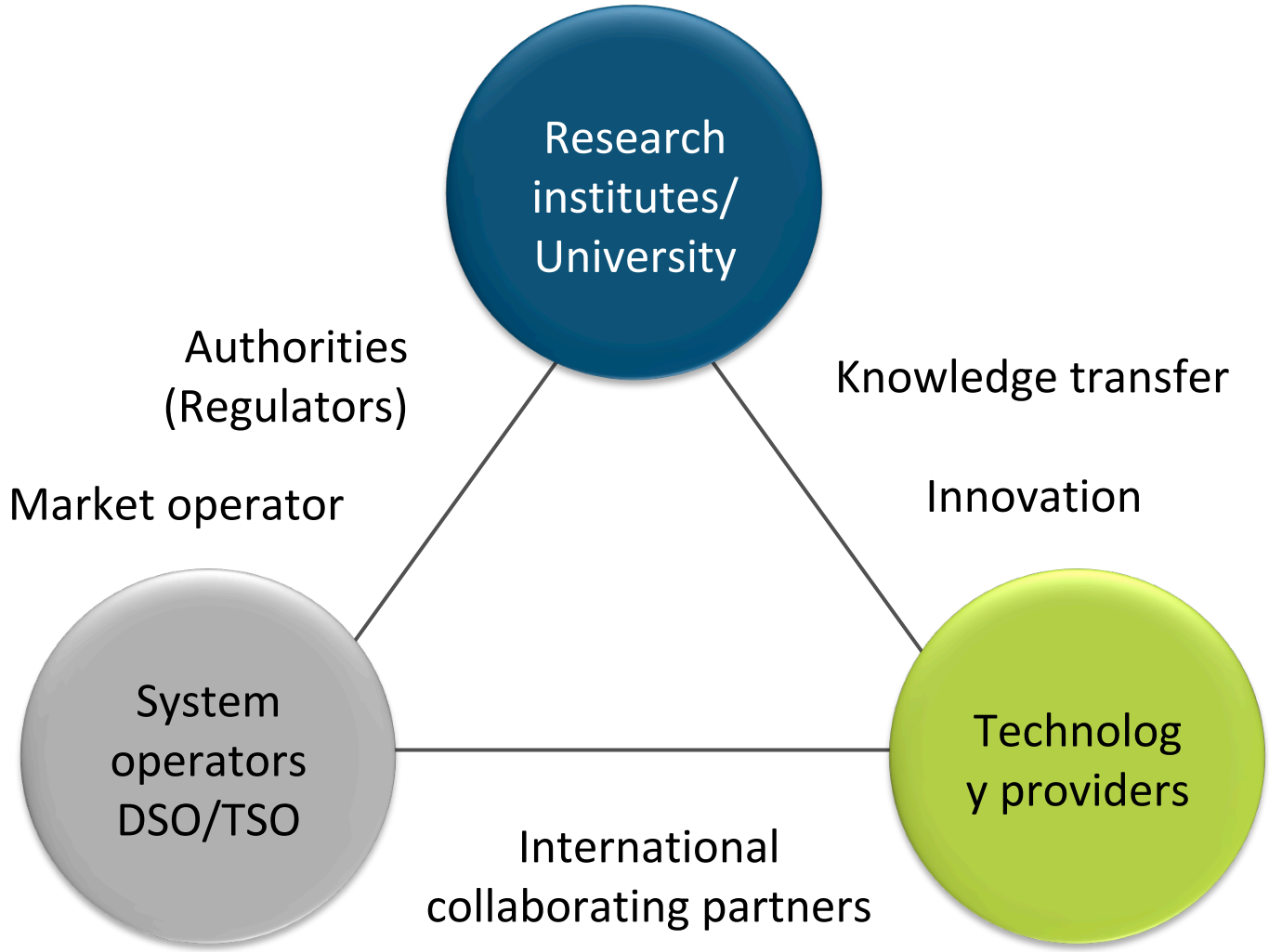
CINELDI in figures

- Budget: 361.2 MNOK (40 M€)
- Duration: 8 years (2016 – 2024)
- 29 partners
- Host institution/project responsible: SINTEF Energy Research
- www.cineldi.no

