

A 3D architectural rendering of a city grid with white buildings. Two teal lines representing district heating pipes run across the city. A red dot is placed at an intersection of these lines, with a soft red glow around it.

IT'S TIME TO KNOW

more about district heating

How district heating can support a green transition

We need sustainable and stable heating solutions

Heating and cooling of buildings is one of the most energy intensive demands in our society.

And the need for heating and cooling is only increasing globally. If we want to meet the climate goals necessary for a greener future, we need to turn to solutions that offer both sustainability and stability.

District heating has the potential to be the energy system the

world is looking for by integrating a growing number of fluctuating heat sources. But it will require significant growth, intelligent navigation of the digital tools the 4th generation of district heating offers – and a strong and unified sustainable vision. It's time to know how district heating can help the world transition to a greener future.

Table of content

06	ARTICLE	There can be no sustainable cities without district heating
10	ARTICLE	Can digitalisation turn sustainable business into profitable business?
16	ARTICLE	3 district heating predictions for the 2020s
18	ARTICLE	You need the right digital tools to make district heating smart
24	ARTICLE	How do we make district heating more flexible?
30	ARTICLE	Digitalising district heating for the planet, people and profit



The green transition

Heating needs are increasing around the world, but the increase in energy necessary needs to be coupled with a transition to a sustainable and green future. District heating has the potential to be the solution that offers both sustainability and profitability, but to truly take the sector to the next level, political action, innovation and digitalisation need to come together in perfect unison.

There can be no sustainable cities without district heating

Today's energy challenges call for smarter and more energy efficient cities focusing on sustainable resource utilisation. Intelligent district heating plays a key role in this development.

As global energy demand and urbanisation continue to rise, fossil fuels are being exhausted and the financial as well as environmental costs of energy production increase. This necessitates a focus on reducing consumption as well as improving the efficiency of how energy is produced, managed, and distributed.

THE UNTAPPED POTENTIAL OF DISTRICT HEATING

For years, the smart electricity grid and "the electrification of everything" has been positioned as the answer to the energy challenges of the future. But the potential to optimise energy consumption related to heating and cooling is actually far greater. It is just a much more fragmented industry than electricity – and one that was previously lacking an overall focus.

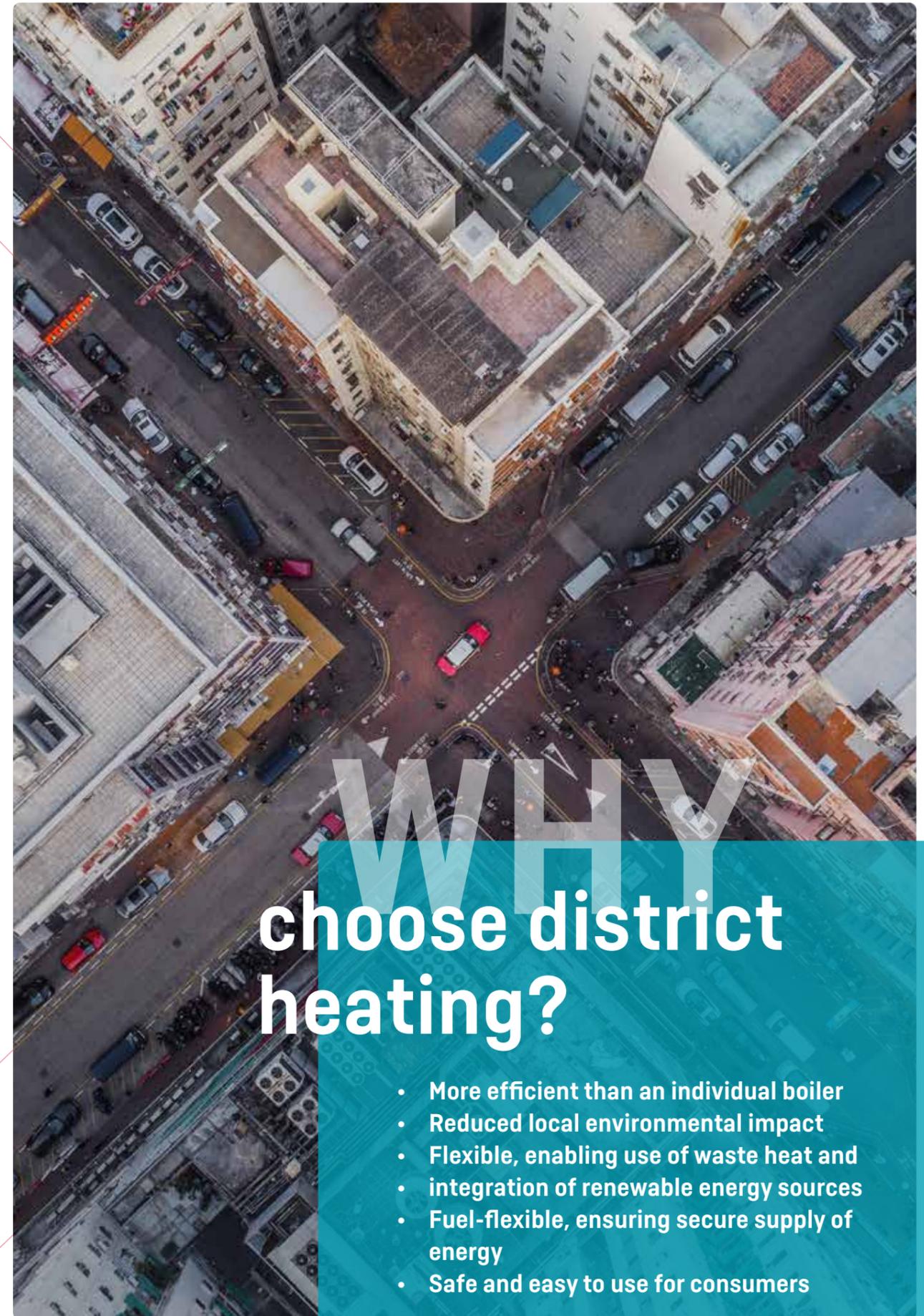
Today, cities are responsible for 75% of energy consumption and between 60-80% of total global emissions¹. In Europe, for example, heating and cooling accounts for 50% of the total energy consumption, and 75% of this is still generated from fossil fuels. District heating, by contrast, only makes up around 10% of Europe's total energy consumption for space heating. Studies show this could be increased to 50% by 2050² and it is also estimated that the waste heat from power plants and industry in Europe would cover the entire European heat demand if it were collected in district heating systems³.

