Energy Cities contribution to EU strategy on energy sector integration

1. What would be the main features of a truly integrated energy system to enable a climate neutral future? Where do you see benefits or synergies? Where do you see the biggest energy efficiency and cost-efficiency potential through system integration?

A truly integrated energy system consistent with a pathway to a climate-neutral Europe goes beyond a mere traditional approach to gas and electricity generation and transmission. The energy system integration approach that will leverage the greatest amount of benefits, synergies, energy efficiency and cost-efficiency potential, is an approach that is **anchored in a holistic European concept of integration that fully embraces the potential for synergies between local district heating grids with gas and electricity networks and establishes a correspondingly broad vision of European energy infrastructure design and finance**. A truly sector integration approach should not only increase the use of renewable electricity but also the development of renewable thermal energies (e.g. solar thermal and geothermal energy) and of waste heat recovery.

The proliferation of efficient & decarbonized district heating networks at local level that are integrated with the wider energy system, is quintessential in addressing the current flexibility and imbalances issues of the energy system. **These networks, working in concert with the gas and electricity grids, have a proven ability to provide vital storage and balancing services as well as a link to local communities and end-users**.

The Member States and cities that have made the most progress on their decarbonisation journeys tend to be those in which efficient, decarbonised district heating networks are (1) widely developed and (2) integrated with the wider energy system. In Denmark for example, sector coupling has been a success story thanks to the combination of district heating networks and high shares of wind power, where electricity surpluses from wind have been matched with the country's heating and cooling needs. **District heating's effective link to electricity systems is further underlined** by the co-generation of electricity and heat**,** and through power-to-heat production in large-scale heat pumps**.** In a well-integrated energy system, a district heat supplier can also respond to price fluctuations in the electricity market and help balance the grid by producing or consuming more electricity. District heating companies can also use thermal energy storage, which is generally less expensive than electricity storage, to provide further flexibility in an integrated energy system. Energy consumption patterns for electricity-specific uses and heat uses are also different and having both electricity and district heating grids allows better optimization of the systems, vs. a 100%-electrification approach.

An EU energy sector integration strategy that "thinks local first" would also benefit from leveraging cities' proven experience in implementing sector coupling on a local scale. Waste heat recovery from industry to feed local heating & cooling needs is already underway in cities like Delft in the Netherlands (from the port of Rotterdam) or Hamburg in Germany (from the local copper plant). In the city of Stockholm e.g., the district heat supplier has introduced a heat market called Open District Heating that allows data centres, supermarkets and industries to sell excess heat into the network.

Taking full advantage of local district heating and cooling as a carbon free energy carrier, energy storage potential and platform for integration is a **no-regret option for the EU's energy sector integration strategy that can make the EU the world's first climate-neutral continent by 2050**.

In addition to this, building collective energy infrastructures such as district heating networks allows to provide clean energy to citizens which would be able to invest in individual clean solutions, such as heat pumps. It ensures a just energy transition which leaves no one behind.

2. What are the main barriers to energy system integration that would require to be addressed in your view?

Currently, the main barriers in this regard are the following:

- Energy producing and energy consuming sectors are insufficiently linked

- Policies are usually designed by sector, which is ineffective if the aim is to have the sectors working together

- The predominant approach to energy system decisions, which is rooted in a centralized and national top-down approach does not leverage the energy efficiency and cost-efficiency potential

- There is a lack of effective multi-level governance when it comes to infrastructure planning – decisions taken at building / district / local / regional / national / EU level are not aligned and coherent. As an example: discussions at EU and national level are too often limited to the supply side (gas-electricity interaction) and do not factor the equal importance of the demand-side and the need to reduce energy needs & demand to have any chance of getting to climate neutrality by 2050;

- The governance around heating and cooling and electricity limits system integration, as both sectors work with separated infrastructures and very different business models and regulations

- There is also a shortcoming in systemic assessments of how local energy solutions, such as district heating and cooling, benefit the wider energy system integration;

3. More specifically:

What role should renewable gases play in the integrated energy system?

