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CSSC LAB

Transnational Strategic Roadmap

A stream of cooperation

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Content

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1. Introduction

The status of supply and use of energy as well as the foreseen trends in energy security show that it is crucial to enhance renewable energy production to reach the goals of the Paris Agreement on decarbonisation and climate change. The share of renewable energy production has already been growing continuously often putting pressure on the existing energy grids and widening the time gap between energy production and energy consumption.

Across the EU main actors in the energy field - policy makers, regulators, utility companies, project developers - increasingly aware of the necessity and urgency of enabling the shift to greater use of renewable energy especially electricity, are turning to energy storage and sector coupling technologies that have the capacity to offer greater flexibility, reliability and efficiency in the delivery of electrical energy to consumers.

Moreover, the expanding energy storage and sector coupling domains will boost related the economic development of the regions and provide job growth opportunities. By identifying the steps needed to accelerate the implementation of energy storage and sector coupling, this Transnatinal Strategic Roadmap (TSR) will enable authorities, industry, and business sector to make the right choices and secure to the citizens the energy they need.

1.1 Vision of the strategic transnational roadmap

This roadmap envisions for the cities of the Danube Region a trajectory where energy storage and sector coupling increases reliable, affordable, and green electrification as well as substitution of fossil fuels by renewable gases and liquid fuels.

1.2 Objectives of the strategic transnational roadmap

The present transnational strategic roadmap aims to

An overview of the current energy status and future direction of the energy storage and sector coupling development in the Danube Region.

To increase understanding among authorities and other stakeholders of the most appropriate applications that CSCC technologies can be used for at various locations in the Danube Region

To be a guide to accelerate the uptake of energy storage and sector coupling in the cities of the Danube Region proposing initiatives to develop this domain further.

To articulate actions and policy recommendations to support the further development of the CSSC domain in the Danube Region with target the year 2030.

2. The EU's energy related strategic framework

Energy has always been in the focus of the EU`s concerns, efforts being put towards strengthening its policies. The main directions have always been to increase energy efficiency, to increase renewable energy production and to mitigate climate change by adapting its energy related policy frameworks.

CSSC development has also been important part of the energy development perspective that was strengthened in 2011 once with the EU`s Energy Roadmap 2050.

Among the main policies relevant for the CSSC domain there is:

- The Climate and Energy policy for 2030 (2014) targeting:
  - At least 40% cuts in greenhouse gas emissions (from 1990 levels)
  - At least 32% share for renewable energy
  - At least 32% share for renewable energy

- The Renewable Energy Directive (2018) set the EU's overall renewable energy target for 2030 at minimum 32%

- The Green Deal (2019) set as main objective for the EU to become the first climate neutral continent by 2050.

- A hydrogen strategy for a climate-neutral Europe (2020). Hydrogen is stated to be key for supporting the EU's commitment to reach carbon neutrality by 2050. The strategy sets to achieve a large scale fully decarbonised hydrogen production.

- Powering a climate-neutral economy: An EU Strategy for Energy System Integration (2020)

- Proposal for a Regulation of The European Parliament and of The Council concerning batteries and waste batteries, repealing Directive 2006/66/EC, and amending Regulation (EU) No 2019/1020 (2020). It aims to modernize the EU's legislative framework for batteries ensuring a more widespread uptake of e-vehicles.

- Proposal for a Regulation of The European Parliament and of The Council on the deployment of alternative fuels infrastructure (2021). The proposal concerns mobility and transport, increasing the deployment of renewable and low-carbon fuels, creating also comprehensive recharging/refuelling infrastructure to enable the widespread uptake of green vehicles.

- Proposal for a Directive of The European Parliament and of The Council amending Directive (EU) 2018/2001 (2021). A landmark towards achieving The Green Deal decarbonisation target, the EU Commission proposed a 2030 target to reduce greenhouse gas emissions by 55% compared to 1990.

- REPowerEU (2022) The European Commission has already planned to reduce its dependence on energy imports from Russia by 2030. The plan, called REPowerEU, contains measures ranging from diversifying gas supplies, supporting energy efficiency measures, and expanding the use of electricity and gas from renewable sources. The measures relating to the acceleration in taking-up renewable energy generation represent extremely favourable conditions for the speeding and scaling up of the CSSC development throughout the member states.

