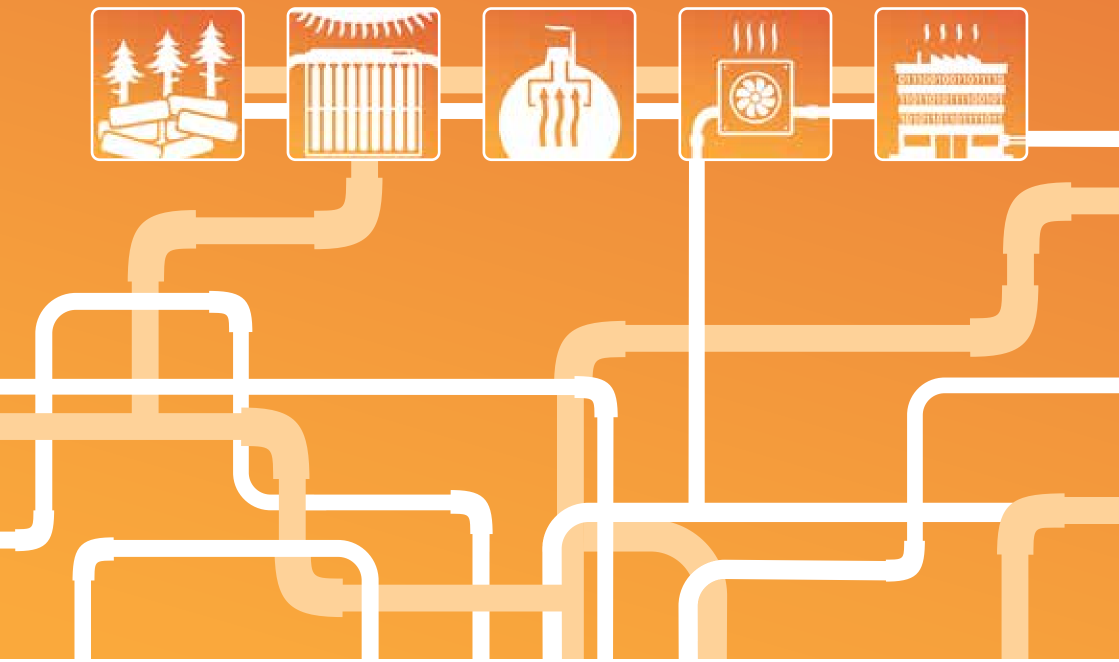
Cool ideas for hot solutions to

KEEPING OUR CITIES SUSTAINABLY WARM

Facilitating a switch towards sustainable district heating



Foreword

This guidance document has been created as a means of helping you navigate some of the key issues involved in **upgrading your district heating** (DH) by using more sustainable energy sources, namely from a variety of viable renewable energy sources and/or excess heat harvestable from industrial/commercial processes.

Integrating and fully-switching to these **greener DH alternatives** makes sense not only at an operational level, but is greatly supportive, if not essential, for the successful implementation of a variety of Europe's flagship policy initiatives, such as:

- Thoroughly reinforcing political ambitions, particularly the **European Green Deal**'s goal of decarbonised energy, climate action and circular economy;

- Deliberately **tackling environmental challenges**, specifically improving air quality and contributing to the Paris Agreement and climate neutrality by 2050;

- Meaningfully **dealing with social implications**, principally addressing energy poverty and guiding regions phasing out all fossil fuels via a "Just Transition"; and

- Systematically fostering **regional Smart Specialisation** added-value chains and economic (co-)benefits deriving from local job creation and holistic resilience.

It should also be noted that, even though this brochure focuses on heat supply-side options for switching energy sources, this does not negate any simultaneous need for on-the-ground efficiency as well – it is not an "either/or" pathway. Demand-side improvements (e.g. aligned with the EU's "Renovation Wave" for buildings) and retrofits to make DH systems more efficient both represent viable, complementary solutions to sustainable energy generation. In fact, such a multi-pronged approach ensures that (particularly central and eastern) Europe's DH systems truly transform into the even more effective, reliable, affordable and sustainable service-providers they can and must become.

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Why switch to sustainable energy systems?

Though most often talked about in terms of its great advantages for fighting against climate change, sustainable energy technologies using renewable energy (RE) and excess heat (ExH) sources stimulate **multiple benefits unmatched by fossil fuels**. Read on to find out more how and why we should all take advantage of these better alternatives for district heating (DH) today!