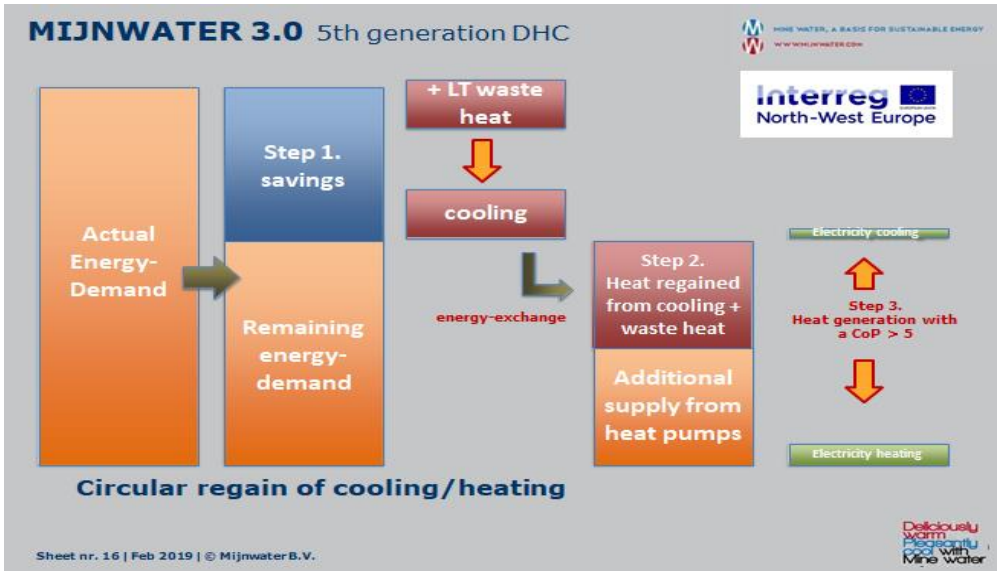
Renewable gases, as expensive energy carriers, should be dedicated to high-temperature heat demands, such as in the industry, for which there is no other renewable alternatives. For low-temperature heat demands, such as space heating and hot water in the building sector, low-temperature and low-carbon thermal energies (such as solar thermal, geothermal, waste heat) and heat pumps should be prioritized to supply the remaining heat demand after the completion of building insulation.

How could circular economy and the use of waste heat and other waste resources play a greater role in the integrated energy system? What concrete actions would you suggest to achieve this?

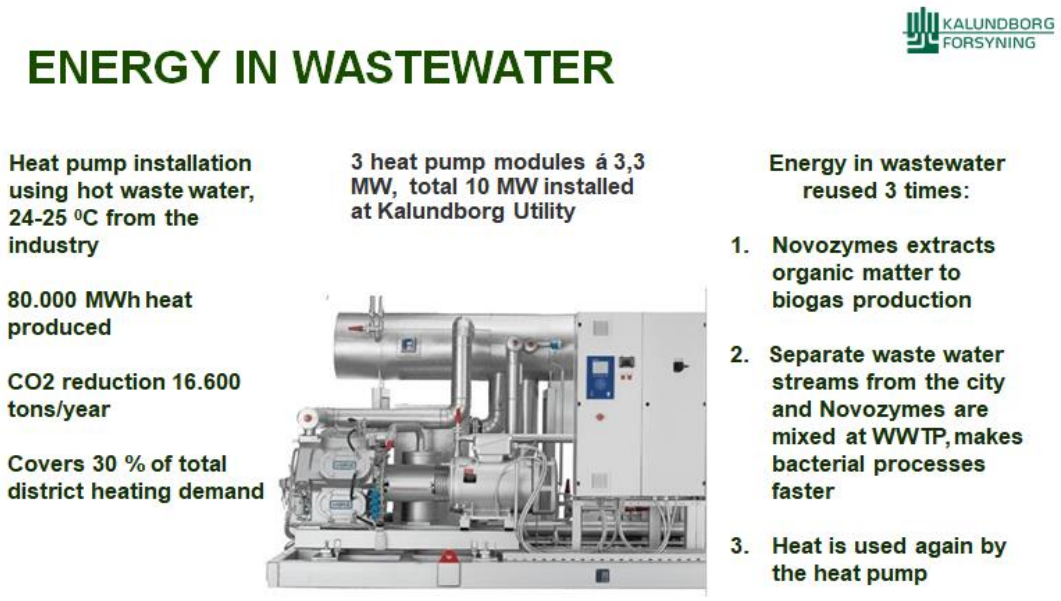
The use of waste heat and other waste resources plays a critical role in the future EU energy sector integration strategy. At the local level, cities are already widely using waste heat recovery, as it is carbon-free or low carbon heat, increases the efficiency of the whole energy system and comes at a low price. Moreover, in these approaches, different renewable and residual energy sources can be integrated in one system, with sources such as e.g. solar thermal, geothermal, PV, biomass or excess heat from sewage water. As such, it enhances synergies between different energy carriers and technologies, allowing for increased energy efficiency (via heat recovery, storage, CHP, maximized system flexibility) and also enables the efficient deployment of renewables while ensuring the system's balance and stability. In order to foster more these approaches, district heating and cooling, waste, waste water and water sectors should be seen more in synergy, by pricing the cost of running such a system on its entirety and not its components. Local authorities are best placed to evaluate the cost optimum of the sector integration and the trade-off between energy efficiency and energy production, based on their local resources and contexts. In addition, long-term planning is key because the lifespan of energy infrastructures (such as gas and district heating and cooling grids) is several decades. Thus, it is necessary to provide the right policy framework to local authorities so that they can invest now in decarbonised technologies (to avoid stranded-assets in the future) and ensure the financial viability of these investments (via policy measures such as compulsory connections to decarbonised grids and carbon taxes).