The potential is there. We just need to take action.

1. <http://www.lgi-consulting.com/sectors/>

2. <http://www.heatroadmap.eu>

3. <http://www.heatroadmap.eu>



WHY choose district heating?

- More efficient than an individual boiler
- Reduced local environmental impact
- Flexible, enabling use of waste heat and integration of renewable energy sources
- Fuel-flexible, ensuring secure supply of energy
- Safe and easy to use for consumers

DISTRICT HEATING ONLY WORKS IF IT'S INTEGRATED PROPERLY

At European level, district heating is now considered an existing and proven technology with great potential to support the EU targets for the energy sector, including decarbonisation.

For example, the waste heat from power generation, industry and other sectors must be transported and distributed wherever the demand is – which is what district heating is all about.

Fully unlocking the potential of district heating requires one overall system integrating the different energy sources – and thereby adding intelligence to urban energy communities.

Enter the era of smart cities.

HOW DO YOU MAKE A CITY SMART?

Smart cities represent total efficiency within all areas. Characterised by a holistic approach to their energy management, smart cities create integrated energy systems based on the synergies of electricity production, heating, cooling, and transport – and district energy is a crucial element in connecting the dots.

Smart district energy networks combine district heating and district cooling while at the same time integrating and balancing the fluctuating energy from renewables and waste heat as well as serving as thermal storage. This makes them a central smart city component and a prerequisite for optimal utilisation of low-carbon and renewable energy⁴.

EUROPEAN COMMISSION PUSHING FOR SUSTAINABLE HEATING AND COOLING

Through the EU's Energy Union, even more focus has been put on the energy sector and its role in achieving a more efficient use of energy resources as well as reducing pollution and CO2 emissions.

However, with European imports of gas and oil from Russia and the oil states amounting to approximately EUR 400 billion every year, security of supply is also a key driver of this development – in some countries perhaps even more so than sustainability.

Accordingly, the European Commission's Heating and Cooling Strategy⁵ published in February 2016, recognises the crucial role of district heating in the decarbonisation of European buildings, shifting to renewable energy as well as in realising a sustainable, independent, and secure supply of energy.



CLIMATE goals for 2030

Renewable energy accounted for almost 17% of heating and cooling in 2014⁶. As part of the EU's energy and climate goals for 2030, a renewable energy target of at least 40% has been set. A target of 36-39 improvement in energy efficiency has also been set⁷.

4. <https://euroheat.org/knowledge-hub/district-energy-explained.html>

5. https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v14.pdf

6. https://ec.europa.eu/commission/presscorner/detail/fr/MEMO_15_5181

7. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en

Can digitalisation turn sustainable business into profitable business?

Digitalisation is a key component of an integrated and efficient energy system where district heating is the natural cornerstone. It will not happen on its own but Danish experiences and European initiatives are showing that sustainable business and profitability don't necessarily need to be mutually exclusive.

Digitalising district heating will enable a greener, more integrated energy system utilising renewable energy sources and surplus heat to decarbonise the heating of buildings. But as it turns out, digitalisation is also simply good business.

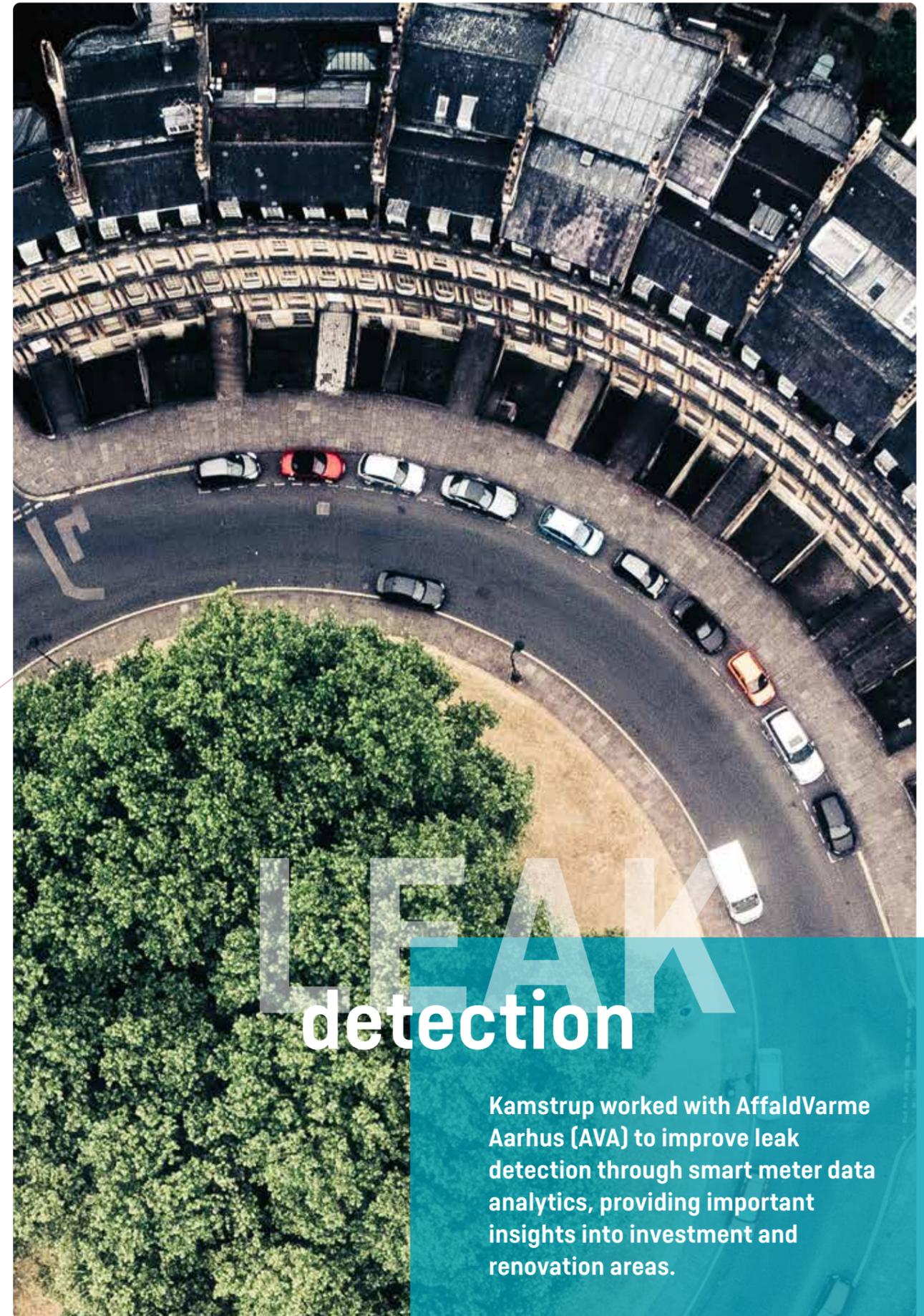
There is no shortcut to realising this potential – and it will not happen automatically. For district heating utilities, reaping the financial benefits of digitalisation is a process that begins with them investing both their time and money in digital tools that enable them to change the way they do things today.

