THULE INSTITUTE

Smart Grids in the North

Distributed energy systems and the future of energy services

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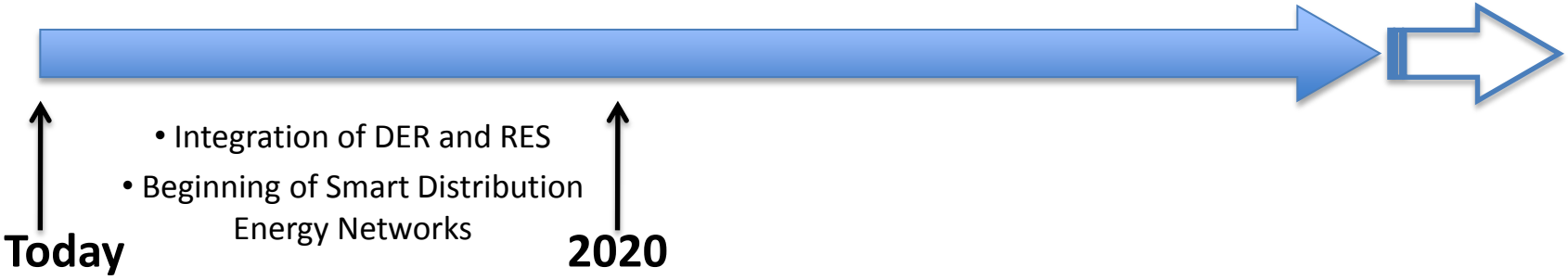
Why are we here in the first place?

Future of Smart Grids in Northern Finland

Smart Grids at the University of Oulu

- Introduce what we do
- Introduce what we want/are going to do
- Discuss and compare interests, experience, needs and ideas
- Possible collaborations

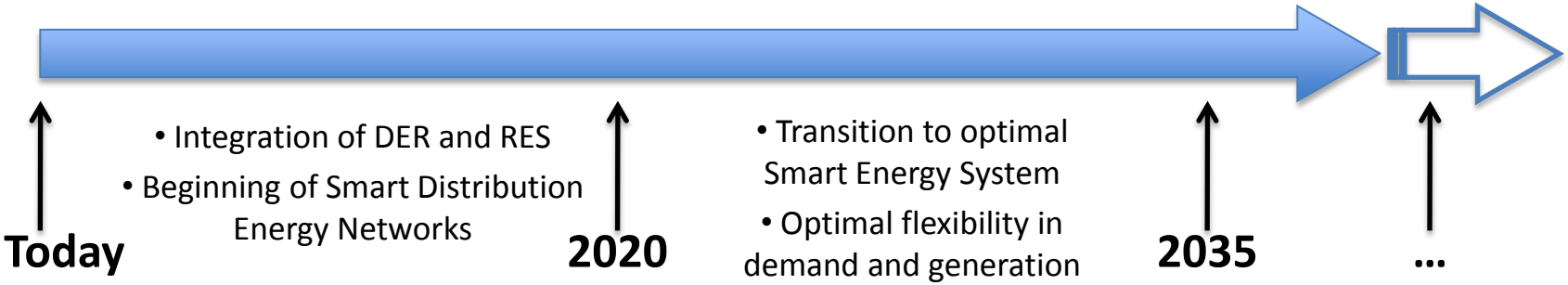
The European prospective



EU 2020 climate and <u>energy</u> strategy

- 20% reduction in GHGs emissions (from 1990 levels)
- 20% energy production from renewable resources
- 20% improvement in energy efficiency