Among the main initiatives related to boosting renewable energy production in energy mix from 40 to 45 percent by 2030:

- Elaboration of a "dedicated EU Solar Strategy to double solar photovoltaic capacity by 2025 and install 600GW by 2030",
- Passing of a "Solar Rooftop Initiative with a phased-in legal obligation to install solar panels on new public and commercial buildings and new residential buildings",
- Scaling up the deployment of "heat pumps, and measures to integrate geothermal and solar thermal energy in modernized district and communal heating systems",
- Putting forward recommendation "to tackle slow and complex permitting for major renewable projects, and a targeted amendment to the Renewable Energy Directive to recognize renewable energy as an overriding public interest",
- Scaling up domestic renewable hydrogen production
- Elaborating a Biomethane Action.

The European Union has provided support the Member States also financially and it will keep doing so during the upcoming transition period "through solidarity measures and even price intervention" (Kadri Simson - The EC for Energy).

3. Current status of CSSC in the project regions

In general, there are substantial differences between the countries in the Danube Region in terms of the current application of CSSC solutions as well as their actual potential. The situation is due to the state of the energy sectors which are at different developmental stages. In Western Europe, where energy is a key economic and political domain for the countries' development, benefitted from the special attention of the decision makers and a more ambitious strategic approach which also triggered a steady flow of investment. In turn these investments led to a wider testing and uptake of innovative technologies. In Eastern Europe even though there is growing willingness to develop energy strategies in line with EU policies, this trend is not at all obvious.

The uneven level of ambition at the strategic level is clearly demonstrated by the target set in each country. Austria, for example set 2040 to achieve carbon neutrality, Germany regularly amends the Renewable Energy Sources Act and Slovenia has a New Electricity Supply Act that includes sector coupling and energy storage. In Bulgaria there are signs of more ambitious targets with the new energy law whereas in neighbouring Romania the National Plan for Energy and Climate Change 2030 now endorses CSSC technologies. The other CSSC Lab regions, namely the Czech Republic, Slovakia, Bosnia and Herzegovina, Montenegro, and Moldova, are lagging behind in comparison, but they are also adopting laws and regulation that enhance RES production.

The existing CSSC potential are nevertheless high in all regions – in what energy storage is concerned lithium-ion batteries, pumped hydropower and flywheels are among the first in line while for sector coupling power to heating and cooling in buildings, district heating and industry are considered of the greatest potential.

There is a divergent use of existing technologies given the diversity in city types in the Danube region having also quite different characteristics. The targeted cities for the analyses ranged from mid-sized ones such as Freiburg im Breisgau in Germany (over 100,000 inhabitants over a space of more than 100 km^2, with a multi-faceted city profile) and the small city of Zlatna in Romania (less than 10,000 inhabitants spread over more than 100 km^2 with a post-industrial city profile).

In terms of existing CSSC technologies, a commonality in all considered regions is represented by the fact that energy storage- and sector coupling-related projects are mostly pilot projects as their economic competitiveness is limited. However, the consensus was that as energy storage technologies become economically viable, they will boost their uptake on a wider scale. There are battery and thermal storage projects in place mostly for ensuring balance in the energy system and complement the production of renewable energy sector coupling examples are mostly related to power to thermal and power to mobility but there are also several bigger scale projects in industry of the heat to power type. Innovative solutions implemented are rare due to the risk they pose and, in this area, only Germany and Austria showed progress involving H2 production and the use of CSSC related custom-made software.

3.1 CSSC development in the project regions

In the recent years CSSC has known a continuous development as it has benefitted from favourable EU policy framework conditions related to decarbonization and other energy related directives. As the EU continues strengthening its efforts toward this direction considering the latest EU policies as well as the proposals for regulations this will also ensure the accelerated future development of CSSC as well.

One of the main reasons is that CSSC provides a viable solution to reach the decarbonization goals of the EU by offering technological solutions to the issues that arise from the accelerated deployment of renewable energy production.

Even in 2011, the EU's Energy Roadmap 2050 showed in its scenarios that the share of renewable energy sources in gross final energy consumption would not follow the demand of energy conclusion that led to concerns related to grid stability. In this context, the EC Energy Roadmap 2050, showed that energy storage will have a crucial role for decarbonization as it is a technology that ensures the security of energy supply.