REAL-TIME DATA TRUMPS THEORETICAL MODELS

Few will argue that optimising production and distribution based on real-time data is not more efficient than using theoretic models.

But for most utilities it is less obvious exactly where to save, how to save and how much can be saved – and that is a prerequisite for any investment. Closer collaboration between utility experts and technology providers is key to solving this challenge.

In an ongoing project with one of the world's biggest district heating utilities, AffaldVarme Aarhus (AVA), operations staff from the utility, therefore, work together with data specialists from Kamstrup to prove detailed business cases for areas where digitalisation is expected to hold financial value.



Kamstrup worked with AffaldVarme Aarhus (AVA) to improve leak detection through smart meter data analytics, providing important insights into investment and renovation areas.

WORKING TOGETHER TO TAKE ADVANTAGE OF DIGITALISATION

With its strong history in district heating, Denmark is amongst those leading the way for digitalising this sector. However, the potential is just as relevant in other district heating countries – and the digital movement is making headway fast.

At Kamstrup, we want to spark the dialogue about the many advantages of digitalising and implementing intelligent heat meters and remote reading to your distribution network. That's how we will be able to take advantage of the digital movement – by working together to understand the future possibilities, challenges, and potential of district heating.

1.3
billion euros

It is estimated that digitalisation can save the Danish utility sector between 360 million and 1.3 billion euros, by using data to reduce losses, increase operational efficiency and improve utilisation and maintenance of the distribution network.



Security of supply

District heating is currently undergoing rapid changes. There is huge potential in the sector, but this untapped potential also means that it is hard to predict the next developments. One thing is certain, however: district heating needs to become more energy efficient in order to remain competitive and ensure stability. Digitalisation is a key enabler of taking district heating to the next level – but what else will we look back on a decade from now?

3 district heating predictions for the 2020s

This decade looks set to be a decisive one when it comes to transitioning towards a greener energy future. District heating plays a key part of this transition and the sector is going through rapid changes these days – but which defining developments in district heating will we look back on at the end of the decade?

1. DEFINING LEGISLATIVE LEAPS

In recent years, legislation and regulation have evolved radically as sustainability and empowerment of consumers have become key focus points. One direct result is that we will look back on the decade as the one when the demand for remote reading of heat meters became effective with the revised EU Energy Efficiency Directive (EED). Another important piece of legislation is the requirement for individual metering and billing in multifamily residential with energy consumption exceeding 200 kWh/m².

What these two examples have in common is that they also represent a huge value-creation potential for district heating utilities, building owners and end users. But you need the right tools to turn your data into knowledge you can act on – which brings us to our second prediction.

2. FULL VALUE FROM METER DATA

Most Swedish utilities have already come a long way with remote meter reading, but many have yet to unfold the full value of the data they collect. In 2030, when we look back on the decade, we believe we will have tapped into the full potential of data thanks to the digital solutions that are available and allow data-driven optimisation of a utility's entire value chain.

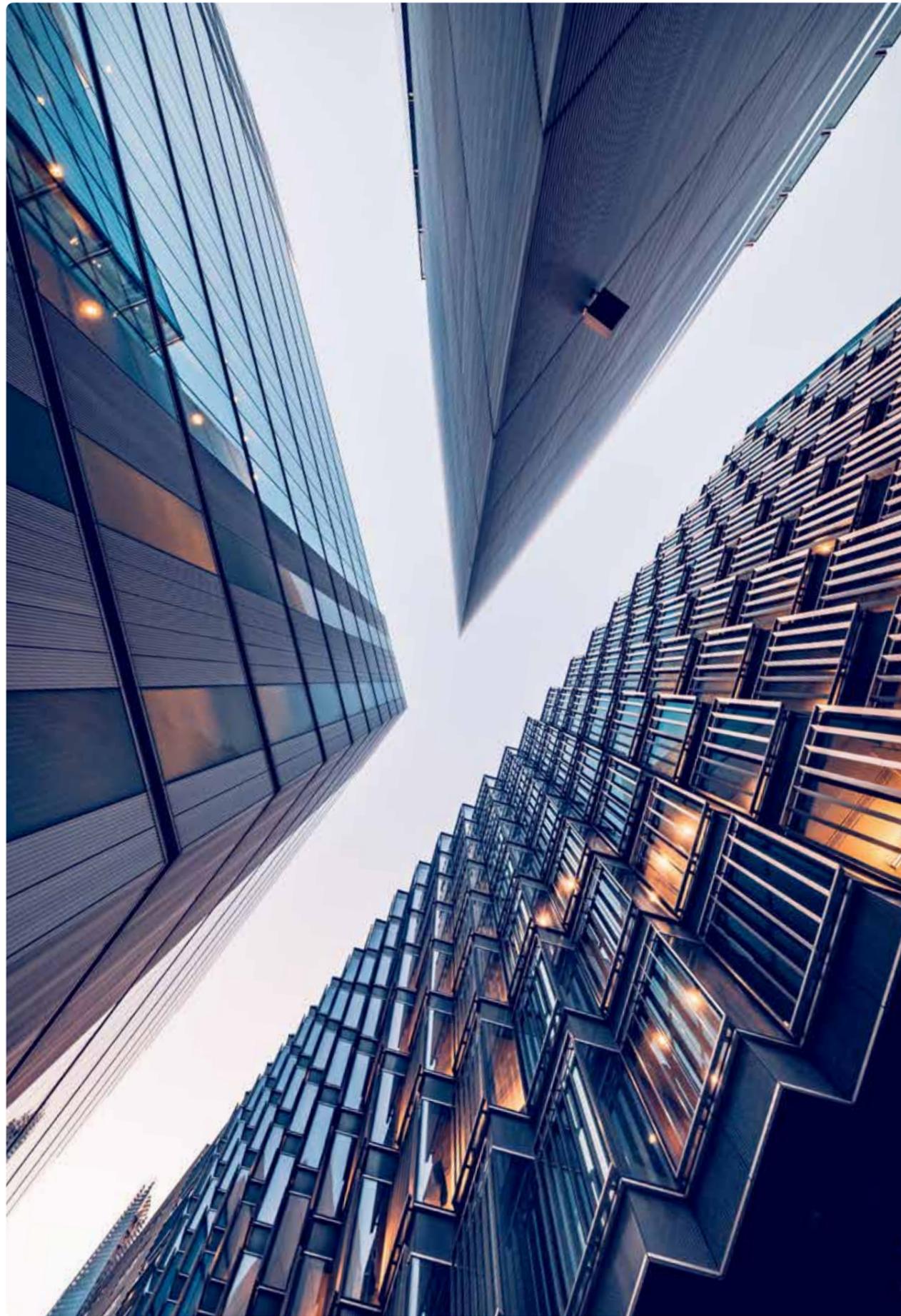
Tools like Kamstrup's Heat Intelligence, which combines smart meter data with facts about the pipes in the distribution network, create the transparency you need – both before and after your point of delivery. This enables you to lower forward and return temperatures, reduce network losses, improve asset management as well as integrate more waste heat and renewables. In this way, you can optimise your core tasks of producing and distributing heat and perhaps even explore new business opportunities. And this handily taps into our final prophecy.