The European prospective

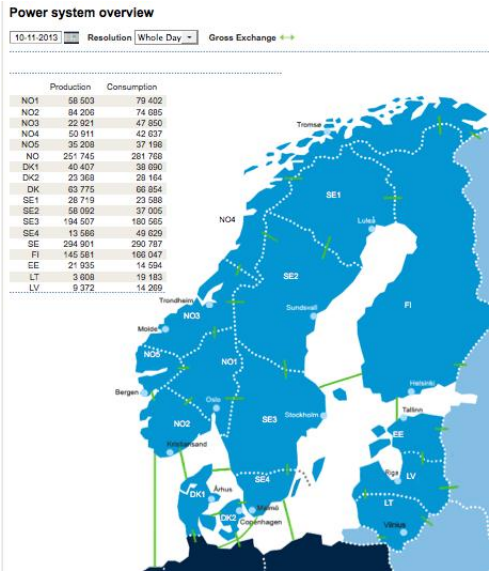


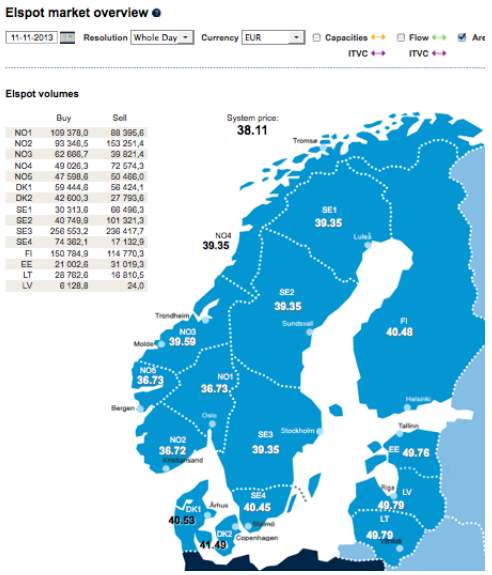
Beyond 2020…

- 80% reduction in GHGs emissions by 2050
- Increased energy production from renewable resources
- Significant challenges to maintain high quality level of power supply and security

The Northern dimension

- Richness in natural resources which gives grounds to their exploitation
- High standards of services
- High-tech and high quality of education
- Industrial strength in “heavy high-tech”: Metallurgy, Forestry, Mining and Chemical ind.
- Members of the largest electricity market in the world