- The most talked-about reason might be their unbeatable potential to contribute to **drastically reducing greenhouse gas emissions to zero** – this is something we all should care about, from public authorities fulfilling political goals to businesses profiting through responsible practices, to customers demanding greener services.
- Beyond CO_2, it is also about **decreasing pollution** overall, since a switch from fossil fuels to sustainable energies can drastically reduce harmful environmental pollutants like SO_2, NO_x, particulates, etc., which means great improvements to everyone's quality of life, more resilient ecosystems and the avoidance of massive healthcare costs* from burning fossil fuels.
- A switch to more DH based on nearby sustainable sources is also a key step towards **putting circular economic principles into practice** and directly resolving systematic inefficiencies in the energy sector. The integration of RE/ExH is not just a key energy efficiency (EE) measure in itself, but also

ensures that local resources are used cost-effectively, which then helps drive further innovations for the growth of competitive economies.

- While the (heavily-subsidised) fossil fuel industry is usually very mechanised and capital-intensive, the energy efficiency (EE)/RE industry relies more on skilled labour. This avoidance of locked-in costs for such heavy infrastructure means that **a DH system strongly emphasising EE/RE means more local employment opportunities** which benefit rural and urban regions alike and offer well-paid jobs for cutting-edge specialisations.

- On the financial side, it is worth remembering that RE and ExH generate their benefits to your DH company at very **low operating costs**. Most RE sources entirely avoid the need to purchase fuels at all, while ExH essentially is just an unused by-product of other processes. Therefore, the added value gained from harvesting any of these untapped resources for heating purposes should come at relatively minimal additional costs to DH companies or their customers (eventually even reducing energy poverty).

- Moreover, since RE sources are generally **inexhaustible resources** and ExH processes are likely to continue anyway, these sustainable options can offer quite **stable prices** and maybe even new revenue streams for local businesses. The result of these complementary energies is a **reliability of service** and **resilience of operations** without equal from traditional DH fuels.

Image: Pikrepo

* For example, the health impacts from burning coal in Europe are estimated to cost European public authorities and individuals at least €42.8 billion per year.

Decarbonisation – why does it make business sense?

Even though they are essentially providing a crucial service to the public, it must be remembered that district heating (DH) companies are businesses. In support of this perspective, it is valuable to realise that renewable energy (RE) and excess heat (ExH) options have distinct **financial advantages over fossil fuels**:

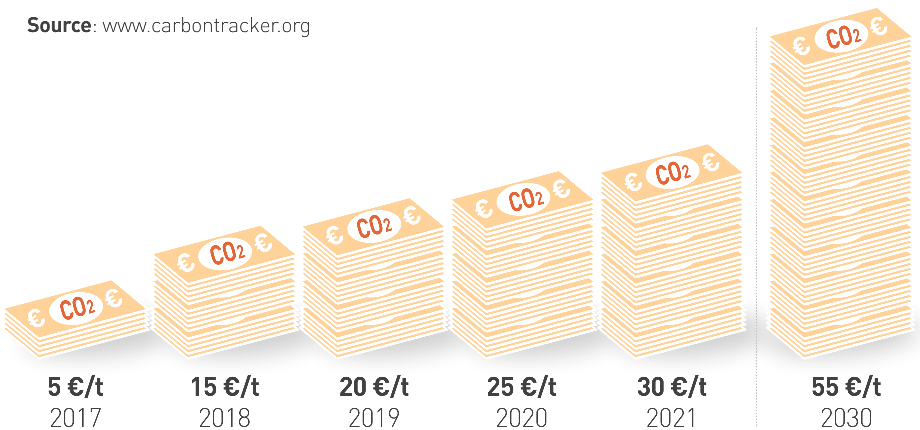
- Very reasonable payback periods;
- Typically, lower costs, especially for running operational and maintenance;
- Cost-efficient customisation and upgrades enabled by modular technologies;
- Stable, low-/no-cost of RE and ExH resources available locally;
- Fossil fuel prices increasing in the long-term due to diminishing reserves, rising extraction costs and accelerating EU carbon allowance prices.

Such factors and market trends reveal the inherent **competitiveness of DH based on cost-effective sustainable energies**.