How can energy markets contribute to a more integrated energy system?
A special place should be safeguarded on the energy markets for citizen and renewable energy communities, in order to foster their development. They are well placed to engage with citizens in general, and assess the local needs, in cooperation with the local actors. It will lead to a just energy transition and a better integration of energy production, consumption and storage at district level and across sectors.

4. Are there any best practices or concrete projects for an integrated energy system you would like to highlight?



The Mijnwater project implemented by the Dutch city of Heerlen is a concrete project that fosters an integrated energy system at local level. After the closure of its coal mines, between 1965 and 1974, Heerlen's old mining tunnels filled with groundwater, which was heated by the earth naturally. The mines became a water reservoir, unused for many years, until the municipality decided to step in with the Mijnwater project. They drilled five wells and built an underground piping system to allow for the water to circulate. In 2008, the first mine water geothermal plant in the world, Gen Coel in Heerlerheide, became operational, and the first connections to the Mijnwater grid were established. Currently, Mijnwater provides renewable energy to dwellings, offices, elementary schools, supermarkets, a nursery and a sport facility in Heerlen. The system combines a low-temperature district heating and cooling grid (15-25°C), with seasonal geothermal heat storage, and the use of reversible heat pumps providing cooling and heating to buildings. The heat pumps are highly efficient as water source heat pumps (compared to air source heat pumps) and are supplied by green electricity (bought on the whole sale market) but which might be produced locally in the mid-term. Medium-term storage is guaranteed by water tanks along the district heating and cooling networks. Finally, some consumers are also producers, as the network recovers heat from some connected buildings, such as industries, datacenters and supermarkets. This example is an outstanding best-practice of electrification and sector integration using local resources. It can possibly be replicated in other coal regions or elsewhere by using thermal pits or geothermal drillings as seasonal storage options.



The Danish city of Kalundborg's approach is another best practice in energy system integration, where energy in wastewater is reused three times and the water, waste water and DHC sector is integrated in a highly energy- and cost-efficient manner. **Another example of sector integration based on low-grade waste heat recovery is the revolutionary Bunhill 2 Energy Centre in Islington** – the first of its kind in the world. The systems recovers waste heat from the London Underground network, allowing integration between the transport and the building sectors. Via a 1.5 km network of underground pipes, the system can provide heating and hot water to more than 1,350 homes, a school and two leisure centres. In addition, the system will cool the London Underground in summer.

5. What policy actions and legislative measures could the Commission take to foster an integration of the energy system?

In order to foster the aforementioned **holistic European concept of integration that fully embraces the potential for synergies between local district heating grids with gas and electricity networks and establishes a correspondingly broad vision of European energy infrastructure design and finance,** the Commission should take the following policy actions and legislative measures:

- As part of the upcoming revision of the TEN-E regulation, introduce an obligation to Member States to support energy planning carried out at a local and regional level, with a specific focus to evaluate the feasibility of district heating networks in spatial planning and urban developments. For doing so, more resources and autonomy should be given to local authorities to develop district heating networks that foster energy system integration in concert with gas and electricity networks;

- Guidelines should be provided by the EU and Member States on energy system planning and assessment of best options from a societal perspective. However, the assessment should be done at regional or even local level, and it should be possible to adapt the parameters of the assessment based on the local conditions;

- Allow for a level playing field between natural gas and energy efficient and decarbonized district heating networks, by assigning the true system & societal costs of fossil fuels in the upcoming revision of the energy taxation directive, and by removing the barriers to the dismantle of the natural gas grids (grid disconnection) at the local level;

- Remove the policy barriers which forbid local actors, especially public and not-for-profit actors, to invest in different sectors (while guarantying the protection of consumers), e.g. some water companies are not allowed to invest in the energy sector although they are more and more possibilities of synergies to increase the overall efficiency of the two systems;

- Phase out EU funding for natural gas infrastructure as of 2021, matching the timeline of the EIB energy lending policy;

- In the upcoming EU projects of common interest, set the funding priority on smart thermal networks and local district heating and cooling grids;

- Revolutionise the “energy efficiency first principle”, by looking at how to synchronise consumption with carbon free production and switching to carbon free energy carriers, with the aim to reduce energy needs and demand. This applies not only to the building sector, but also to other sectors such as mobility, industry etc;

- Support citizen and renewable energy communities in their projects of smart sector integration and production of renewable thermal energies, fostering an integrated and efficient energy system at district level, by providing them with favorable market and administrative conditions .