3. A REDEFINED ROLE FOR SUPPLIERS

The ever-increasing complexity of a utility's reality is unlikely to have changed by 2030. We predict that we will see more and more utility professionals dedicate their efforts to doing what they do best and leave the rest to their suppliers.

This could range from the hosting of your metering system to the full operation including data collection and IT infrastructure compliance – or anything in between depending on your needs.

Time will tell if our predictions prove to be correct in 2030, but considering the development of the district heating industry over the last decade, it is difficult not to be optimistic about what can be accomplished in the coming years.



You need the right digital tools to **make** district heating smart

We are currently going from talking about the potential of digitalisation to showing the results it has generated. Many utilities have already come a long way with technologies such as remote meter reading. But the value of smart meter data is determined by how it is brought into play, which requires the right tools. One of these is Kamstrup's analytics platform, Heat Intelligence.

USING DATA TO CREATE TRANSPARENCY AND OPTIMISE OPERATIONS

Heat Intelligence helps district heating utilities optimise their distribution and operations. The tool combines smart meter data with facts about the pipe network (length, diameter, and type) to create a digital twin that can help maximise performance in the distribution network in relation to temperature, flow, and pressure levels.

This new level of transparency enables temperature optimisation, faster identification of heat loss and leaks and improved asset management – all with the purpose to ensure quality of delivery and create the right conditions for integration of waste heat and renewables.

SPENDING TIME ON WHAT CREATES REAL VALUE

We have a number of ongoing pilot projects with Swedish utilities to define their opportunities in using Heat Intelligence as a grid visualisation tool and the value of the detailed insight they can get from a digital twin of their distribution network.

Expected benefits include improved understanding of their network, being able to make more qualified decisions regarding cost-heavy renovation and investments and giving more people access to specialised knowledge to enable faster onboarding. This will result in lower temperatures, less heat loss, and more efficient operations – and allow utility professionals to spend their time on what creates the most value.

DATA THAT CAN HELP YOU STRENGTHEN YOUR WEAKEST LINKS

Several Danish utilities have already generated great results with Heat Intelligence. Aars District Heating has achieved a whole new level of network transparency now that they can monitor temperatures and flow all the way to and from each customer.

The tool is used as a daily operations tool as well as to find the network's weakest links and prioritising renovation efforts so that their asset management is now based on data.

It is clear that the district heating systems of the future will only become more complex. Having the necessary tools to understand and control your network will therefore only become more important. Fortunately, the breakthrough in digital solutions on the market today is a promising indicator of what utilities will be able to do in 2030.

AARS

District Heating

Heat Intelligence enabled Aars District Heating to go from around 200 bypasses to 16, lowering the forward temperature by 3°C and reducing annual heat loss by 7.8 MWh per consumer in one particular area.



4th generation district heating

We know that digitalisation has the power to change and shape the future of district heating. And we have a pretty good idea of what we want the future of district heating to look like. So how do we get there? Through continued innovation, increased flexibility – and a constant focus on sustainability. It won't be possible without getting consumers on board – but the good news is that district heating can benefit the planet while generating profits.

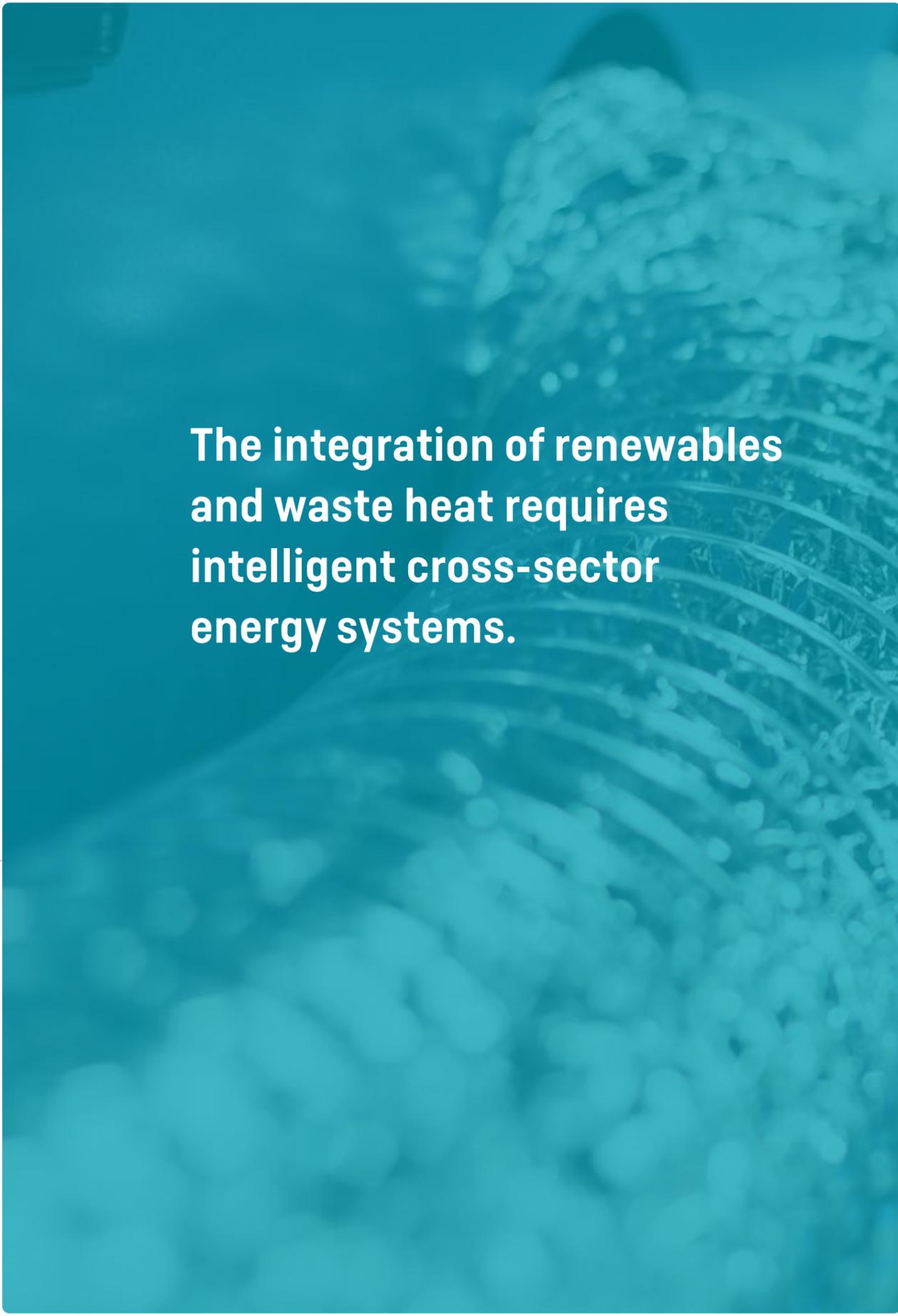
How do we make district heating more flexible?