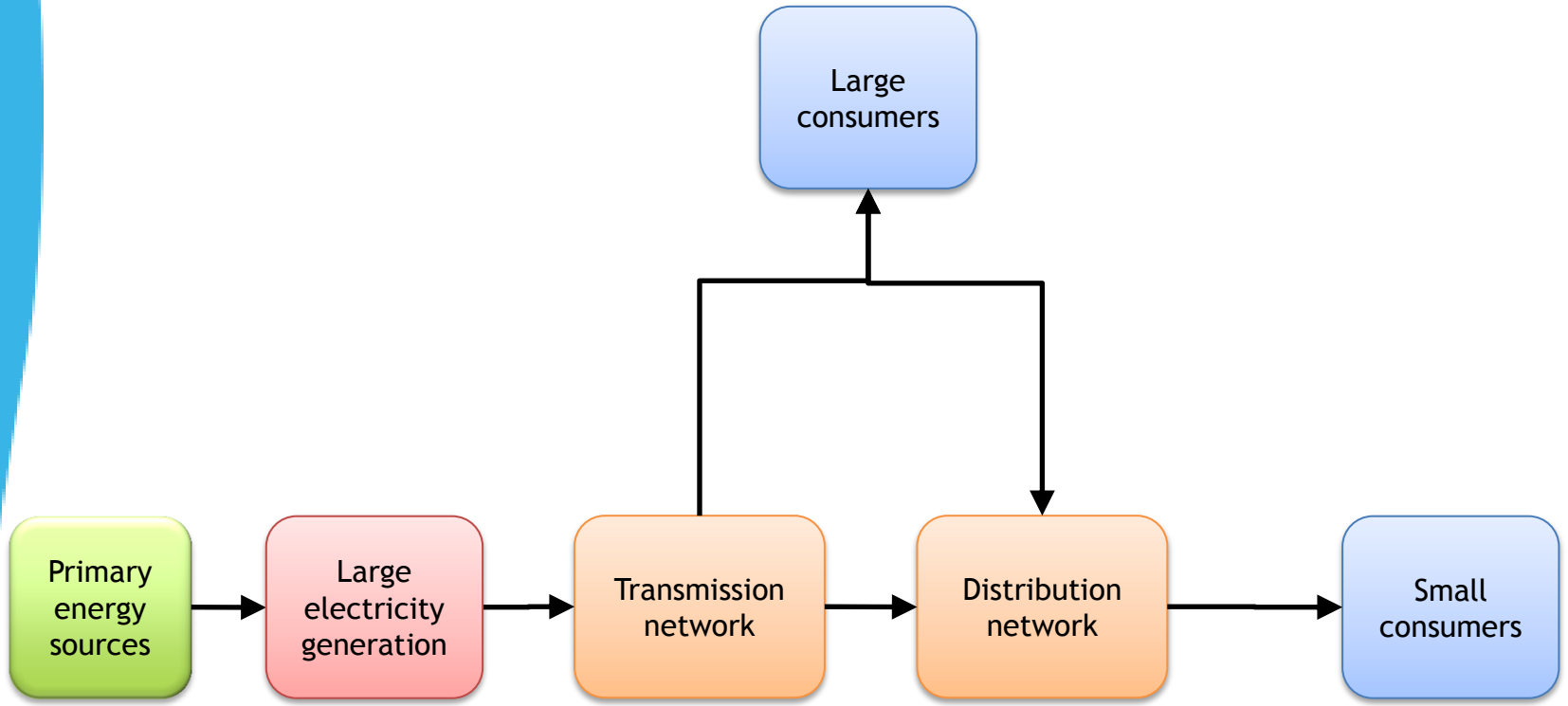




About Finland and the Arctic

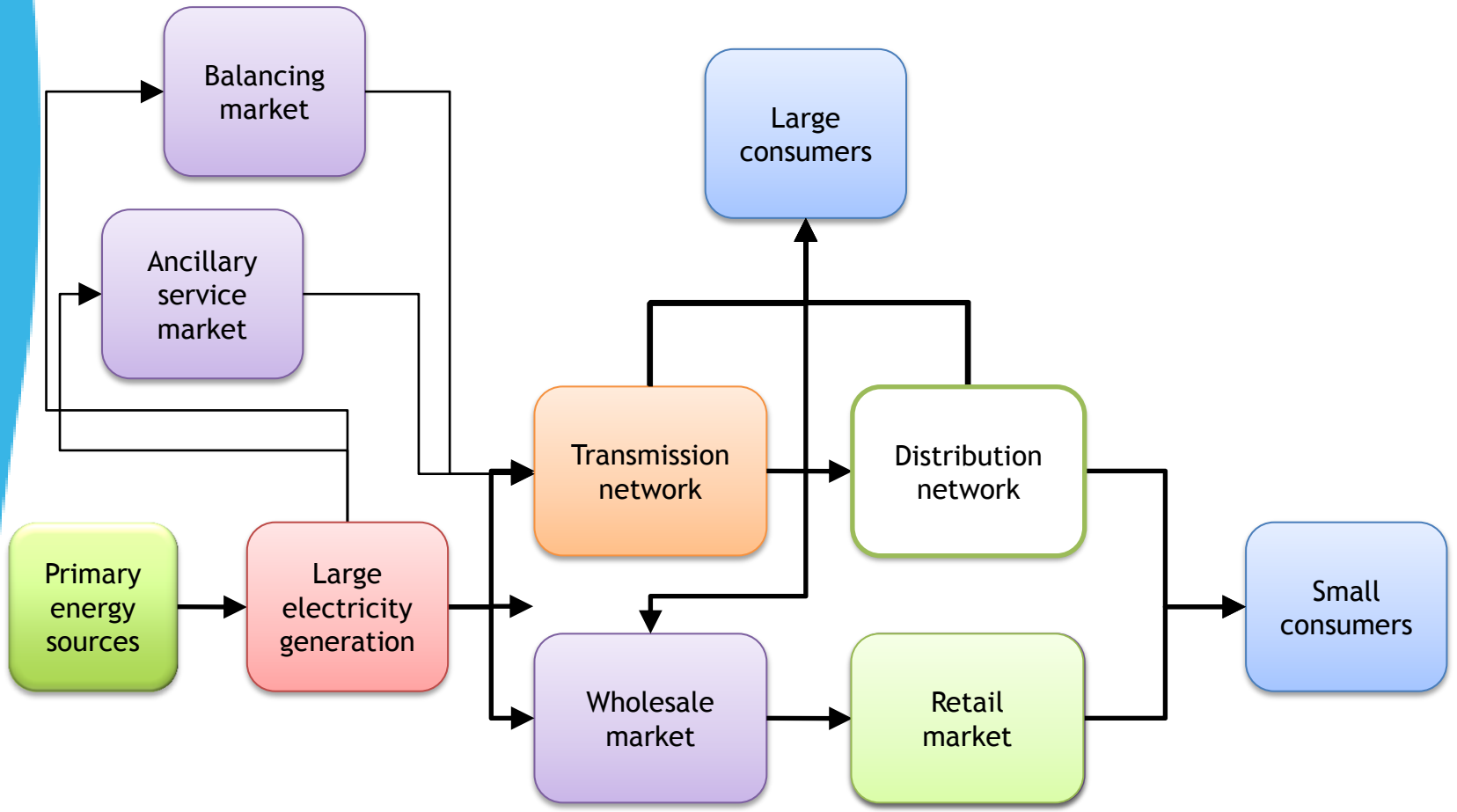
- Leading actor for a sustainable development of the Arctic region
- Active role in developing business opportunities by reconciling environmental limitations with business opportunities
- Developing ad promoting Finnish expertise in a number of key areas of the arctic development, including:
  - **Energy industry** (structural and material engineering for the energy industry infrastructure). -> Opportunities for the **development of decentralised energy systems**
  - **Renewable natural resources**
  - **Clean technology (environmental technology for high efficiency and low emissions)**
  - **Traffic and transport systems**
  - **Data communication and digital services**

