We live in exciting times. “Build-back-better” became the universal slogan in times of COVID-19 crisis and recovery. It seems that we have finally realised that we are fragile, that we do not control nature and that climate change is a real threat. More than ever before, we know that the European district heating sector could be one of the most important contributors to the Green Deal transition.

Supplying, on the one hand, a significant amount of the heating services in northern and western parts of the EU (approximately 50% in Denmark and Finland), district heating is a mature technology. On the other hand, in most Central and Eastern Member States, district heating is facing severe challenges such as an old and inefficient infrastructure and a loss of consumers due to the unreliability of supply over the last decades. Yet, there is a wide consensus: district heating is one of the most promising options to decarbonise the heating sector and cities in general, and is therefore crucial to reach European and global climate goals.

How are we going to do this? The local context is always a challenge for district heating and there are no ready copy-paste solutions. The good news is that funding is not the issue, as there is no lack of funding for good projects with strong impacts. We have a very interesting and dynamic financing period in front of us, we just need to use it.

The district heating sector offers options for great innovations. Solar energy, biomass, geothermal, cogeneration, waste heat from industry, smart and digital solutions and so much more... Buildings need heating and cooling, and this is unlikely to change. Therefore, the future lies in supplying heat and cooling energy to low-energy buildings, with low losses and high energy efficiency. The heating sector and district heating in particular will be a catalyst for new business models such as waste heat utilisation or heat prosumers. It can help drive the stronger uptake of renewable electricity through demand-side measures and sector coupling.

Decarbonisation of the European district heating is not a goal in itself. Together with innovation, it will drive the competitiveness of our industry; it will reduce our reliance on fossil fuels thus increasing our security of supply; and it will help improve air quality both indoors and outdoors, protecting our health. If the EU wants to decarbonise, our cities need to decarbonise first and district heating is a key piece of this puzzle.

Dr Julije Domac
FEDARENE President, Special Adviser on Energy and Climate to the President of the Republic of Croatia and REGEA Managing Director
Europe is in a period of extraordinary efforts. The EU is putting in place the European Green Deal, a strategy to make Europe climate neutral by 2050, simultaneously with the Economic Recovery Plan to restart economic growth after the COVID crisis. These initiatives provide the foundation for a green and digital recovery. Increased deployment of renewable energy plays an important role in transitioning to a resilient carbon neutral economy in a cost-effective way.

### Heating and cooling in the EU Energy System

In the last decade, we have seen an important and steady increase in renewable energy in our energy system. Today, more than a third of electricity we consume comes from renewables. Renewable energy constitutes the largest part of new investment in power generation today and they are projected to reach above 80% market share by mid-century. Unfortunately, similar breakthrough did not take place in the heating and cooling sector.

Heating and cooling drives half of the energy consumption in Europe. However, more than two thirds of demand is met with fossil fuels and only around one fifth comes from renewables. Changing the conventional fossil paradigm in heating and cooling is essential for reaching the EU decarbonisation goals.

### The challenges

Heat cannot be transported over long distances and heat needs are specific to each user. Heating systems are local with their own particular geographical, technical and other conditions. Successful heat decarbonisation strategies should embrace these specific circumstances, while EU policies can provide overarching frameworks for common elements.

Most heating takes place in cities and buildings (~60%). Cities have limited space and often renewables are brought in from surrounding areas. That is why district heating and urban planning can play an important role in heat decarbonisation in cities.

### Integrated urban planning, coordination and cooperation

Modern renewable based efficient district heating can operate on multiple energy sources and heat generation technologies, thus capable of collecting and distributing renewables and other carbon-neutral sources from a wider area. By combining these sources, they can satisfy the full demand of buildings with clean energy. However, for these systems to develop they need a sufficient expansion of efficient, low-temperature buildings. Investment in the decarbonisation of heat supply must be closely coordinated with refurbishment programs and infrastructure development.

The first step in decarbonising heat is energy planning and heat mapping. Municipalities should assess the evolution of heat demand within their territories and the renewable energy sources available cost-effectively in sufficient quantities. They also need to assess infrastructure needs to transport those sources to consumers.

Infrastructure developments depend very much on urban planning and municipalities play important roles in developing energy infrastructures as owners, regulators, or facilitators. Coordination of renewable heat supply and infrastructure with building refurbishment or construction plans is essential. Good coordination across the many actors at national, regional and local levels, and between municipalities, utilities, citizens, professional bodies is key for successful heat decarbonisation. Municipalities are at the center of local coordination to bring together all these actors.

### The way forward

The Climate Target Plan increased the EU 2030 CO2 reduction target to 55%. This makes it necessary to review the targets and measures in the Renewable Energy Directive and the Energy Efficiency Directive.
Similar reviews are required for other relevant legislation, e.g. the Energy Performance of Buildings Directive, the EU ecodesign and energy labelling state-aid and energy taxation.

The 2021-2027 EU multiannual budget and the Resilience and Recovery Plan foresee substantial increase in clean energy investment. The Renovation Wave calls for the doubling of building renovation rate and the replacement of 4% of heating equipment annually. The EU Energy System Integration strategy prioritises renewable electricity use in all end-use sectors and the development of modern district heating and cooling systems.

