The Research Council of Norway

Hydropower as a renewable system enabler - Public funding of hydropower R&D in Norway

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RESEARCH FOR INNOVATION AND SUSTAINABILITY

- Hydropower as a national R&D-priority
- Current natioanl R&D funding
- Can we see any effects of the long term R&D-efforts on hydro power?

National strategy for research, development, demonstration and commercialisation of new, climate-friendly energy technology

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Key trends of future energy systems

- Continued rapid development of many different energy technologies in parallel.
- Energy systems becoming digitalised, integrated and more complex.
- Customers become active participants and more involved in systems operation.

An integrated systems perspective will be crucial for cost-effective development of the energy systems and safeguarding security of supply.

The big question:

How should the Energi21 strategy address these challenges?

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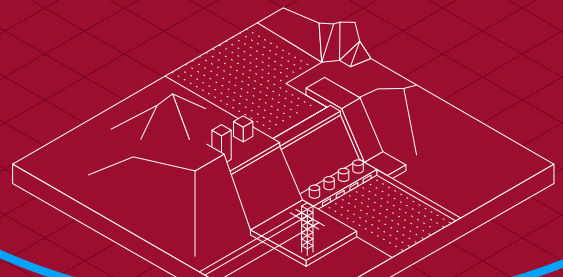
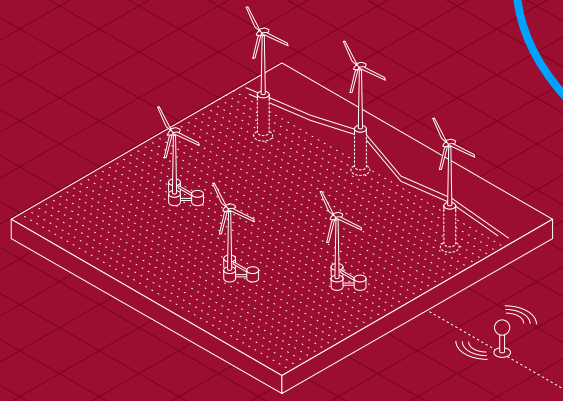
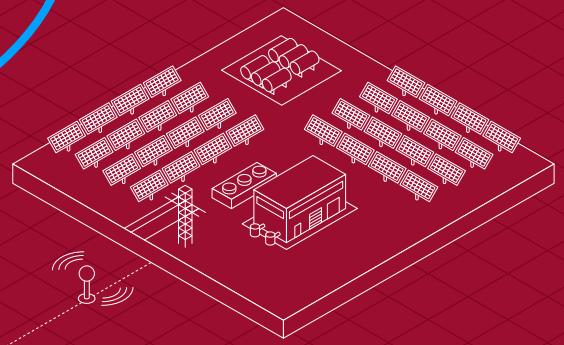
Hydropower as the backbone of the Norwegian energy supply



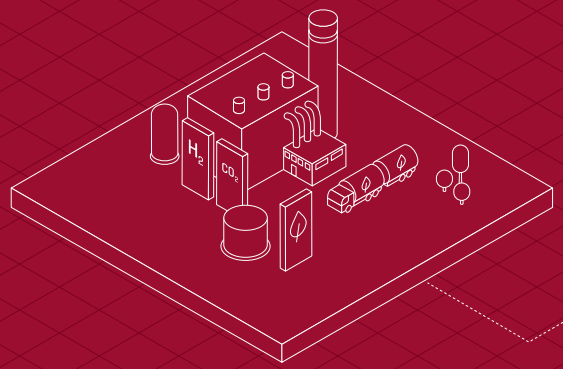
Offshore wind power for an international market



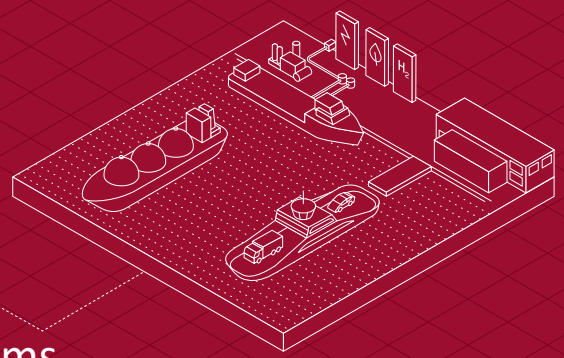
Solar power for an international market



Climate-friendly and energy-efficient industry, including Carbon Capture and Storage (CCS)



