Smart Energy Systems ERA-Net | Spotlight

WG SaCECS 2021

ANM4L, CLUE, DISTRHEAT, EPC4SES, EVA, FLEXI-SYNC, HEATflex, IFAISTOS, PIGergy, SONDER, TOP-UP, ZEHTC

View all Spotlights on expera

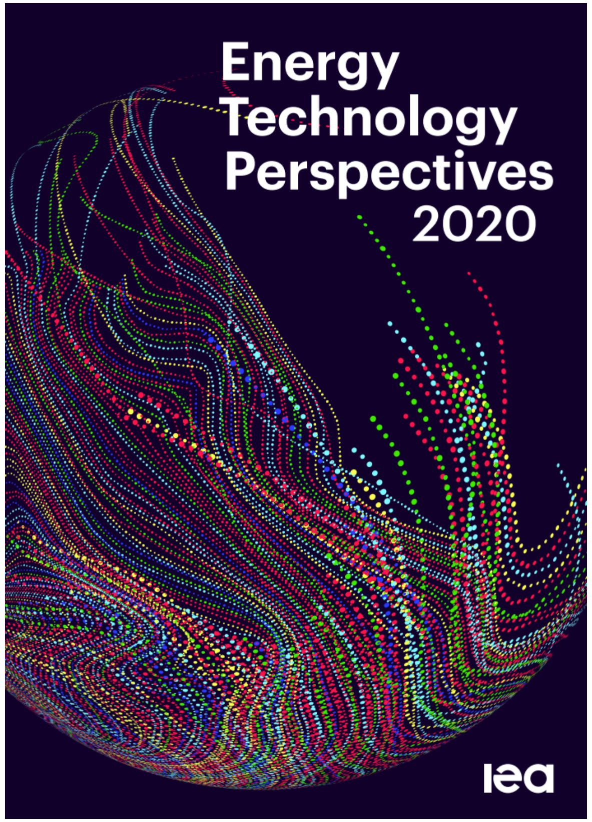
ERA-Net SES has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements no. 646039, 775970 and 883973.

ERA-Net SES Projects´ Perspectives on

- Power system flexibility
- Demand response
- Low temperature district heating
- Contribution of bioenergy to reducing CO_2 emissions
- Hydrogen in the power sector

ERA-Net SES Spotlights showcase intermediate results of the Joint Programming Platform´s RDD projects and the Knowledge Community to researchers and experts. Each Working Group selects reference documents of high relevance to put their results into context. All Knowledge Community experts are invited to comment the current edition's Living Document on expera.

Building on "Energy Technology Perspectives 2020" by IEA



Distributed storages and demand response are essential to provide flexibility to the power system (I)

"The integration of much higher shares of variable renewables into electricity systems requires far greater use of flexibility mechanisms, such as energy storage, to ensure electricity security. Greater electrification of end uses facilitates this integration by increasing the potential of demand response." *(Energy Technology Perspectives, page 81)*

WG SaCECS

ANM4L

ANM4L is looking at any kind of equipment available in our systems that can support the flexibility we need. We're studying:

- both active and reactive power
- e.g. optimal voltage regulation to increase the capacity in the grid
- different type of demand and sector integration possibilities available in the grid

Further resources

www.anm4l.eu

EVA

EVA aims at exploring innovative territorial infrastructures capable of effectively supporting the emerging technologies in road mobility. We are learning

- to predict and control energy storage demands and the relevant energy distribution through smart grids
- so that all electric vehicles of the future could be supplied power uninterruptedly

Further resources

www.evaproject.eu

CLUE

CLUE targets the integration of RES and flexibilities into energy communities and their usage optimization. We've found that

- energy communities could enhance the integration of energy storage systems
- potential of demand response depends on the implementation (e.g. if it is voluntary or obligatory)

Further resources

www.project-clue.eu

EPC4SES

EPC4SES Digital Building Twins

EPC4SES investigates digital twins for smart energy systems based on data from the energy performance certification of buildings. We have a vision about

- a model based predictive control
- that may be spanning different energy systems (district heating, power to heat, gas...)
- and include storage as district heating buffer tanks

Further resources

www.smartenergy.nu

Distributed storages and demand response are essential to provide flexibility to the power system (II)

“The integration of much higher shares of variable renewables into electricity systems requires far greater use of flexibility mechanisms, such as energy storage, to ensure electricity security. Greater electrification of end uses facilitates this integration by increasing the potential of demand response.” *(Energy Technology Perspectives, page 81)*

WG SaCECS

IFAISTOS

The main objective of IFAISTOS is to make the power-to-gas technology a viable solution for long-term storage. We create flexibility through:

- electrofuel production (e.g. methanization)
- integration of production with other processes (in particular biomass combustion)
- and smart management techniques (model predicted control techniques)

Further resources

www.mdh.se/ifaistos

SONDER

In project SONDER we explore the potential of collaborative energy management by coordinated demand response in energy communities.