CINELDI Work packages

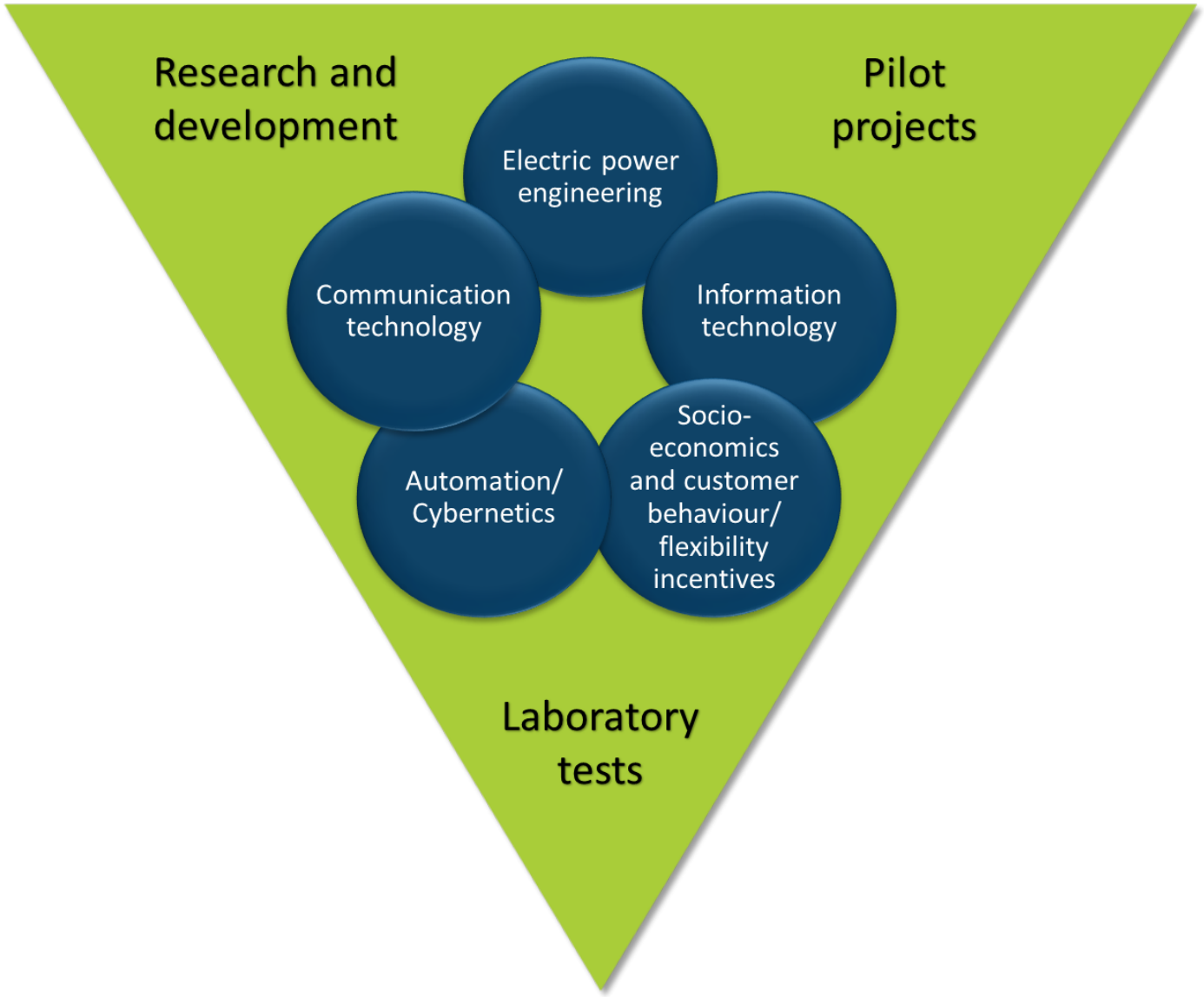


CINELDI partners



National partners

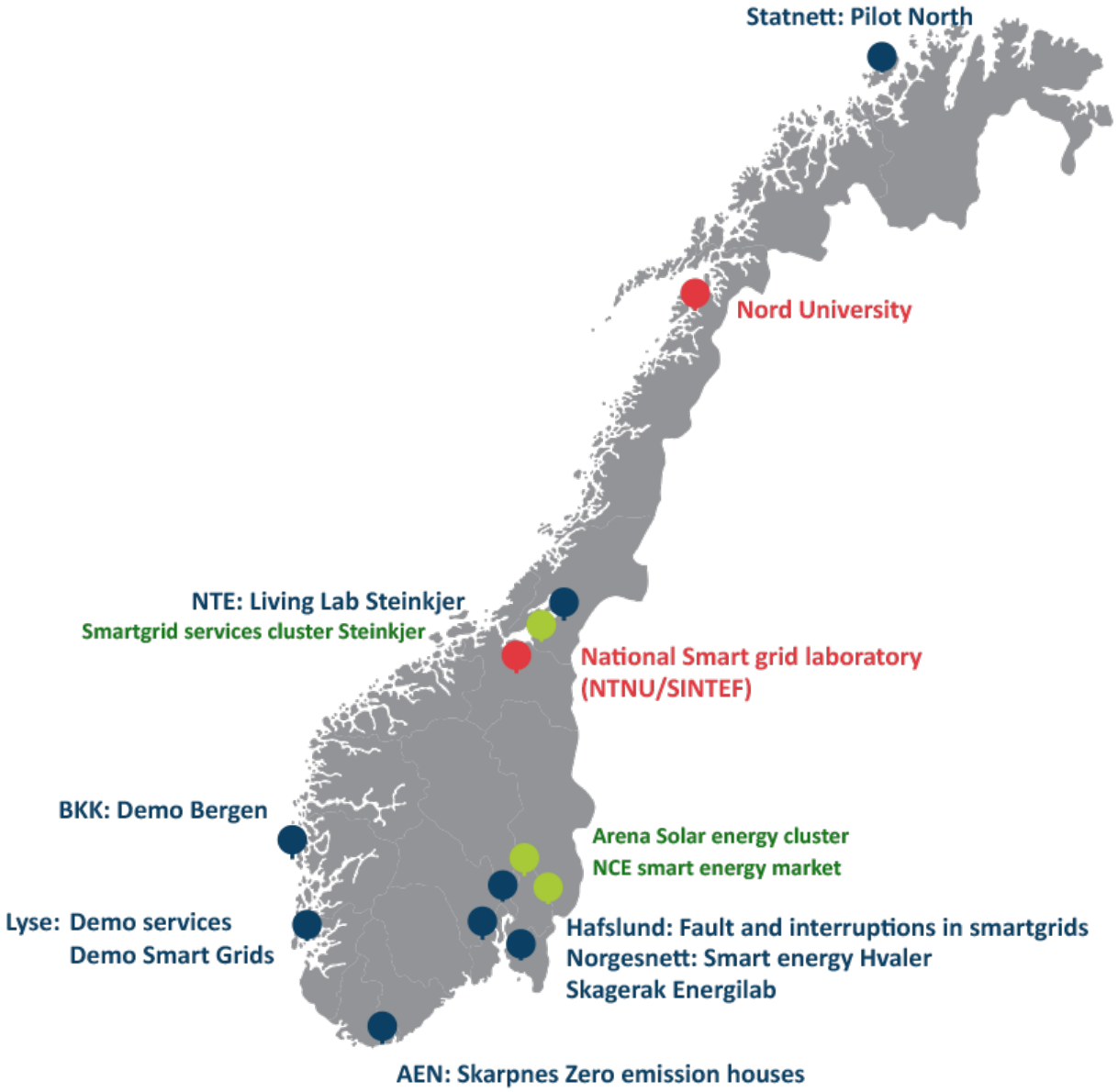
Multidisciplinary research