Climate-friendly energy technologies for maritime transport



Digitalised and integrated energy systems

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Hydropower as the backbone of the Norwegian energy supply

- Hydropower will play a major role in the transition to a low-emission society.
- Hydropower provides significant value creation in society.
- Norwegian industrial actors and research groups possess some of the world's leading hydropower expertise, - an excellent basis for the export of Norwegian solutions and services.

The Research Council´s national funding instruments for Energy R&D (2020)

ENERGIX

43 mill. USD

- Renewable energy
- Energy grids/infrastructure,
- Energy use
  - Transport (land and sea)
  - Industry
  - Buildings

CLIMIT

8 mill. USD

Carbon Capture & Storage

Centres for Environment-friendly Energy Research- FME

18.5 mill. USD

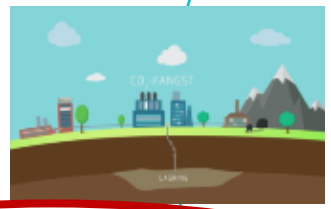
Centres for Environment-friendly Energy Research- FME

Centre for intelligent electricity distribution – CINELDI

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

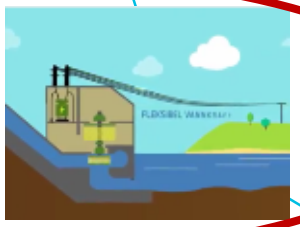
Mobility Zero Emission Energy Systems - MoZEES

Norwegian CCS Research Centre - NCCS



Research Centre for Sustainable Solar Cell Technology

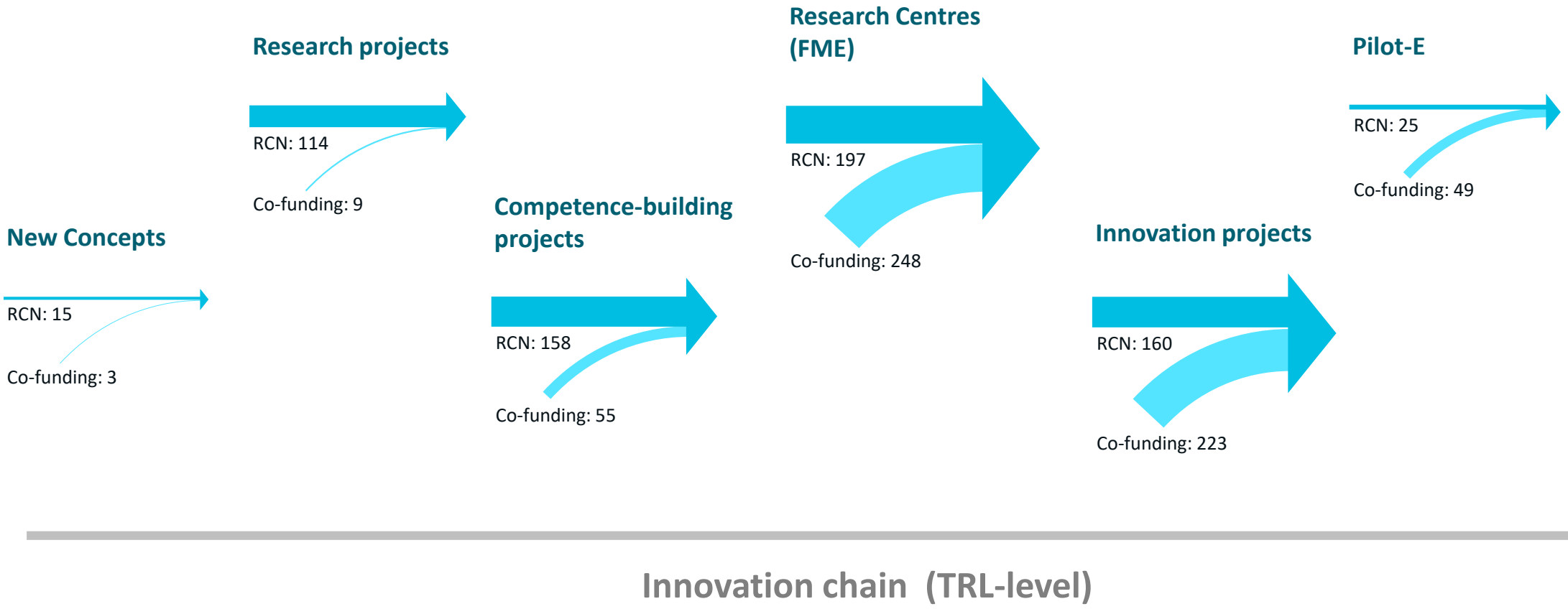
Norwegian Research Centre for Hydropower Technology - HydroCen