We focus on:

- EV charging
- data center operation
- residential & industrial demand response
- integration and operation of community energy storage

Further resources

www.project-sonder.eu

TOP-UP

TOP-UP studies how TOP-down initiated heat networks can play a central role in integrated regional energy systems, and empower bottom-UP participation among local actors and sectors. In our view:

- distributed storage units and demand response schemes
- would help to solve the problem of energy unbalance
- accentuated by the stochastic nature of some renewable sources

Further resources

www.top-up.info

Joint Conclusions

Smart management techniques are needed to make full use of decentralized storages and demand response.

We need:

- improved energy efficiency through integrated networks
- bidirectional communication between energy production and energy grids
- bidirectional communication with people in energy communities

Demand side response has a large part to play in meeting rising flexibility needs, in particular by peak shaving (I)

"Demand-side response, which has a large part to play in meeting rising flexibility needs, in particular by shaving peak demand and redistributing electricity to time periods when the load is lower and electricity is cheaper." *(Energy Technology Perspectives, page 134)*

WG SaCECS

ANM4L

Demand can provide a significant part of required flexibility. Our project intends to utilize demand as one of several type of flexibility resources. We point out that:

- shifting demand to follow electricity generation decreases the need for electricity transfer
- it is difficult to highlight the value of being a provider of flexibility
- risk of dependency of key users should be avoided

Further resources

www.anm4l.eu

EVA

In project EVA we support the statement that demand-side response has a major role to play in meeting rising flexibility needs. We are working on:

- how charging stations of electrical vehicles require shaving peak demand and redistributing electricity
- how to predict such energy peaks through mobility data (WP 4 of EVA project)

Further resources

www.evaproject.eu

FLEXI-SYNC

By making use of building heat pumps, alternative heat supplies (district heating and heat pumps) and the thermal inertia of buildings, there are opportunities to lower the peak heat demand. It results in:

- less use of fossil peak boilers
- more efficient participation in the electricity markets
- a need of new business models and pricing to make use of the demand side flexibility

Further resources

www.flexisync.eu

DISTRHEAT & IFAISTOS

We agree that when dealing with stiff electricity production technologies, the elasticity should be on the demand side. We aim to enable flexibility through

- smart management of district heating networks
- electrofuel production processes

Further resources

www.distrheat.eu

www.mdh.se/ifaistos

Demand side response has a large part to play in meeting rising flexibility needs, in particular by peak shaving (II)

"Demand-side response, which has a large part to play in meeting rising flexibility needs, in particular by shaving peak demand and redistributing electricity to time periods when the load is lower and electricity is cheaper." *(Energy Technology Perspectives, page 134)*

WG SaCECS

TOP-UP

Knowing prosumers' personal motives allows us to better understand their willingness to share among them the costs associated with the generation, distribution and consumption of energy.

Further resources: www.evaproject.eu

SONDER

We will combine the centralized control of the battery energy storage system with various demand response (DR) programs on the customer side controlling heat pumps, EVs and PVs.

Further resources: www.project-sonder.eu

Joint Conclusions

Smart Energy Systems ERA-Net

We need both technology and end users to fully utilize demand response.

- Demand response is needed in both electricity, heat and mobility.
- The true value of demand response for consumers might not be the same as it is for industrial customers.
- End users need response for their actions to stay motivated.