Also, the current geopolitical situation has pushed CSSC technologies in the limelight revealing their potential to solve energy security issues. The current issues related to energy supply has forced European leaders to consider measures to become energy independent. Among the existing solutions in achieving this aim, CSSC technologies have been acknowledged as having exciting potential as it can be deployed rapidly and given the diversity of the technologies it meets the needs of the different regions according to their renewable energy potential.

3.2 Main drivers of CSSC development

The main drivers that are underlying the foreseen rapid development of CSSC:

- Rapid evolution of storage technologies
- Decline in costs of storage technology production
- High potential to support present political decarbonization goals
- The need for flexibility in the energy system with an increasing renewable energy production
- The need to become energy independent triggered by the latest geopolitical context
- The need to provide alternatives for energy production and to ensure energy security and supply also triggered by the latest geopolitical context

3.3 Energy systems readiness for CSSC implementation in the project regions

Energy systems in the analysed Danube regions show in general good stability and well-developed electricity network, above average infrastructure quality, with coverage ranging from 20% for natural gas to 90% for electricity grid with variability among the countries. Issues arise about stability when individual renewable energy systems are added to the grid. District heating grid in operation at municipal level are present especially in the western part of the Danube Region.

In Croatia, the electricity grid is stable, but old and inefficient which results in functionality issues that arise in case of PV introduction in the system. Also, the development is hindered by administration. In Austria, the power grid stability is very high with very stable and secure energy supply however there are issues with the flexibility in case additional PV plants are added to the grid. District heating has a wide coverage in the targeted Zagreb region, and it is foreseen to be developed

The Slovenian electricity grid infrastructure is stable but outdated and its development is further hindered by bureaucratic barriers which makes it difficult to foresee an easy integration of the raising number of individual solar power plants.

The Bulgarian power sector is well developed covering all the country, with universal access to the grid however the Bulgarian energy sector is almost totally dependent on imported fuels from Russia which poses a great threat in the current geopolitical situation.

Romania's energy networks are stable but outdated for the present foreseen energy demand especially in terms of integration of new individual renewable energy production systems. The power infrastructure is covering all area of the analysed regions. District heating networks are almost inexistent all over the country but there are laws foreseen to make mandatory small-scale district heating for new buildings or groups of buildings.

The Czech Republic presents excellent power infrastructure stability and an outstanding grid coverage both for gas and electricity. The only concern is that the significant development of renewable energy sources (especially photovoltaic and wind power plants) has to be complemented by CSSC technologies as they will produce imbalance in the Czech system. District heating is also developed in the region.

In Slovakia power grids are also very stable with particularly good infrastructure quality. There is a full coverage of electricity in the targeted region and the district heating system is also above average.

Germany has a comparatively well-developed and branched electricity network. Germany`s Baden-Württemberg region' power grids are very stable, and the energy security is ensured through cross border energy supply systems. As the consumptions are high and the current nuclear and coal plants ensure the supply, the concern is that considering the plan to be eliminated in the future there will be needed complementary sources, however these are under planning phase. This being the case there is an enormous potential for future renewable energy production as the energy demand will not be met by the supply.

The energy sector one of the strongest economic sectors in BiH having a well-established energy network, however, the quality of infrastructure lags behind the standard of other countries in the region of Southeast Europe, and compared to EU countries, the difference is significant. The energy production is coming mainly from coal, but a shift of interest of key actors toward hydro and wind has taken place. This will shape the future of the energy networks in BiH.

The national energy system in Montenegro is small but flexible and there are various production capacities in the country among which hydro, wind. A significant development potential is seen of the hybrid energy systems (diesel-solar, wind-solar, etc).
The energy sector of the Republic of Moldova is highly dependent on external energy resources. The country's import of energy resources is about 80%, mostly from a sole source, which makes the country's security vulnerable. In this sense, it is necessary a diversification of energy sources, but also a more efficient use of the existing internal potential, including renewable energy sources.

3.4 Challenges of current energy systems in the project regions

Grid stability is problematic in several countries when individual renewable energy production is to be integrated in the network. These might be technical issues or operator related bottlenecks i.e., it is difficult for them to process large numbers of small-scale individual systems and approve their integration given a lower level of operational capacity.

Outdated grids with low capacity of absorption of the increasing renewable production posing a threat to the energy supply and management peak loads in the network.

Regulatory framework not adapted to be in line with the EU directives to increase renewable production to be integrated in the networks

Low level of investments foreseen for the development of certain countries' energy networks.