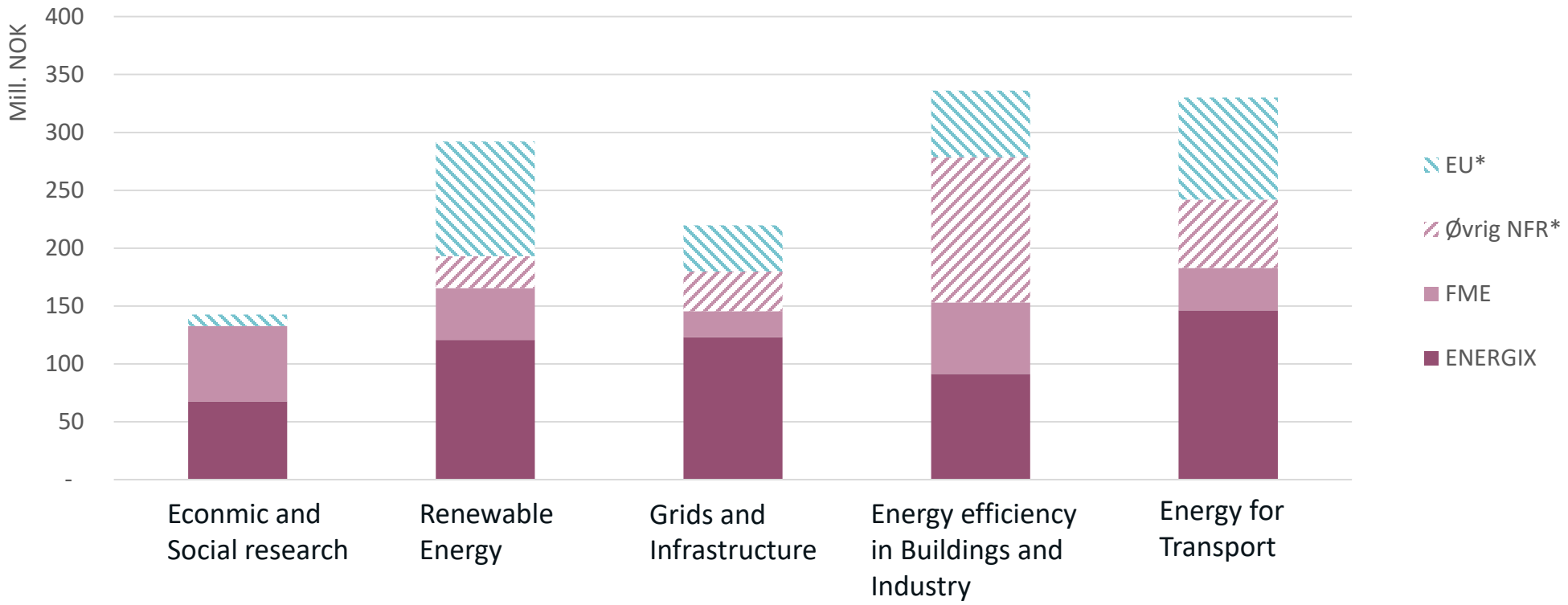
Norwegian Centre for Sustainable Bio-based Fuels and Energy - Bio4Fuel