Lower temperatures in the district heating network would allow connecting more low-carbon energy sources in the supply mix (I)

"District heating networks would have to convert from the traditional high temperature operation mode to more efficient low-temperature operations and integrate low-carbon energy sources into the supply mix." *(Energy Technology Perspectives, page 383)*

WG SaCECS

DISTRHEAT

In project DISTRHEAT we develop smart control of district heating and cooling networks in order to enable flexibility, which

- allows us to increase the share of renewables in the energy mix
- makes it possible for the end-users to act as storage

Further resources
www.distrheat.eu

EVA

Although EVA project is not related to this statement we support district heating and storage in low temperatures operations, because

- it's the only viable long-term solution for efficient storage capacity
- it is needed to sustain a continuous heat supply

Further resources
www.evaproject.eu

FLEXI-SYNC

One of the project Flexi-Syncs demo sites in Berlin is developing concepts to use the excess heat from the subway and the sewage system. We want to point out that

- such concepts, making use of both high-temperature and low-temperature excess heat from industries, have also been tested in previous projects with success

Further resources
www.flexisync.eu

HEATflex

In HEATflex, we see district heating as a cornerstone in the transformation towards a low carbon society. The benefits are:

- with lower temperatures we can make much better use of waste heat
- the utilization of heat pumps becomes more efficient
- it helps to stabilize other energy systems such as electricity and gas

Further resources
www.heatflex.eu/

Lower temperatures in the district heating network would allow connecting more low-carbon energy sources in the supply mix (II)

"District heating networks would have to convert from the traditional high temperature operation mode to more efficient low-temperature operations and integrate low-carbon energy sources into the supply mix." *(Energy Technology Perspectives, page 383)*

WG SaCECS

TOP-UP

Project TOP-UP recently developed a model of a district heating system that can be used to analyze and control modern and future district heating installations with several distributed heat sources.

Further resources: www.evaproject.eu

ZEHTC

In project ZEHTC we show how low temperature heat from the operation of an electrolyzer can be connected to district heating to improve efficiency.

Further resources: www.top-up.info

Joint Conclusions

Several projects support converting district heating networks from the traditional high temperature operation mode to more efficient low-temperature operations.

- It would help to integrate low-carbon energy sources and storages into the supply mix.

The contribution of bioenergy to reducing CO2 emissions is particularly important where direct electrification is difficult

Smart Energy Systems ERA-Net

"An important advantage of bioenergy is that it can be converted into energy forms that are compatible with existing energy technologies that rely on the combustion of fossil fuels: it can be used as feedstock in the chemicals industry and it can be used in existing vehicle fueling networks and gas pipelines, for example in the form of biomass-to-liquid (BTL) thermochemically produced fuels, hydrotreated vegetable oil or biomethane."*(Energy Technology Perspectives, page 117)*

WG SaCECS

PIGergy

Perspective

Biogas can be produced from organic waste feedstocks, such as animal manures, which is the focus of PIGergy. It can be done by means of anaerobic digestion, which is a well-established technology. The biogas thus generated can be used in power generation, and for the production of electricity and heat in co-generation plants.

Further resources

www.glasportbio.com/era-net-smart-energy-systems-ses/

PIGergy

About

A small-scale pig farm with 20 pigs (which is the size of most pig farms in Italy and Ireland) generates enough electricity for heating the sheds for winter. In existing small-scale CHP plants that make a family of 5 persons self-sufficient when it comes to energy, wooden pellets could be replaced with pig pellets. This would provide sustainable base load energy (power and heat) especially in remote locations with weak electric grid connections, far away from district heating networks and behind difficult transport distances.

15% of the hydrogen produced in EU should go to power by 2050

The IEA estimates in its sustainable development scenario that approximately 15 % of the hydrogen produced should go to the power sector on global level. They say that it is a realistic target, applicable also for the EU. *(Energy Technology Perspectives, Figure 2.15, page 210)*

WG SaCECS

EVA

We agree with the statement. It is very difficult to sustain and accommodate increased power demands if not hydrogen production, for at least 15% or more, is integrated to the power sector.

Further resources: www.evaproject.eu

ZEHTC

Hydrogen can be brought to the power sector by using gas turbines. Our question is, will the share of hydrogen available for the power sector be 15% also in Europe?

Further resources: www.zehtc.org

Joint Conclusions

Smart Energy Systems ERA-Net

Hydrogen is used to produce fuels for aviation and shipping.
Even industry is getting a big share. Power sector would need at least 15% by 2050.

- Sector coupling links the use cases to each other.
- Hydrogen is needed in regions and places where direct electrification isn't possible.

Funding Partners

Smart Energy Systems ERA-Net

The Joint Programming Platform Smart Energy Systems receives funding from the European Union´s Horizon 2021 research and innovation program under the grant agreements no. 646039, 775970 and 883973.