The evolution of the system – stage 1

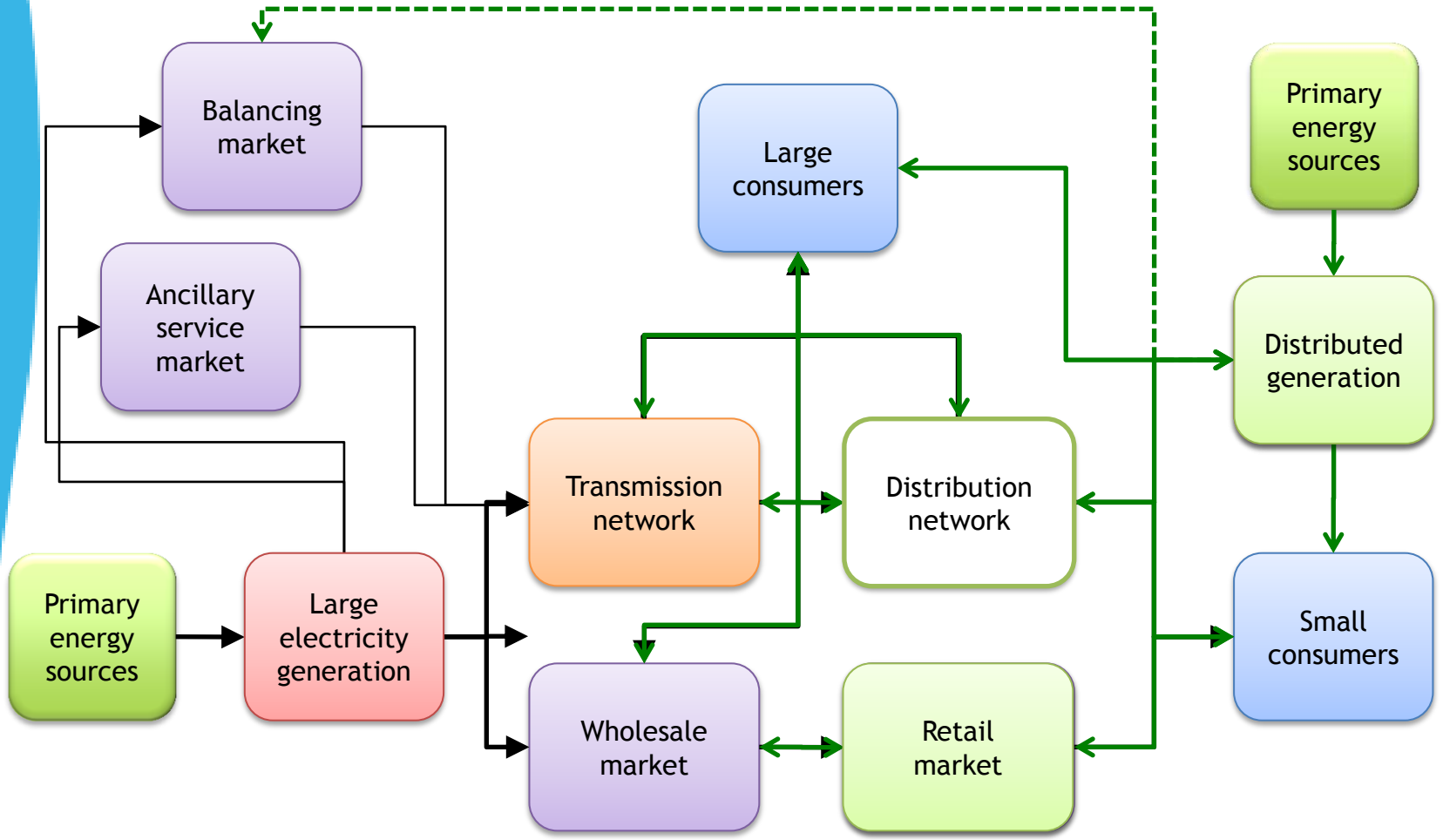


Scheme based on:
Donkelaar M. and Scheepers M.J.J.,"A socio-economic analysis of the technical solutions and practices for the integration of distributed generation", (2004) DISPOWER report ECN-C-04-011