CINELDI targets system innovation

CINELDI

… as well as smart grid pilot projects and living labs



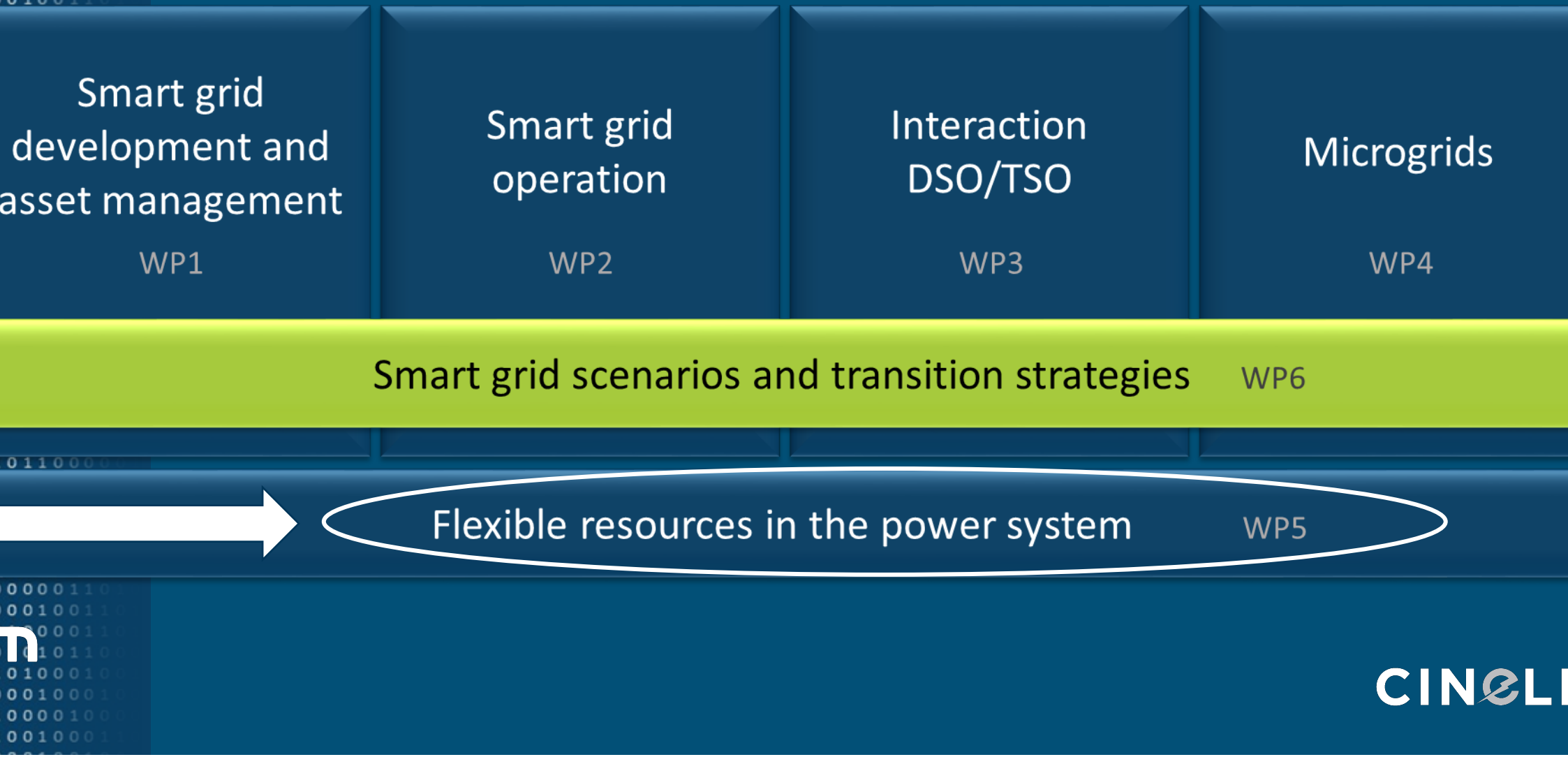
Living labs
Innovation clusters
National Research Laboratories