The Research Centre on Zero Energy Neighbourhoods in Smart Cities – ZEN Centre

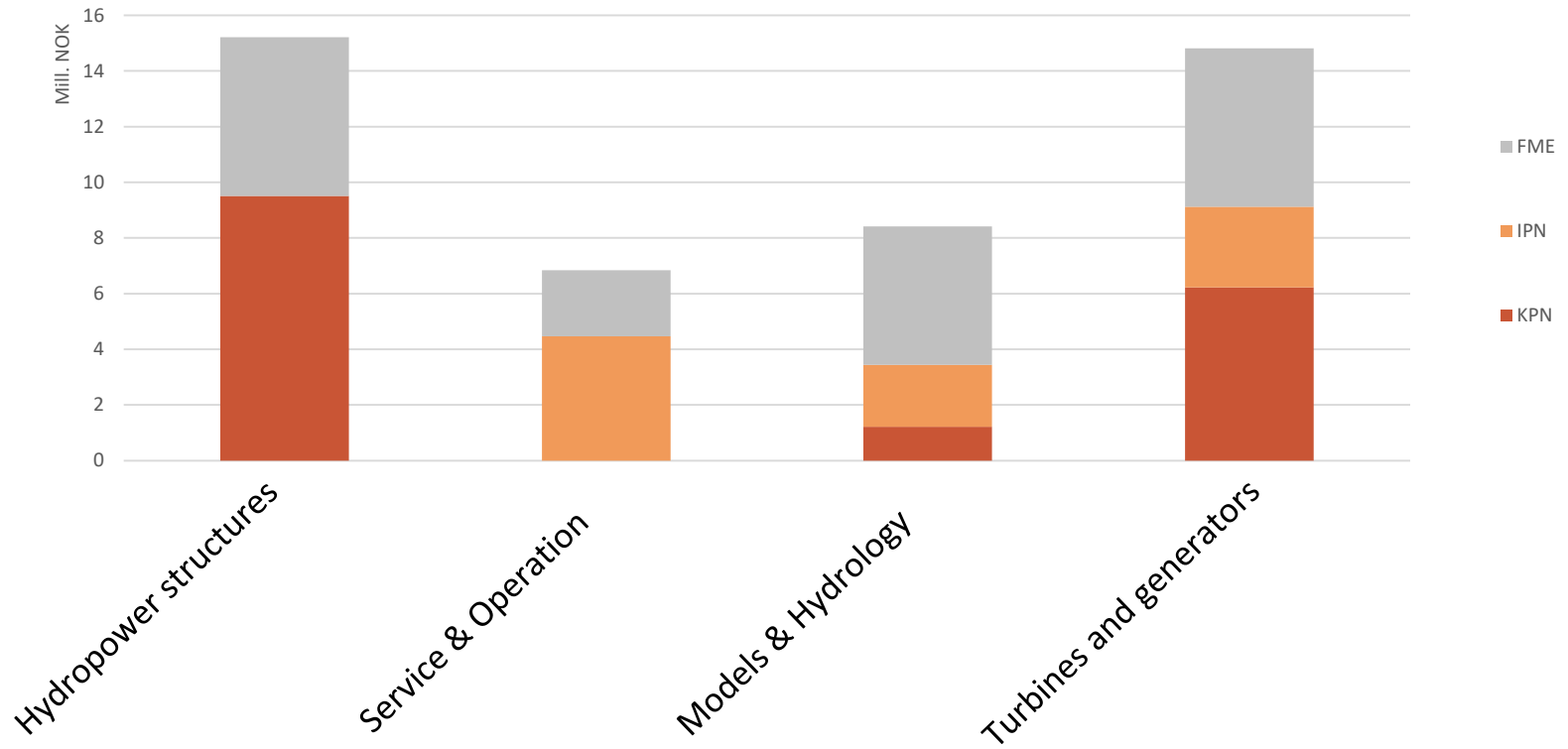
Energy R&D – national intruments covering the innovation chain (mill. NOK)



Total Portfolio on Energy R&D 2019



The portfolio of hydropower projects – 4,5 mill. USD/year (2020)