District heating has the potential to be the cornerstone of a truly integrated energy system where demand adapts to the fluctuating production based on renewables and waste heat. But realising this potential will require a much higher degree of flexibility than we have today.

The integration of renewables and waste heat requires intelligent cross-sector energy systems. This places new demands on district heating utilities, as they will be dependent on an increasing number of production sources that fluctuate depending on factors such as power generation, industrial production, wind conditions and sunshine hours.

Imagine if you knew the weather forecast, the exact behaviour of your end users, and how individual buildings would perform under various weather conditions. Then imagine that you were also able to see the dynamics and the retention time in the distribution network.

This knowledge would enable you to make exactly the right decisions about your energy production and distribution for the upcoming operating hours. Unlike assumptions and theoretical models about things like the distribution system, this knowledge would be based on facts and what is actually going on in the network.



The integration of renewables and waste heat requires intelligent cross-sector energy systems.



MATCHING SUPPLY AND DEMAND WITH CHANGING ENERGY SOURCES

Utilities used to base their production on traditional forecasts. In other words, the better they were at predicting the consumption, the more efficient they were able to be.

In an integrated energy system, it will be the other way around. Here, heat production is based on multiple fluctuating energy sources resulting in a variable heat supply that must be matched with the demand from buildings and end users in the other end of the district heating system.

Getting the whole system to balance and interplay efficiently increases the need for flexibility throughout the entire value chain. This necessitates adding to the mix the energy performance of buildings as well as involving end users much more than they are today.

TECHNOLOGY CANNOT SAVE ENERGY IF PEOPLE DON'T SAVE ENERGY

Boosting the energy efficiency of buildings is critical because the gains from optimisations in the distribution system will often depend on how the buildings perform under different conditions.

This may be in relation to both the building envelope and the technical heat installation. Additionally, buildings can potentially act as thermal storage capacity in the network.

Also, energy consumption and peak demands are still closely connected to the behaviour of end users. Easing their access to knowledge about their consumption and behaviour will enable them to better understand their energy use and take an active part in saving energy and utilising it optimally.

THE IDEAL ENERGY SYSTEM IS BOTH SMART AND FLEXIBLE

The intelligent and integrated energy system focuses on high energy efficiency in order to reduce energy waste. This involves utilising the available energy sources as efficiently and sustainably as possible while creating the ideal circumstances for integrating renewables.

The district heating networks are used to link the available heat sources with the heat demand from buildings and end users.

The challenge for district heating utilities will be to balance the electricity systems while at the same time utilising waste heat from industries and integrating as much renewable energy as possible. This requires running production close to the limit and lowering distribution temperatures, making it even more crucial to continuously manage and optimise their production and distribution network decisions.

Utilities must constantly be able to assess the current conditions to decide if, for example, they should start the heat pump, or if it would make more sense to get their heat from Combined Heat and Power production (CHP) or for example solar.

If that can be achieved, district heating will have come a long way.



BOOST

the efficiency

By lowering return temperatures in the network, district heating utilities not only reduce energy waste but also boost the efficiency of their production based on renewables.