smartgrid The Norwegi Smartgrid Ce

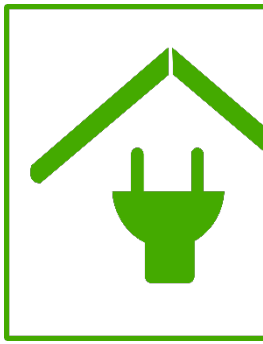
www.smartgrids.no

CINELI

CINELDI Work packages

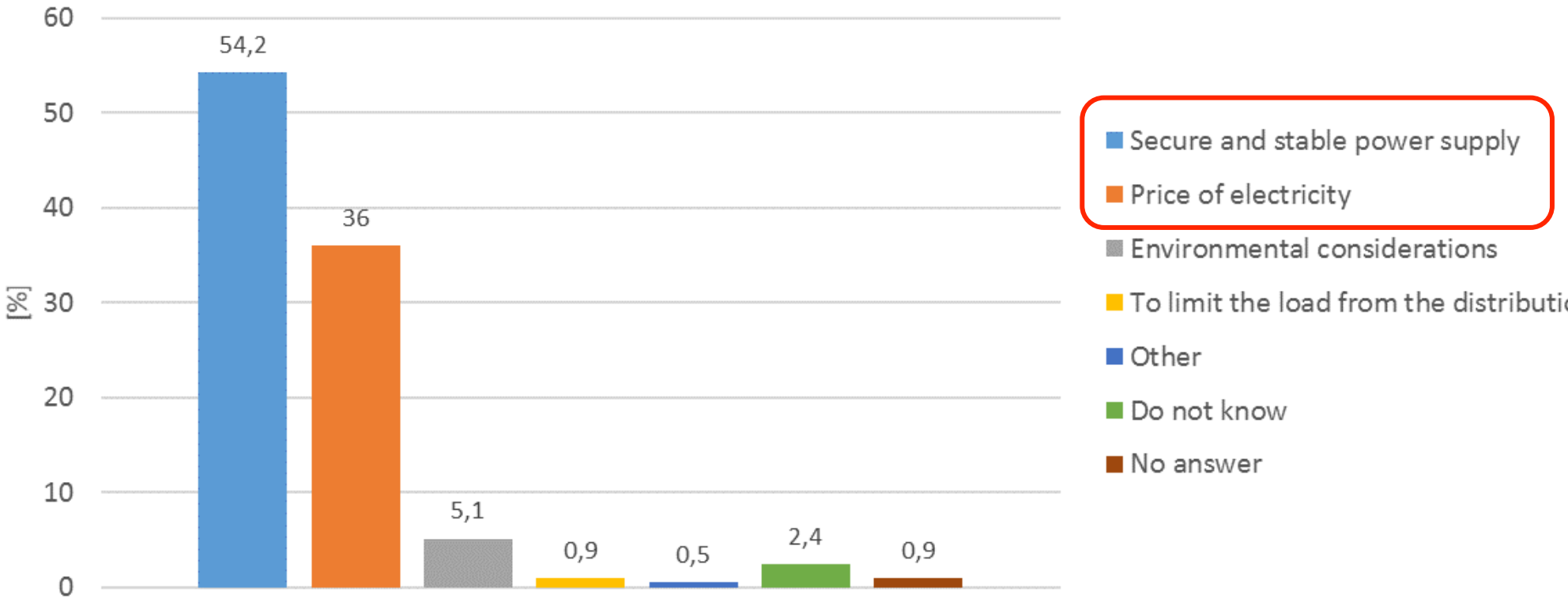


Modelling Flexible Resources in Smart Distribution Grid - ModFlex

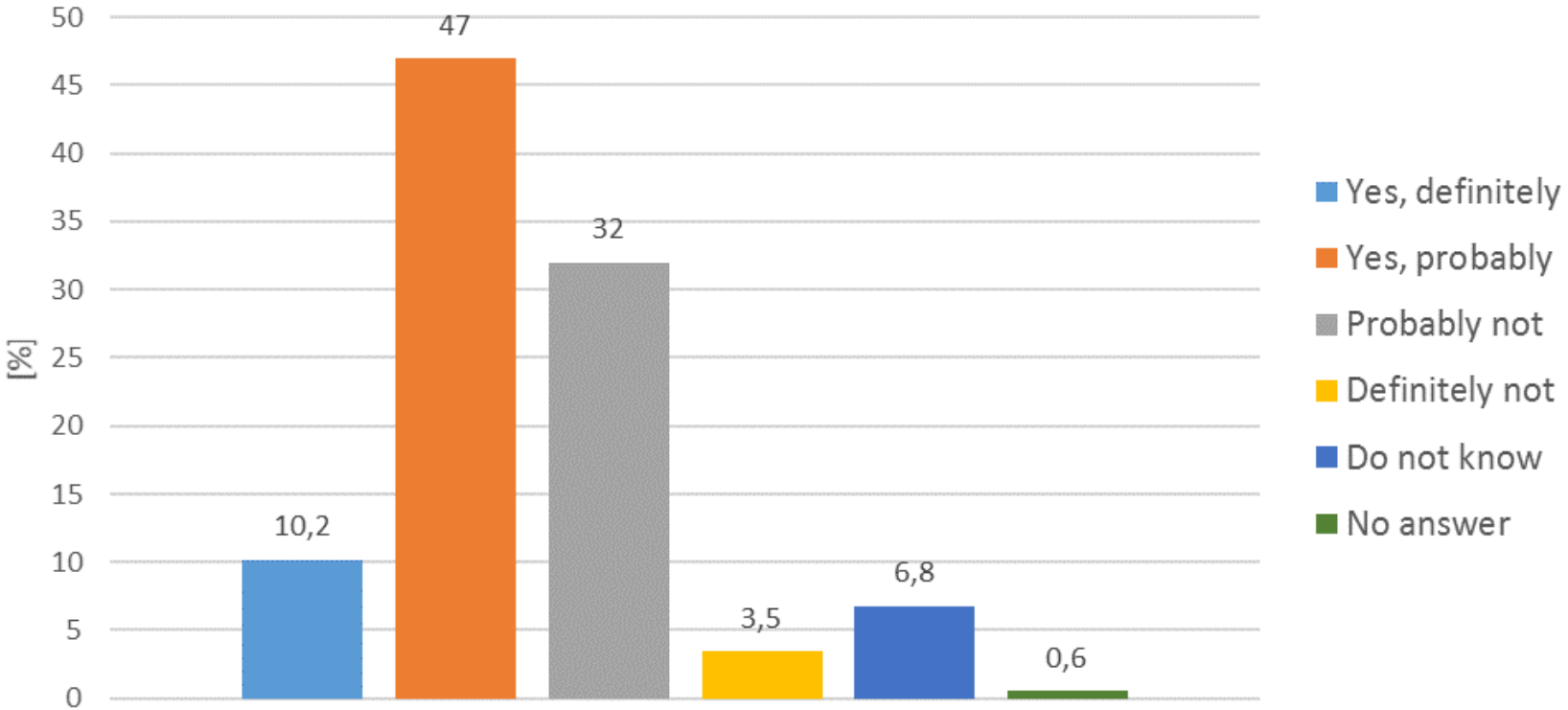


- Research project (included within CINELDI)
  - Focus on flexible resources in the distribution grid
  - Project period: 2016-2020
  - Funded by the Norwegian Research council and several Norwegian DSOs
- Survey (Spring 2017)
  - Performed among a representative sample of Norwegian households
  - Mapping potential for demand response
  - Respondents: 1007

What, if something, means most related to your use of electricity?