The need to become energy independent triggered by the latest geopolitical context

High costs of maintenance of energy networks combined with high technological losses that hinder investment plans for development

3.5 CSSC and their role in the future of energy systems

Energy storage technologies and sector coupling technologies support energy security and climate change goals by providing essential services to better integrate green electricity and heat in the energy systems.
They also play a crucial role in securing energy supply.

CSSC technologies:

- Offer solutions to integrate higher levels of renewable resources
- Increase the production of renewable energy
- Increase self-production and self- consumption of energy
- Facilitate energy access of consumers
- CSSC offers the introduction of SMART solutions in local energy networks and in the energy use systems
- Improve grid stability and reliability

3.6 CSSC technologies with implementation potential in the project regions

Following the CSSC Lab regional analyses, five relevant city types (Table 1) were identified as most representative based on area, population, profile and shape for the involved regions.

A	Small agricultural town, under 10,000 inhabitants, about 50 km2 in size, shaped with offshoots
B	Small industrial town, under 10,000 inhabitants, about 50 km2 in size, shaped with offshoots
C	Midsize city, agricultural and touristic, under 50,000 inhabitants, about 100 km2 in size, with offshoots
D	Midsize industrial city, under 50,000 inhabitants, about 100 km2 in size
E	Touristic metropolis, more than 100,000 inhabitants, larger than 100 km2 in size

In relation to the framework conditions of these specific city types the following CSSC technologies were analysed as possible technologies to be implemented:

Storage technologies

- Pumped hydropower
- Compressed air energy storage
- Thermal cycle
- Flywheels
- Supercapacitors/Superconducting Magnetic Energy Storage
- Hydrogen electrolyser / fuel cell

- Batteries
  - » Lithium-ion batteries
  - » Lead-acid batteries
  - » Redox flow batteries
  - » High temperature sodium-based batteries
- Gas distribution network
- Heating grid
- Others

Sector coupling technologies

- Power to heating (and cooling)
  - » in buildings
  - » in district heating
  - » in industry
- Power to mobility
- Power to gas/fuel
- CHP renewable
- CHP fossil

The analyses conducted using a matrix that combined these CSSC technologies with the city types resulted in model cases that were used for the selection of the model solutions suitable for small and medium-sized municipalities.

3.7 CSSC LAB model solutions for municipalities in the project regions

The six CSSC Lab model solutions were selected in a multi-stage selection process based on the following characteristics: innovative character, availability, transferability, and feasibility.

The following technologies were selected as model solutions suitable for the relevant city types in the Danube Region:

1. Heat pumps
2. Electric cars
3. Batteries
4. Latent heat storages in combination with photovoltaic systems
5. Sensible heat storages in combination with photovoltaic systems
6. Fuel cells combined with solar systems or heat pumps

The selected model solutions are meant to offer city actors possibly the most appropriate technologies for their purpose based on suitability according to the specific of their regions. Thus, the proposed model solutions will ultimately accelerate the implementation of CSSC solutions for municipalities.

The analyses of the CSSC solutions could also provide basic information on the advantages and disadvantages of the model solutions, which would offer city actors the starting point of the evaluation for the suitability of a CSSC technology in their regions.

Model solutions	Main advantages	Main disadvantages
Heat pumps	High potential of applicability Low implementation and maintenance costs Environmentally friendly	Difficulties in installing Efficiency issues in cold weather Carbon neutrality depends on the electricity source
Electric cars	High potential of applicability High efficiency	Needs proper infrastructure Relatively high costs
Batteries	High potential of applicability Mature technology High efficiency	Low energy density Life cycle related issues
Latent heat storages in combination with photovoltaic systems	High storage density	High cost for implementation Space required for the storage device
Sensible heat storages in combination with photovoltaic systems	Cost-effective, widely used simple technology Suitable for district heating	Energy cannot be stored or released at a constant temperature Larger quantity of medium is required
Fuel cells combined with solar systems or heat pumps	Flexibility High efficiency Environmentally friendly	Effective in combination with green hydrogen

4. Policy frameworks related to CSSC

Legislative, regulatory frameworks and policy tools are crucial drivers behind the accelerated development of CSSC. These have a major impact and usually these are shaped by authorities at different levels.

In the CSSC Lab regions the strategies, legislations regarding the energy sector are done at national level, while usually there is no different applicable legislation (and environmental regulation) on local/regional level. Regional and local authorities (municipalities) have limited regulatory capacity in what energy and climate policies are concerned.