District Heating (DH) systems are one of the most energy-efficient heating systems in urban environments, with proven reliability. When combined with renewable and waste heat sources, DH becomes an even higher efficient solution to decarbonise heating. It also guarantees competitive energy costs with limited influence of fossil fuel supply price volatility. To achieve this, a transition is needed in DHs, comprising not only measures to improve overall performance (temperature level reductions, improvement of substations, etc.), but to guarantee system viability as a whole in a context of reduced heat loads with the transition to Nearly Zero Energy Buildings (NZEB).

RELaTED deploys a decentralised, Ultra-Low Temperature (ULT) DH network concept, which allows for the incorporation of low-grade heat sources, larger shares of Renewable Energy Sources (RES) and distributed heat sources. In RELaTED, every single building is converted into an energy node, where bi-directional heat exchange is allowed between the network and the building, with the introduction of heat pumps as heat generation systems. This way, operational costs are reduced due to fewer heat losses, better energy performance of heat generation plants, and extensive use of decarbonised energy sources at low marginal costs.

One of the pilots of the project is located in Iurreta, in the Basque Country (Spain). The demonstration site consists on a corporate district heating network in buildings owned by the Basque Government, which will be connected to a ULT DH, including the installation of heat pumps in each of them.

Ente Vasco de la Energía (EVE), the Basque Country energy agency, believes this pilot will demonstrate the feasibility of DH, even in southern Europe. They have thus performed a study at the regional level in Basque Country to identify industrial waste heat sources suitable of heat recovery and they have matched this available resource with candidate urban areas suitable for ULT DH systems, considering their heat energy demand and the cost of setting up heat delivery infrastructure. The work will allow them to define three feasibility studies with the more promising sites in urban areas of the region to analyse the opportunities of this technology. They expect that the results obtained will showcase the viability of the technology and an opportunity to develop it in the Basque Country.

Since 2017, the RELaTED project has progressed in the development of its ULT DH concept by testing new technologies and running its four demonstration sites (Iurreta - Spain, Tartu - Estonia, Belgrade - Serbia, and Vinge - Denmark). The work carried out shows that substantial efficiency and environmental benefits can be reached with the use of much lower temperatures.

Usual DHs are designed and operated to distribute heat at about 80 °C to consumers. However, RELaTED aims to successfully implement service temperature levels as low as 40-50 °C. This leads to many opportunities and challenges for both consumers and producers.

One of the big challenges is managing and optimizing ULT DH networks with high energy flexibility. Another key issue was the economic feasibility of the conversion from classic DH to ULT DH systems. The Energy Price Assessment carried out by the project reviews different heat production technologies and their associated fuels to evaluate their cost/benefit ratio in the medium and long-term. The study considered the specificities and constraints of each demonstration sites which can affect the price volatility of energy. The Vinge pilot illustrates and details a guide on how low-temperature concepts can be applied in new district heating developments.

The high potential for mixed sources of energy is essential to understand the aim of RELaTED. Project partners are currently working on several developments - the incorporation of technologies like DH substation, heat pump, and solar thermal systems. The ambitions of RELaTED are high and the results published so far show that the project is on the right pipe!

For more information, visit the website: relatedproject.eu
TRANSFORMATION OF DISTRICT HEATING SYSTEMS
IN KOROŠKA SAVINJSKA AND ŠALEŠKA REGION

Through its involvement in numerous EU projects and the largest Slovenian district heating system being located in the region, the energy agency KSSENA has acquired a considerable amount of knowledge and experience in DHs renovation and transformation, which it is currently applying in three different operations.

In the H2020 project KeepWarm, KSSENA played an important role in preparing a roadmap for the municipal district heating of Velenje – KP Velenje, which will invest around 3.5 million EUR in the modernization of the grid in the next five years. With this investment, primary energy savings are estimated at 1,600 MWh on a yearly basis (40 GWh over 25-year lifespan). Annual CO2 savings will amount to around 784 t/year (19 600 tons in 25 years).

Another large DH investment is taking place in Slovenj Gradec, where local biomass will become the main energy source for their local district heating system. The DH system currently uses natural gas as the only energy source. With the new biomass boiler, which will cover up to 80 % of the energy needs and drastically increase the share of renewable energy sources to around 10,000 MWh per year. Such an investment would lead to CO2 savings of 1,600 t/year (40,000 tons in a 25-year life span).

Finally, KSSENA is also involved in the Interreg Central Europe project ENTRAIN, which aims at improving the capacities of public authorities to develop and implement local strategies and action plans for enhancing the use of endogenous renewable energy sources in small district heating grids. Implementation of these action plans will lead to a CO2 emission reduction, to an improvement of local air quality and to socio-economic benefits for local communities. On its territory, KSSENA is supporting the quality of operation of several small DH systems running on biomass by providing planning guidelines for biomass and renewable district heating, from the project initiation to the plant commissioning phase. The target group of these guidelines are potential operators and investors of biomass district heating systems.