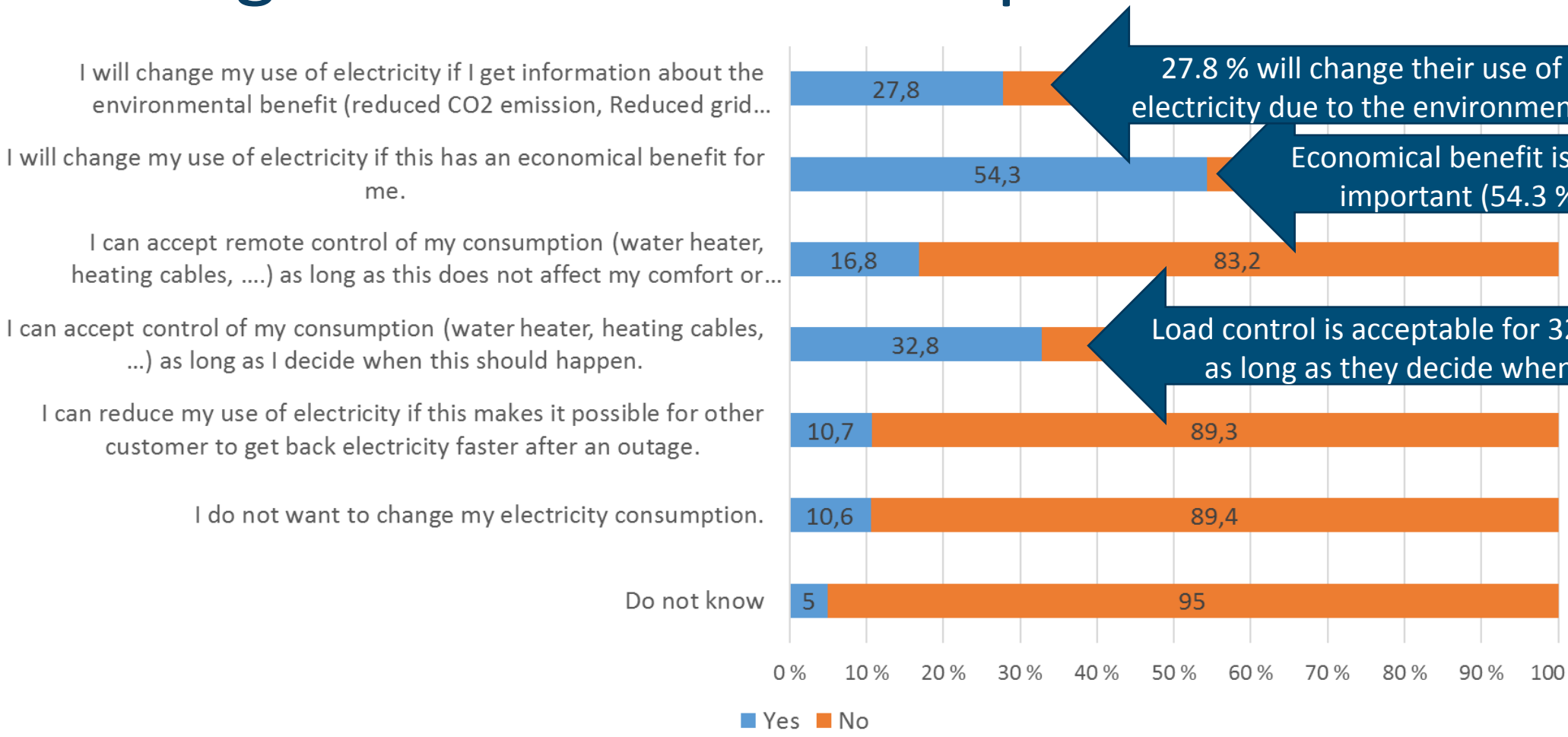


Start-up: In general, can you consider changing how you use electricity?