The evolution of the system – stage 2



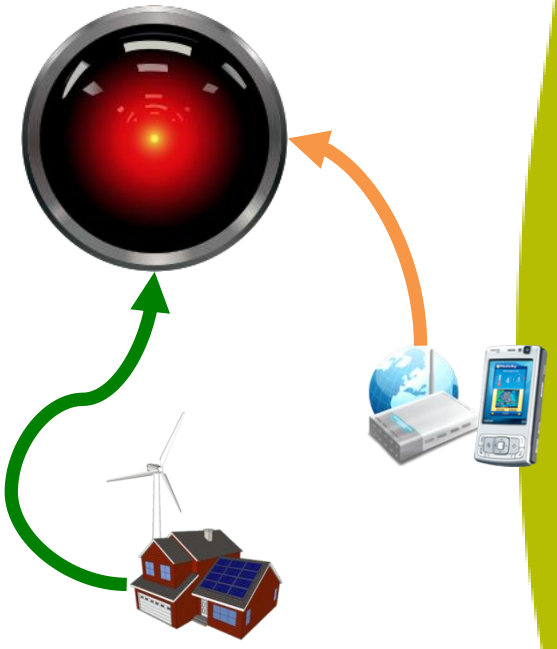
The evolution of the system – stage 3



Smart Grids

Energy production, transmission and distribution network based on a two-ways communication system between suppliers and consumers.

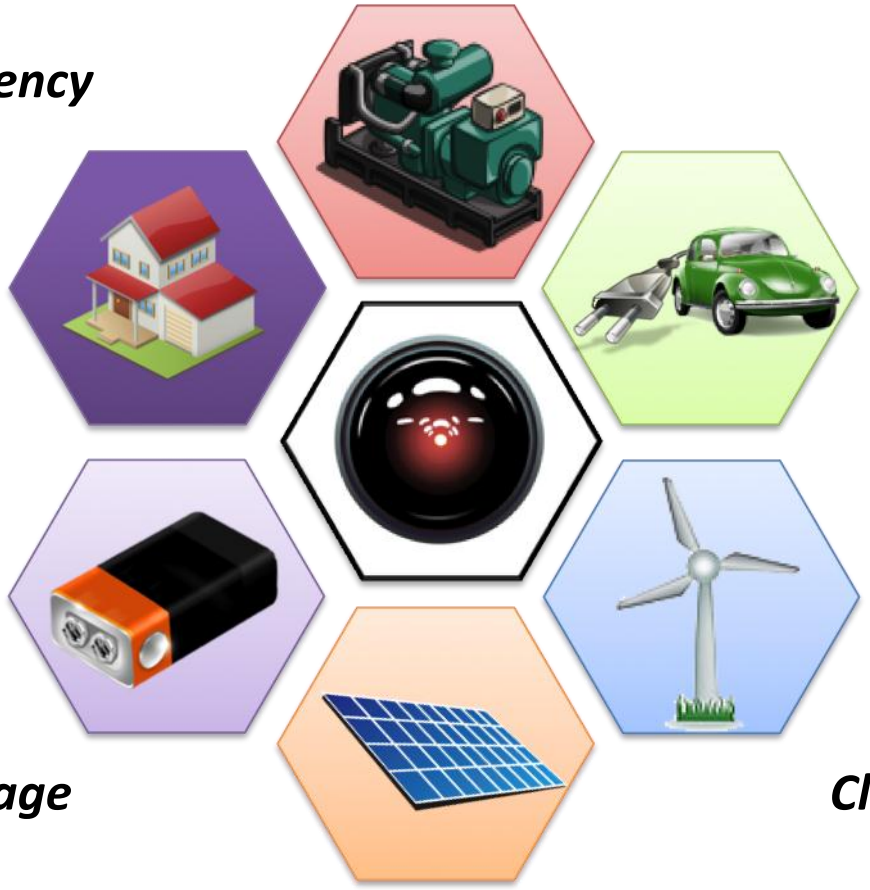
- Real time monitoring of the network condition
- Control
  - strong seasonal variation
  - single user choices
  - weather and climate conditions
  - …
- Information flow
  - Data acquisition, management and processing
  - Privacy, system intrusiveness
  - Security
- Redistribution of peak loads