Where favourable regulatory and legislative frameworks are present, regional and local authorities back up the national policies related to energy by regional/local policy tools policy tool. In such cases domains such as CSSC, benefit from an advantageous position having a smoother path to follow in their development.

4.1. Challenges posed by the energy related policy frameworks in the Danube regions

Several policy related factors can hinder the development of CSSC in the CSSC Lab Danube regions:

Very restrictive administrative procedures related to RES in general and CSSC in particular

Lack of well-defined policies and regulations applicable at national and regional levels. containing provisions more specific to CSSC technologies

Big differences in energy related policy in terms of their statuses and ambition levels that foster RES development among the CSSC Lab Danube regions

Slow introduction of new concepts (related to CSSC) in the legislative framework.

Lack of synchronized approach of different energy, climate and spatial development policies at local and regional level

5. Policy frameworks related to CSSC

The availability of financing opportunities as well as investment levels of authorities at different levels are behind the state of development of the CSSC domain at every level.

The CSSC Lab Danube regions usually rely on traditional financing sources, i.e., private investments and bank loans. Some countries are more inclined to consider EU financing for CSSC type project, but overall, the general impression is that there has been a lack of financial support for strategic CSSC investments at national level. Just a few CSSC lab countries such as Austria has federal or state level funds, awarding grants for the installation of battery storages, or Germany where the state or federal state (even cities) provide subsidies for RES related projects targeting the users to increase the use of sector coupling and energy storage.
Alternative financing, such as crowd investments do not play a big role yet; only in countries like Austria and Germany have been several citizens funded PV projects In the period 2022-2030, the European Union will allocate significant amounts for investments in renewable energy production and storage capacities, energy efficiency, modernization and expansion of electricity networks and other energy fields. The implementation of these projects was envisaged in the context of the European Union‘s energy efficiency and decarbonisation policies and objectives.
The need for these investments is amplified by the new political discourse on increasing the European Union‘s energy independence, generated in the context of the conflict in Ukraine.

5.1. Challenges in financing RES and CSSC in the Danube regions

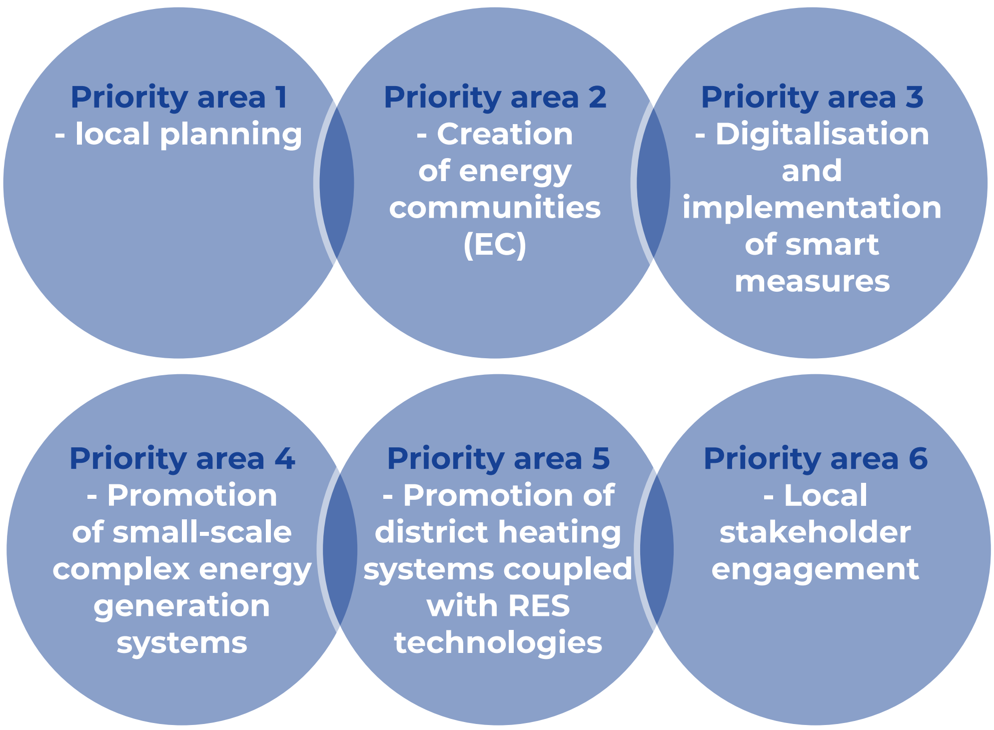
Energy storage and sector coupling projects are still considered expensive, and costs related to the implementation of larger scale CSSC applications at city level are somewhat similar in different countries given the price of the technologies involved. The high costs, however, have been continuously falling and this trend is expected to continue given the foreseen larger uptake of the technologies which will make them more economically viable. Prices of electricity in some countries, at least before the Russian invasion of Ukraine, were low which made investments in energy storage not profitable and thus not feasible from the economical point of view.