57.2 % are positive, 35.5 % are negative

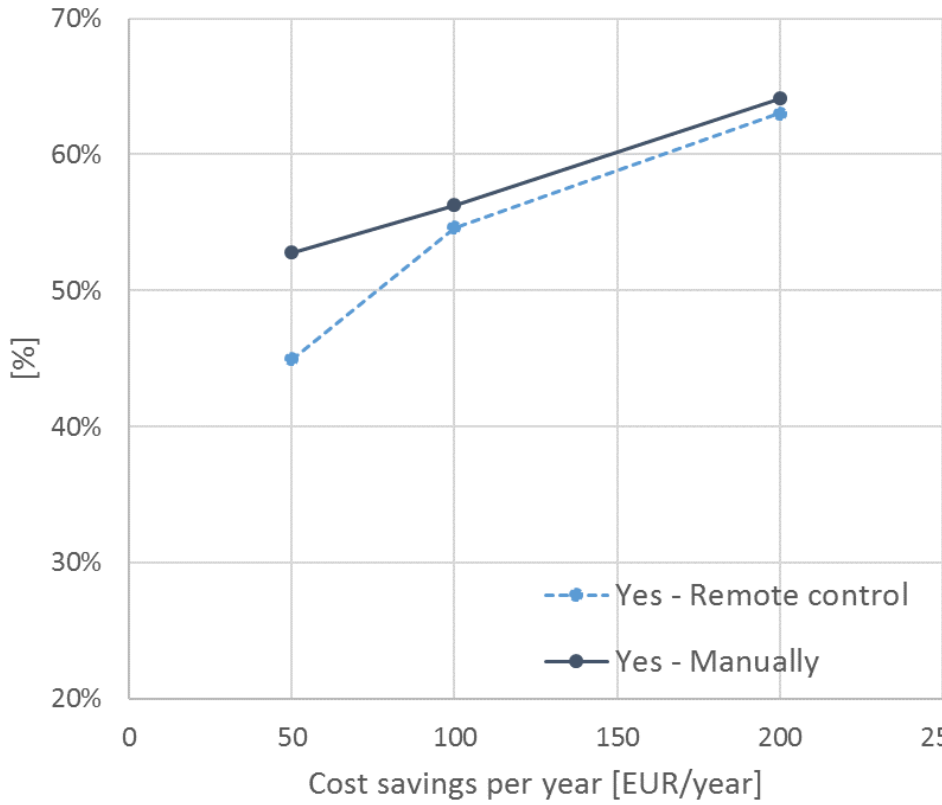
Willingness for demand response



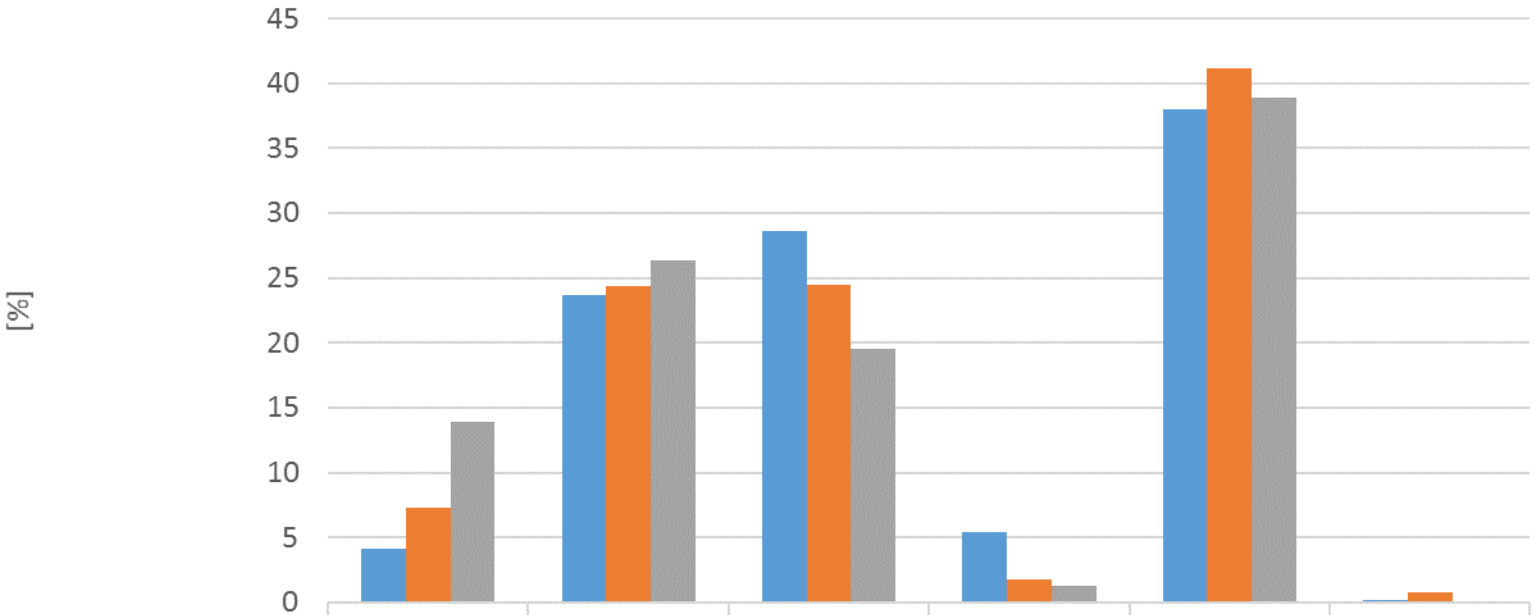
Few accept remote load control (16.8 %) and only 10.7 % want to share with others.

Electricity and economy - Expected cost savings to accept demand response

- Alternatives
  - Remote control of load (water heater, no cold water) in peak load periods
  - Manually changes (own control) in use of electrical appliances
- Remarks
  - More positive to manual control than remote control
  - Increasing positivity with increasing cost savings
    - Manually: from 52.8 % to 64.1 %
    - Remote control: from 44.9 % to 63.0 %