Toward a cleaner energy mix

Energy efficiency

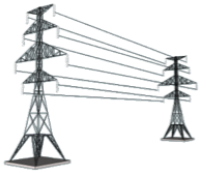
Alternative mobility solutions



Energy storage

Cleaner energy production

Smart Grids vs. Smart Energy Networks

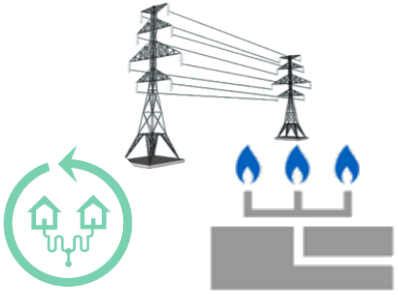


Smart Grids

- A group of technologies aiming at using electricity more intelligently

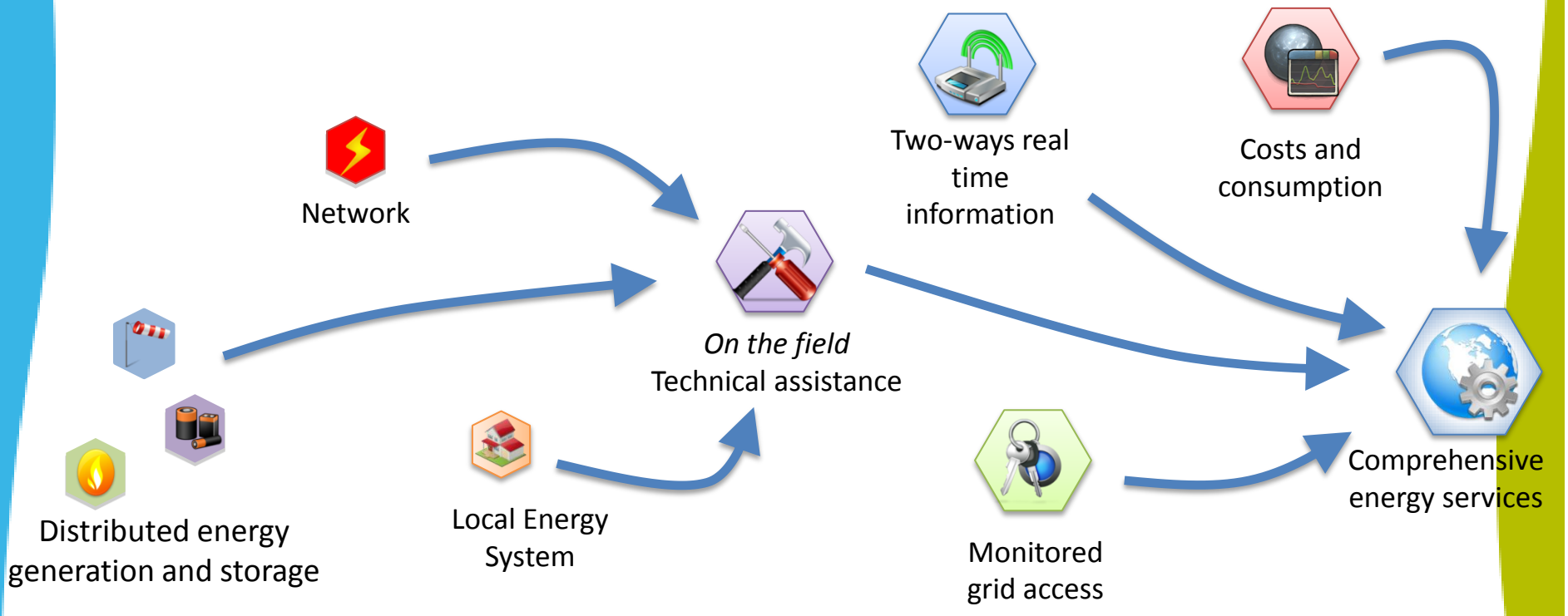
Smart Energy Networks

- Integration of multiple networks and energy vectors
  - Electricity
  - District Heating
  - Natural gas
  - …



- It links different energy production, distribution and storage systems

Energy services



Energy services

Technical

Customized

Energy services as the main driver for the energy market: a possible solution for gradually moving from a quantity based growth to a quality based one.

- Improve the users' possibility to move toward a sustainable energy (SE) generation and use
  - Improve awareness and commitment
  - Facilitate access to and application of commercially available SE technology
- Moving from the integration of RES into the energy system to a SES
  - An overall sustainable use of available resources
- A possibility to satisfy growing demand and stabilize consumption

An instrument that would work as a driver towards solutions that are socially acceptable, economically sound and environmentally sustainable.