Additionally, DH systems relying on fossil fuels should consider the clear financial ramifications larger political and investment trends of numerous progressive (both) which are beginning to re-balance Europe's

EU carbon allowance price acceleration

Source: www.carbontracker.org



markets away from fossil fuels. Your bottom line for existing operations could be impacted by **subsidies removed from fossil fuels**, as well any mandated internalisation of hidden costs from coal, natural gas and oil (e.g. delayed economic growth/innovation, degraded public health and polluted air, water, soil and ecosystems). At the same time, many banks are also consciously making more **restrictive loans for fossil fuels** (especially coal), making it even more likely that any further investments into them are a losing bet.

Meanwhile, as the obvious benefits of greener energy sources become more apparent, these same **decision-makers are deliberately stimulating the growth of RE and ExH**. Local to national public authorities are making green-DH core elements of their energy action plans and setting up dedicated budget lines to ensure achievement. Meanwhile, public and private investors are mandating sustainability as a key prerequisite for funding projects. This means that RE and ExH will get the financial green light for DH while it becomes more difficult to fund investments for fossil-fuelled DH.

Therefore, you should definitely take advantage now of this new dynamic by embracing these political and market trends as an inspiration to upgrade your DH to RE and/or ExH. Front-running DH companies should not miss out on these opportunities – **the time to join the ranks of effective, profitable and decarbonised DH is today**!

How do sustainable energy sources stack up against coal, oil and gas?

For anyone wishing to switch over to sustainable energy sources, it is of course highly useful to know more broadly how to compare district heating (DH) systems currently burning fossil fuels to those exploiting **local renewable energy (RE) and excess heat (ExH) sources to keep us warm** far into the future.

Here* you can find some details of the most important information about fossil fuels, which you can then compare to major RE and ExH sources on the following pages to reveal the variety of benefits that you can gain from a switch to greener DH.

- Technical characteristics are essential to know how **particular sustainable energy sources can improve DH operations**, and therefore is a crucial perspective for DH staff and relevant planners to keep in mind when upgrading to sustainable energy systems.

- Financial costs, like upfront capital and operation/maintenance (O&M) expenses, should be core criteria in any decisions made by DH companies instituting a switch, but also market trends like the effects of **carbon prices**. Furthermore, they are also fundamental data points for any funders building up a greener portfolio reinforcing the **energy transition through cost-effective, profitable investments**.

- Environmental considerations, as emphasised at the start, should be important to everyone, but are particularly valuable to public authorities and policy-makers to know that **RE/ExH-DH contributes greatly to climate goals** by modernising one of Europe's largest energy sectors. Also, as mentioned in the previous chapter, **sustainability is becoming a key benchmark for funding** projects, and therefore poses a financial roadblock to reliance on fossil fuels.

- Socio-economic factors are increasingly vital for decision-making, especially among public authorities and policy-makers, because they reveal some of the **economic and societal benefits of sustainable energies** on the ground, be it advantages in facilitating regional transitions away from fossil fuel dependence, **job-creation** or even their positive effects of green-DH on affordability and energy poverty.

COAL

- *Plant capacities*: **1-100 MW**
- *Upfront costs*: **1.2-2.8 M€/MWe**
- *O&M costs*: **1.5%** of investment
  + **3 €/MWh** variable (fuel) costs
- *GHG emissions*: **320-400 kg/MWh**
- *CO_2 price for energy generation*:
  ~8-10 €/MWh
  (~17-22 €/MWh by 2030)*
- *Jobs in EU*: **1.01/MW**

NATURAL GAS

- *Plant capacities*: **0.5-20 MW**
- *Upfront costs*: **0.5 M€/MW**
- *O&M costs*: **3%** of investment
  + **40-60 €/MWh** variable (fuel) costs
- *GHG emissions*: **180-220 kg/MWh**
- *CO_2 price for energy generation*:
  ~4.5-5.5 €/MWh
  (~10-12 €/MWh by 2030)*
- *Jobs in EU*: **0.95/MW**

HEATING OIL

- *Plant capacities*: **0.5-25 MW**
- *Upfront costs*: **0.5 M€/MW**
- *O&M costs*: **2-5%** of investment
  + **highly volatile** variable (fuel) costs
- *GHG emissions*: **250 kg/MWh**
- *CO_2 price for energy generation*:
  ~6 €/MWh (~14 €/MWh by 2030)*

* Own approximation combining 2020 EU carbon allowance prices and GHG emissions: 25 €/t × (__ kg/MWh × 0.001 t/kg) – the second values given above use instead 55 €/t, which is the carbon allowance price foreseen for 2030.