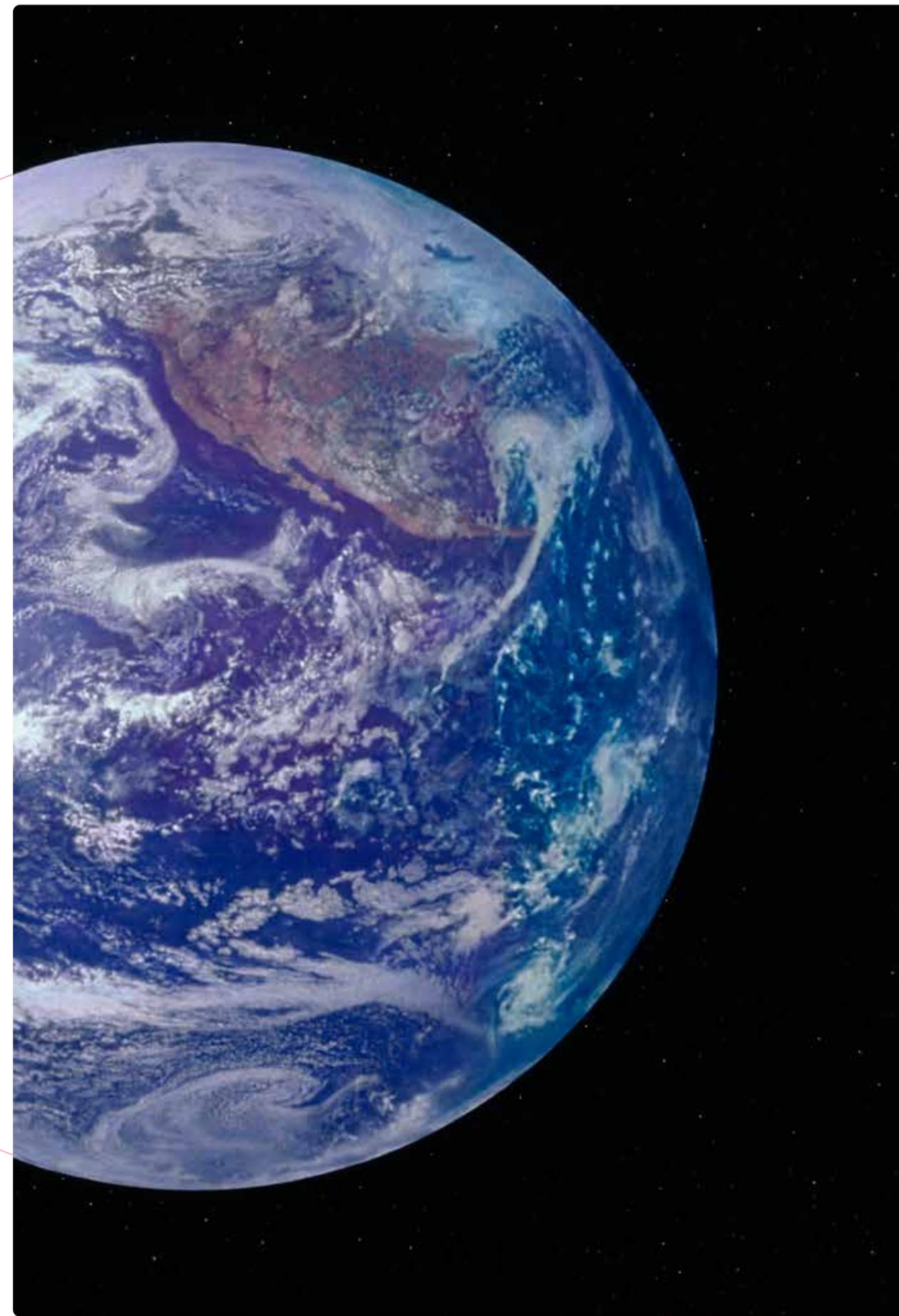
Digitalising district heating for the planet, people and profit

District heating holds the potential to help the world move towards decarbonisation. If we add in digitalisation, we are well on track for a sustainable energy future. But best of all? Digitalising district heating might make it easier to connect with consumers – and it is also simply good business.

District heating provides the flexibility that is necessary to integrate, utilise and store waste heat and fluctuating energy from renewables, ultimately increasing the efficiency of the entire energy system.

Unleashing the potential in district heating, however, will require significant growth of a sector that simultaneously needs to balance increased sustainability and efficiency with profitability, competitiveness, and attractiveness to end users.

That is a challenge that is exactly as complicated as it sounds. Digitalisation is a key part of the solution because it gives district energy providers the transparency and overview they need to navigate in systems that are becoming more and more complex.



DATA MEANS OPTIMISATION – AND FAST RETURN-ON- INVESTMENT

We have seen examples of district energy providers reducing network losses by as much as 12% and lowering temperatures by up to 10 degrees while still providing sufficient heating to consumers – all from optimisation based on smart meter data. Results like these mean that the return-on-investment period for smart metering solutions is 7-8 years, which is short compared to other investment horizons in the district energy sector.

Nevertheless, despite all of its potential, digitalisation in district heating will not happen automatically. It will require the joint efforts and high ambitions of technology suppliers, industry players, legislators and, most importantly, district energy providers themselves that need to learn how to get the most out of cutting-edge technology that can bring available data into play. This will pave the way for digital district energy providers with bottom lines that are as green as they are black, ultimately also benefitting consumers and society alike.

REAL-TIME DECISIONS REQUIRE REAL-TIME DATA

As district heating continues to evolve on its way towards the 4th generation of the sector, it is no longer good enough to realise tomorrow what you should have done today. Real-time decisions require real-time data. Essentially, digitalisation of district heating is about connecting the need for increased efficiency and optimisation with the opportunities made available by recent technological developments.

Frequent data from intelligent meters and sensors form the very foundation for the digital district energy provider while automated meter reading systems and advanced analytics enable the monitoring, analysis and planning necessary in the near future. And with the revised Energy Efficiency Directive (EED), the requirement to install only remotely read energy meters that can deliver frequent data is now here.

Digitalisation in district heating will not happen automatically. It will require the joint efforts and high ambitions of technology suppliers, industry players, legislators and, most importantly, district energy providers.

WHO WOULDN'T WANT AN ENERGY BILL BASED ON ACTUAL CONSUMPTION?