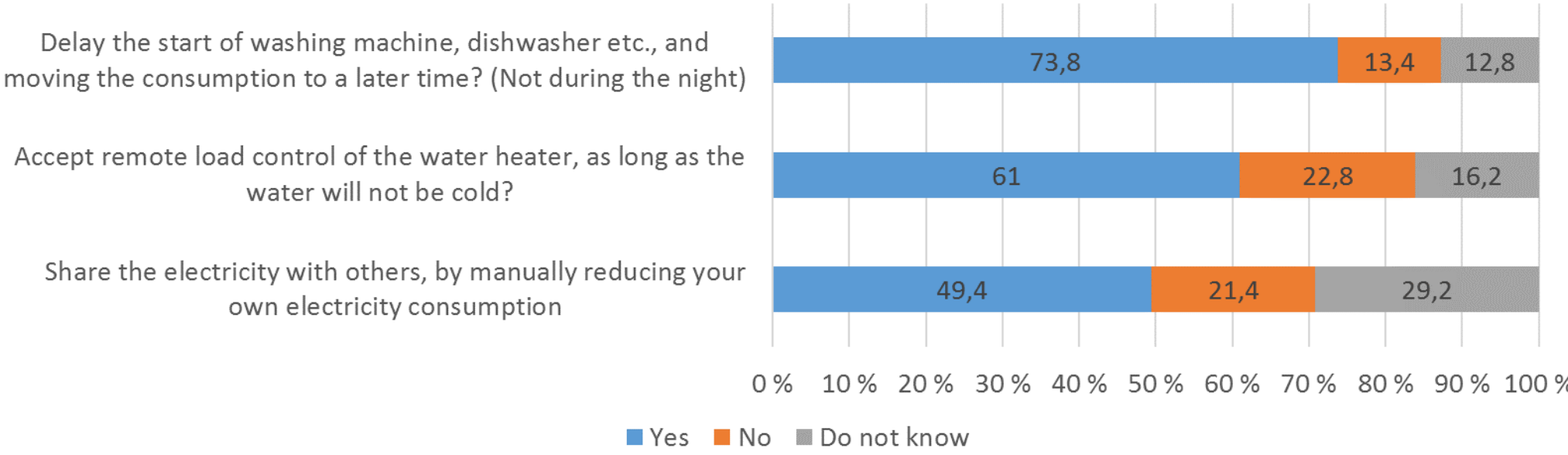
Use of different electrical appliances



	Morning	Afternoon	Evening	Night	Varying	Do not know
Dishwasher	4,1	23,7	28,6	5,4	38	0,2
Clothes dryer	7,3	24,4	24,5	1,8	41,2	0,8
Washing machine	13,9	26,3	19,5	1,3	38,9	0,1

Approx. 20-28 % in use in Afternoon and Evening

Demand response on cold winter days (peak load periods for the grid)

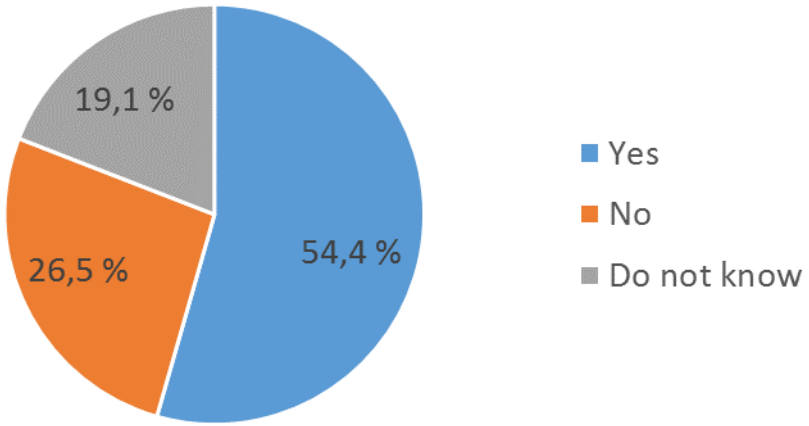


The share of positive response is largest (73.8 %) related to manual change (own control), reduced (61.0 %) related to remote control and less (49.4 %) related to sharing electricity with others

From the start of the survey: 57.2 % could consider changing how they used electricity. Increased positivity during the survey – due to more information about the case?

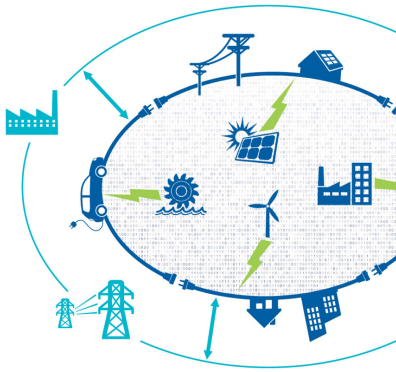
Demand response on holidays

- Question:
  - Will you accept remote control of your water heater or heating cables on holidays(24th December, Christmas Eve) for a shorter period, as long as this will not affect your comfort (i.e. you can still cook and wash, without freezing)?



The positivity related to remote control is reduced from 61.0 % in peak days (previous slide) to 54.4% i holidays/Christmas Eve.

One comment received from the survey:
The Christmas Eve is a bad example for remote load control, since all people are at home this day and us electricity. Remote load control should be performed on holidays when people are not at home.



Summary

- FME CINELDI (2016-2024)
  - is a centre for environmental friendly energy research that will ensure that we are building the smart energy system of the future.
  - will enable a cost-efficient realisation of the future flexible and robust electricity distribution grid.

- Survey among a representative sample of households shows that
  - there is a potential for demand response in Norway
  - households are more positive to manual change (own control), reduced positive to remote control and less positive related to sharing electricity with others.
  - the positivity for changing use of electricity increased during the survey, indicating that more information and clear description of solutions are needed before demand response can be realized in large scale.

SINTEF

Teknologi for et bedre samfunn

This presentation has been funded by
CINELDI - Centre for intelligent electricity distribution, an 8 year Research Centre under the FME-scheme (Centre for Environment-friendly Energy Research, 257626/E20) and ModFlex – Modelling Flexible Resources in Smart Distribution Grid (255209/E20).
The author gratefully acknowledge the financial support from the Research Council of Norway and user partners of CINELDI and ModFlex.