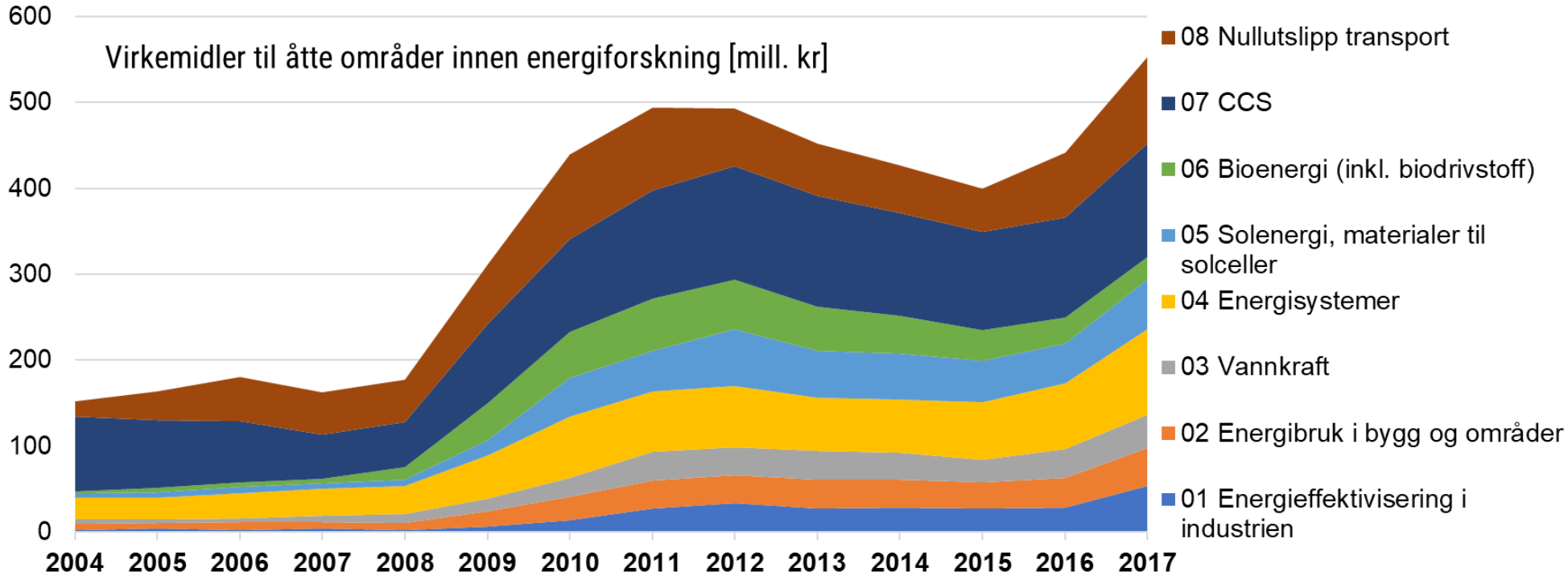
Effects of Energy Research – is energy R&D profitable?

Core questions of the evaluation:

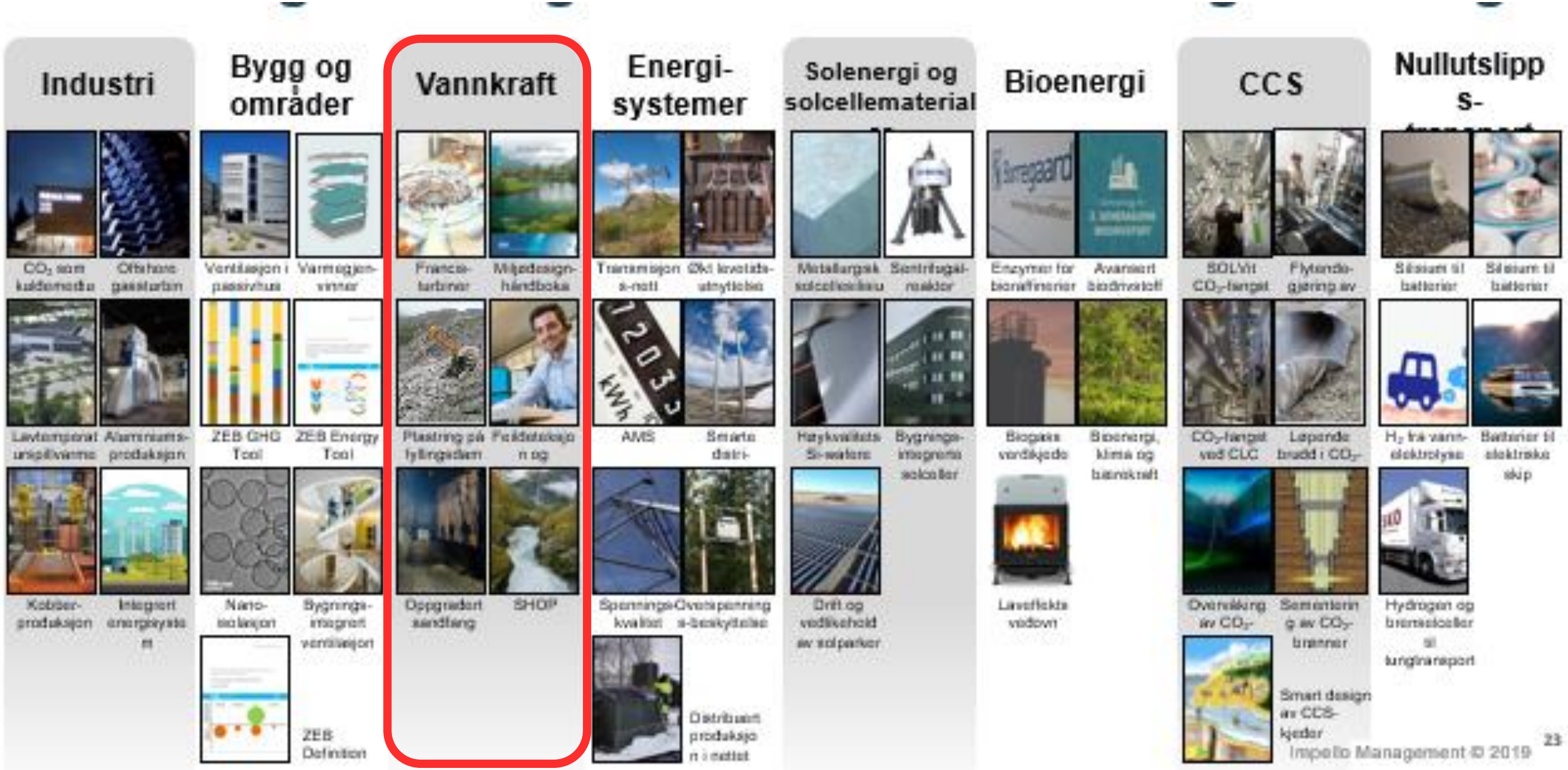
Does energy research pay off? - can effects be documented?

Investments:

- 400 mill. USD from the Research Council – Renergi, Energix, Climit and FME
- 400 mill. USD cofunding from industry, public sector and R&D institutions



48 cases selected in cooperation with the R&D-communities (from portfolio of 670 projects)



What is the effects of the 48 cases?

1.6 bill. USD in documented realized economic effects in Norway (2008-2017)

- Increased revenues, reduced costs
- Reduced and postponed investments in infrastructure
- Realized investments in new industrial operations
- Additionally 10 bill. USD identified future economic potential (Norway/Europe)

Yes, energy research has paid off

- 400 mill. USD granted by the Norwegian Research Council to approx. 670 projects (2008-2017).
- Realized economic effect of **4** times the appropriations.

Most of impact comes from a small number of successful cases

Models for short term planning of hydropower production

- **680 mill. USD in increased realized value of Norwegian hydro power**

CO_2 as refrigrerant in cooling systems of 18.000 supermarkeds

- **100 mill. USD value of reduced energy cost**
- Reduced energy need
- Reduced emissions of climate gases

Optimal development and operation of transmition grids

- **300 mill. USD reduced investments**

Extended life time of power transfomers

- **250 mill. USD in postponed investments**

Material for solar cell wafers and operation of solar park

- **Turnover >300 mill. USD**
- 100 % export
- REC, Norsun, Scatec

Production planning – decades of R&D

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