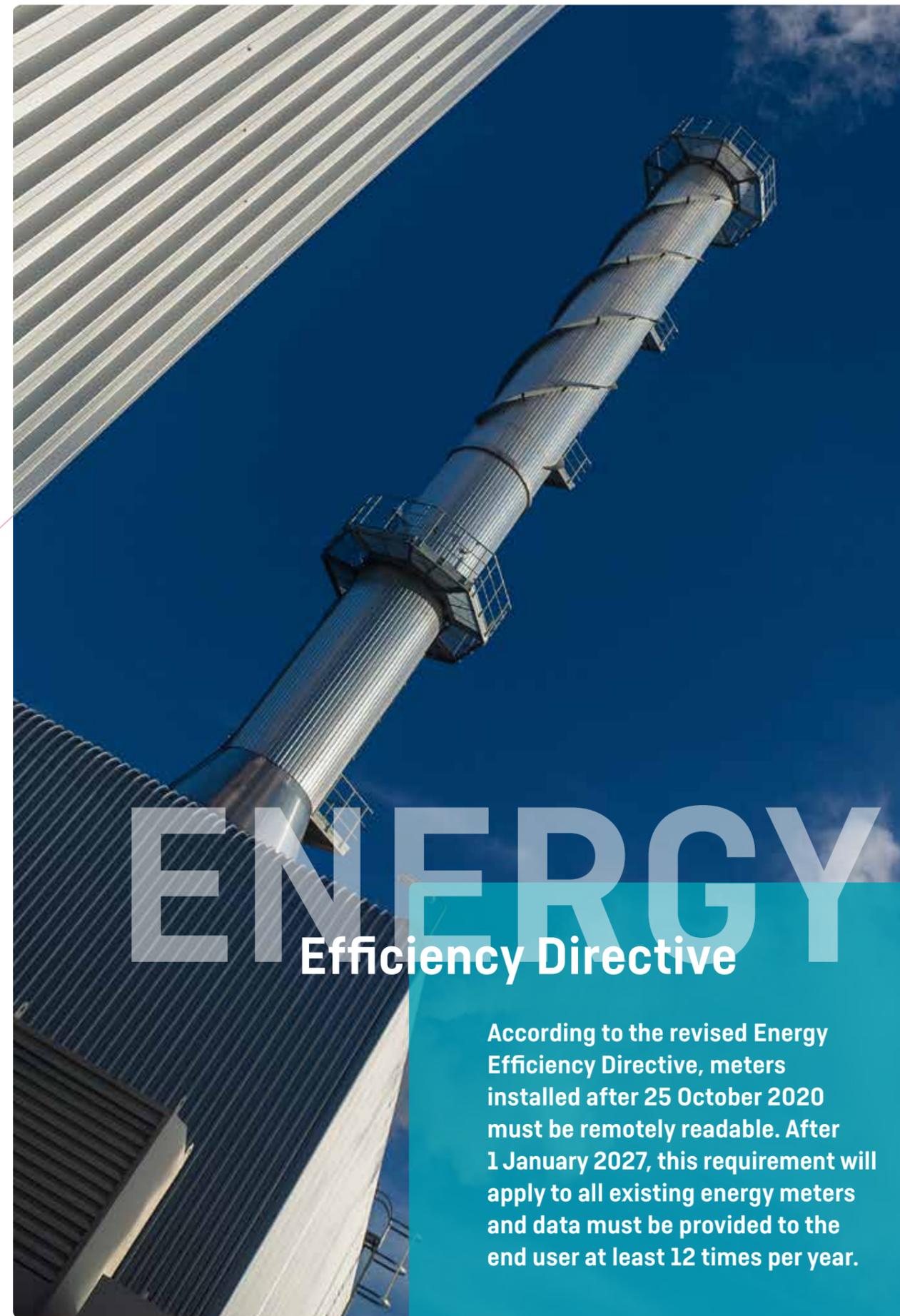
Clear and timely information as well as energy bills based on actual consumption empower consumers to play an active part in reducing our energy needs. In 2018, the EED was therefore updated as part of the Clean Energy Package. One of the aims of this update was to clarify and strengthen the rules concerning metering and billing for heating and cooling. This was a natural step because energy efficiency in buildings is crucial to achieving the ambitious EU target of at least 32.5% energy savings by 2030.

The adaptation of the EED is a clear sign that the European Union is committed to developing a sustainable, competitive, secure, and decarbonised energy system. However, while its original driver was empowerment of consumers, there are also clear benefits to be reaped by district energy providers ready to embrace the digital transformation that smart metering prompts. It is critical to bring focus to this potential, not least by ensuring that the legislative framework is available for district energy providers to utilise frequent meter data to attack the highly complex challenges facing the sector.

MAKING DISTRICT HEATING SMART IS SIMPLY SMART

Once the meters are installed, the additional expense for a district energy provider to collect daily or even hourly data is minimal compared to the added value from adopting a more holistic digitalisation approach to its entire value chain.

First of all, smart metering provides the basis for district energy providers to make fact-based decisions related to their core tasks of producing and distributing district heating. These include optimising the production and forward temperature to run closer to the limit, detecting losses in the distribution network as well as identifying improvement opportunities for building performance and consumer behaviour. This is all also crucial to achieving the right conditions and low temperatures to integrate more waste heat and renewable energy.



ENERGY

Efficiency Directive

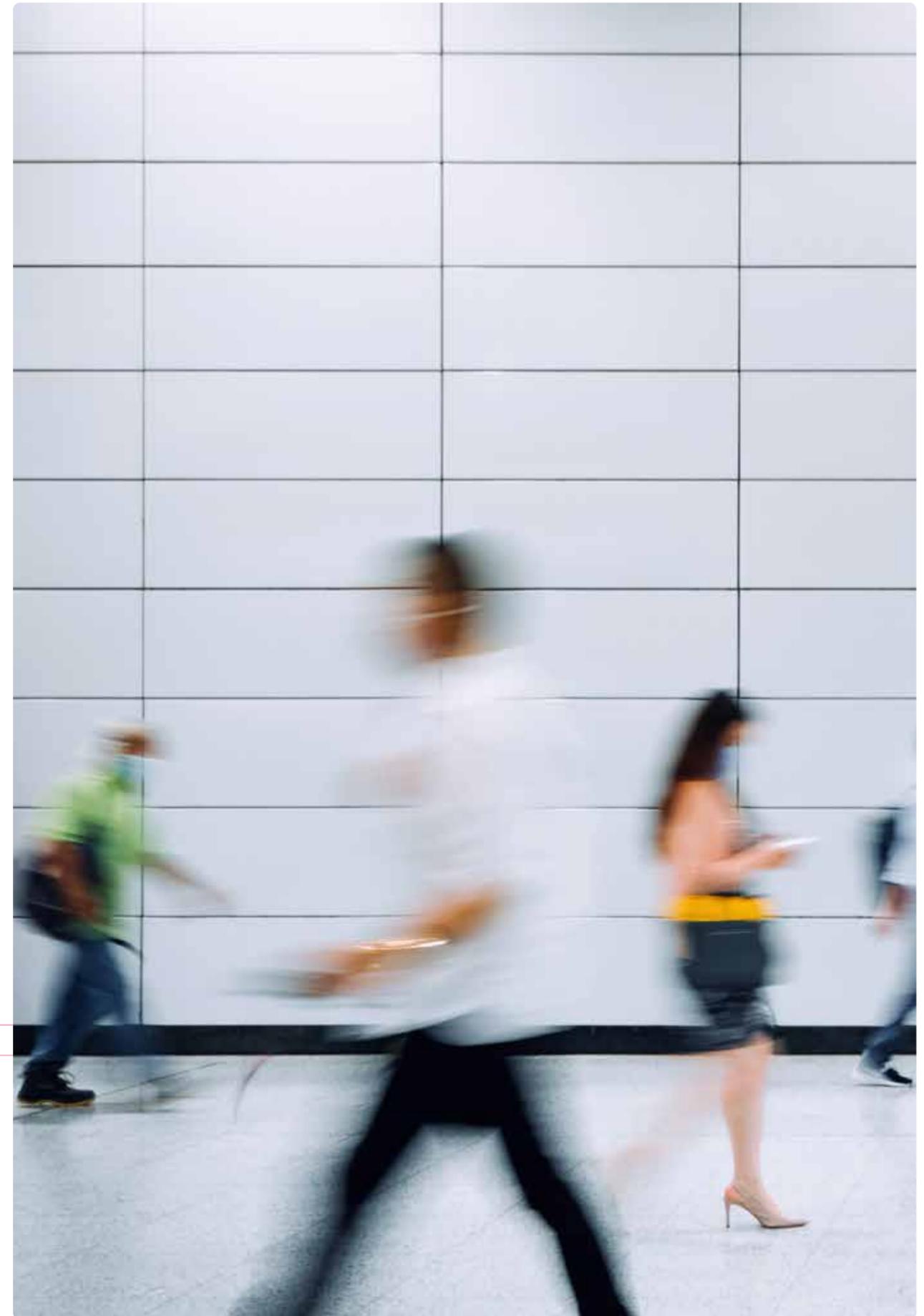
According to the revised Energy Efficiency Directive, meters installed after 25 October 2020 must be remotely readable. After 1 January 2027, this requirement will apply to all existing energy meters and data must be provided to the end user at least 12 times per year.