6. Priority areas and policy recommendations

The present roadmap provides several general directions and concrete steps on how to how reach the acceleration of CSSC technology take-up. The directions and proposed actions are inspired by the regional action plans developed by the CSSC Lab partnership in the project regions. These constitute the basis of the following proposals and take into account the findings of the regional actin planning workshops as well.

The multitude of CSSC technologies present on the market constitutes both advantage and disadvantage in their take up. On one hand city actors are having difficulties in evaluating which technology is best fit for their purpose and specific, and on the other hand the several CSSC types offer solutions to a wide range of energy related issues different regions face. Another recent issue is also constituted by the identification of the purpose a municipality sets out to attain when looking to implement CSSC in their region. Namely, the current situation has forced cities to find solution not only for the proper grid integration of the ever-increasing RES production or for attaining decarbonisation goals but also to find rapid ways to ensure energy supply and make steps to become energy independent

The roadmap recommendations focus on the different methods of accelerating the uptake of CSSC in the project regions:



6.1 Priority area 1 – Local planning

Sustainability measures implementation at local and regional level can be done more efficiently by harmonizing the local development plans, namely, to approach planning by connecting energy and climate measures and their impacts in other planning tools such as spatial and/or mobility plans. Local planning tools have as common goal to ensure sustainable development by measures that have as end goal the increase of the quality of life. These local planning tools often influence each other and possibly propose measures whose impact possibly overlap and which can often be implemented in a harmonised way. Thus, their elaboration should be done in a coordinated approach, capable of maximizing their impact taking advantage of certain synergies.

Actions:

1.1 creation of an interdepartmental working group within a local authority and set the strategic goals for local development

1.2 evaluation of the harmonization potential within local planning instruments

1.3 adoption/creation of methodologies to approach the planning phase in an integrated manner

1.4 elaboration of the harmonised local planning tools

1.5 monitorisation of the harmonised impacts

6.2. Priority area 2 – Creation of energy communities (EC)

The favouring regulatory conditions regarding RES production as well as the decrease in costs of RE technologies have led to the growth of renewable electricity production both in households and in small businesses. The possibility to inject the energy produced in the grid thanks to latest regulations in several project regions makes it very attractive for any citizen to become a prosumer. Thus, the trend is estimated to continue but beside the desired effect of decarbonising local communities it might have some negative consequences on the electricity grids as well. On one hand the creation of EC would solve grid related issues and on the other hand EC members would get empowered to collaborate and engage in activities for other investments.

Actions:

2.1 awareness raising among existing prosumers on the benefits of being part in an energy community, organisation of information workshops

2.2 establishment of EC according to national regulations/laws

2.3 promotion of storage technologies for the established ECs

2.4 support the EC with installed storage technologies to act as grid stability service provider

6.3. Priority area 3 – Digitalisation and implementation of smart measures

"Digitalisation can help integrate the growing share of renewable energy by delivering flexible electricity systems that provide demand-side solutions and energy storage."

The consensus among experts is that, especially in countries with less secure grids, and not only, will eventually have difficulties in taking in high renewable energy loads. In this perspective one solution to overcome this issue is to digitise the energy value chain.

Digital technologies have the capacity to provide system optimisation, to support energy system integration. They can provide data to match supply and demand, and they can provide support for optimising the use of the existing grid capacity.

Technologies and digital services available at present for the energy systems are smart meters, demand-side response, smart grids, ICT, energy sensors, AI etc. The adoption of such digital technologies will support energy transition at local and regional level.

Actions:

3.1 provide available digital technologies to citizens (prosumers, energy communities)

3.2 foster innovation by mobilising STKs

3.3 collaborate with research and development centres to identify pilot solution in order to transfer and scale it up

3.4 set up collaboration models with the business sector to provide the necessary digital infrastructure

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6.4. Priority area 4 – Promotion of small-scale complex energy generation systems

The decrease in the RE generation technologies, especially PVs coupled with the existence of incentives provided by central authorities have led to the rapid growth of rooftop PV installation on many households or small businesses. However, these by themselves do not ensure the prosumer to become energy independent. The installing of the energy production equipment needs to be coupled with energy storage solutions, proper energy management systems, and IT solution for monitorisation.

Actions:

4.1 information campaigns targeting owners on how to improve the RES systems already installed to maximise the benefits

4.2 provision of tailored advice on CSSC technology implementation depending on individual needs and specific as well as provision of financing possibilities

6.5. Priority area 5 – Promotion of district heating systems coupled with RES technologies

The district heating systems operating in the EU cities are mainly using fossil fuels such as gas and coal. Moreover, in the recent past in several Danube countries, district heating systems were replaced by individual heating units which are mainly run on gas. However, DHS systems have a great potential to contribute to the decarbonisation goals especially by integrating renewable energy sources. In this perspective the EU with the Renewable Energy Directive (recast), the Energy Efficiency Directive and the Energy Performance of Buildings Directive push toward the expansion of district heating systems that integrate renewable and carbon neutral energy sources using energy efficient technologies.

Even if at present, setting up DHS systems in already built areas is not cost effective or hard to implement there is still room for its future development even in Eastern EU countries where DHS are not perceived positively by the public.

Actions:

5.1 setting up regulations for mandatory implementation of DHS systems combined with production of energy from renewable energy sources in new constructions (blocks of flats, groups of buildings, groups of residential houses)

5.2 promote DHS benefits among the public to raise acceptance levels

6.6. Priority area 6 – Local stakeholder engagement

CSSC technology implementation requires the involvement of a wide range of local stakeholders in order to be properly done. Stakeholders in charge with the technical aspects (energy distribution, system operators, utility providers), financing organisations, the business sector (companies, industry), policy makers, citizens should all be part of the efforts in CSSC implementation. They can bring in expertise and provide information on technical readiness, energy needs and other data that can ensure the development of the domain according to local specific.

Actions:

6.1 Conduct awareness raising on CSSC technologies in general. Inform STKs on the role of CSSC in the energy systems, on their benefits

6.2 Enhance interaction among STKs to start creating a CSSC implementation strategy. The goal is to start outlining the development level, the local readiness level and future goals

6.3 Identify suitable technologies for the local specific. Assess the benefits and the difficulties in their implementation

6.4 Build scenarios and estimate results/impact of the identified CSSC technologies

6.5 Prioritize the implementation according to local development strategies

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7. Policy recommendations

1. Development of a common policy framework for harmonised climate, energy, mobility, and spatial planning with provisions that aims to ensure the integration of CSSC sector. This would make sustainable development planning at local and regional level more efficient and would enhance the capacities of public authorities in the Danube region to reach their decarbonisation goals.
2. Identification of legal frameworks adoptable by the Danube regions for the creation of energy communities. These frameworks should provide indications of organisational forms as well as set legal grounds based on which ECs would be supported in generating financial revenues for further development of CSSC technologies.
3. Provision of support policies to enhance introduction of digital services and technologies in the energy production value chain. It should provide easy access to data sharing frameworks and ensure data availability and data interoperability. Moreover, it should foster the creation of smart grids which connected to balancing solutions form the CSSC sector, such as energy storage technologies, would be able to equilibrate the energy system sensible to fluctuation given the intermittent generation of renewable energy.
4. Policy support given to the take up of small scale complex renewable energy generation systems at consumer level and enhance direct access of consumers in the energy market. These systems consisting of renewable energy generation, storage capacities, smart energy management systems can be supported in further creating local community microgrids. These systems would not only allow energy sharing reducing household energy bills, but it would support grid stability thanks to CSSC technologies.
5. Support given in the development of national policies/strategies for adopting regulations that would enhance the uptake of district heating systems in combination with heat production from renewable energy sources (biomass, solar) and CSSC technologies. The regulations should enhance the DHS introduction in new buildings especially at small scale construction (block of flats or groups of buildings).
6. Provision of policy support of enhancing STK collaboration. Creation of collaboration/ partnership models among STKs to determine their engagement in a proactive way in all stages of CSSC integration (analyses – planning – implementation – monitorisation).