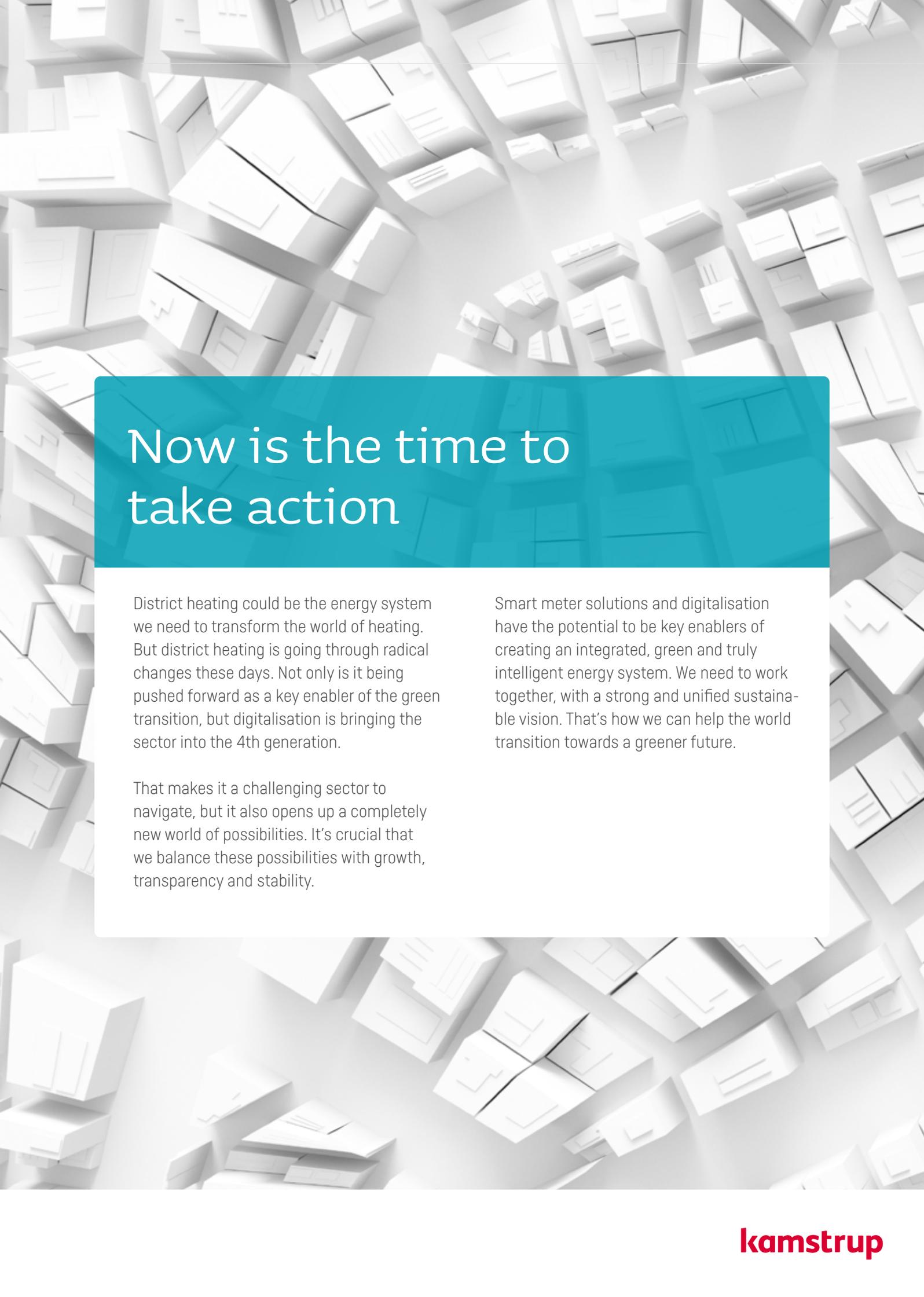
CONSUMERS WANT TO BE PART OF THE SUSTAINABLE ENERGY STORY

Frequent meter data – as opposed to theoretic models – enables district energy providers to monitor the performance of the underground pipes that make up the distribution network. Combined with innovative analytics solutions already available in the market, this allows better utilisation and renovation planning of existing assets so that they may avoid or defer some heavy investments in this area.

Being able to compare the actual network load and capacity to its design criteria will also reveal how well they match. In this way, district energy providers can both extend the current infrastructure's lifetime and optimise dimensioning of new networks to avoid expensive oversizing.

Finally, smart metering enhances end-user involvement. District heating is often misconceived as old-fashioned, monopolistic, and fossil-fuelled, but digitalisation can help district energy providers make it more attractive to consumers. This could include offering targeted services like billing based on flexibility, or taking responsibility for the heat installation, but also by emphasising how it utilises waste heat from local supermarkets to heat up homes in the community. In this way, end users become part of the shared story of a sustainable energy system.





Now is the time to take action

District heating could be the energy system we need to transform the world of heating. But district heating is going through radical changes these days. Not only is it being pushed forward as a key enabler of the green transition, but digitalisation is bringing the sector into the 4th generation.

That makes it a challenging sector to navigate, but it also opens up a completely new world of possibilities. It's crucial that we balance these possibilities with growth, transparency and stability.

Smart meter solutions and digitalisation have the potential to be key enablers of creating an integrated, green and truly intelligent energy system. We need to work together, with a strong and unified sustainable vision. That's how we can help the world transition towards a greener future.