Biomass

Within the district heating (DH) context, biomass exploitation remains one of the most versatile renewable energy (RE) options out there, useful directly in boilers and/or combined heat and power (CHP) plants. It takes advantage of **agricultural and wood residues** (e.g. pellets or chips) under controlled burning conditions to generate heat (and even electricity through CHP) with **limited environmental impacts**.

Although it is the only RE source to require an actual fuel for burning, whose availability is one of its key limiting factors to consider, in case of a sufficient and sustainable supply, biomass presents a very effective way of **achieving DH with 100% RE**. Furthermore, it is potentially the RE source with lowest upfront and long-term costs and can be adapted to supply a heat load fitting most local needs. Although if not sustainably harvested, then the fuels can be of diminished environmental benefit, at least the overall greenhouse gas (GHG) **emissions are essentially zero**, especially if the biomass fuel is sourced locally (ideally within 30-40 km to support the regional economy).

Image: Flickr / CC

Technical characteristics:

- *Plant capacities*: **1-50 MW**, 65-95% thermal efficiency
- *Supply temperature*: **80-140°C**
- *Resource needs*: **270 kg/MWh pellets** or **380 kg/MWh chips**, assuming 75% DHS efficiency
- *Technical prerequisites*: **Fuel storage space** (roughly double or more than for coal); **Rebuilt plant** from fossil fuel to accommodate biomass
- *DHS suitability*: **best with modern** (prefabricated) **or low-temp DHS**, not really suitable for steam or older hot-water DH
- *Operations*: **up to 100% biomass** share of DH can be very effective, but also works well in **combination with any other sustainable energy** source, usually to supply the **base-load**

Financial data:

- *Upfront costs*: **0.3-0.7 M€/MW**
- *O&M costs*: **1.8-3%** of investment
- *Payback period*: **3-13 years**
- *Jobs*: **0.78–2.84/MW**

Stakeholder engagement:

Beyond the general stakeholders and their roles mentioned near the end of this document, and providers of needed technologies, biomass requires special involvement with:

- **Local/regional/national public authorities** - should ensure suitable infrastructure network (e.g. forest roads) is in place and provide oversight on the sustainability of forestry/agriculture practices, as well as ensure compliance with air emission standards and pollution limits
- **Pellet/chip suppliers** - key partner to guarantee fuel supply and quality
- **Forestry/agriculture experts** - useful for understanding fuel availability and sustainability

Greenhouse gas emissions: **0 kg/MWh**

Even if including the transport of biomass fuel as well, though this usually counts as transport instead of energy generation, the entire biomass cycle still only releases 30 kg/MWh.

Solar thermal

Solar thermal district heating (DH) relies on **pure sunshine** and therefore remains one of the most desirable options for green thermal energy, since it is a resource sufficiently **available everywhere**, based on solar irradiance levels at a given location. Solar thermal systems typically deploy a field of collectors, but also decentralised (i.e. on the roofs/walls of buildings) are effective as well. Most collectors utilise vacuum-tube panels to convert sunlight efficiently into heat transferrable into a DH system (DHS). Their **modularity** allows for the expansion or reduction of capacities as needed, without much down-time of operations, making solar thermal a highly **flexible** option to match your needs into the long term.

Ideally **paired with thermal-energy storage** (including seasonal storage) for maximum efficiency, it can also **supplement other sustainable heat generation** capacities well. In either case, solar thermal definitely can help ensure that all your heating needs are met, even with strong potential during periods of lower sunshine.

Although the upfront costs might seem to be too high, especially when you invest in thermal storage, its running costs remain very low. You will end up with a robust system of very high efficiency, particularly when you have a low-temp (≤ 100°C) DH. Since solar thermal energy does not require any fuel and therefore is a process without any greenhouse gases (GHG) emissions at all, it means that **solar-DH is a brilliant investment**.

Image: Wikimedia / Chixoy

Technical characteristics:

- *Plant capacities*: **modular to fit your needs** - 110 MW is the largest so far, but the only real limits are your heat demands and available space
- *Supply temperature*: **40-180°C**
- *Resource needs*: **solar collectors function well even with normal levels of solar irradiance**, depending on type of solar collectors; as solar collectors are a plug-in technology, larger fields have lower heat losses
- *Technical prerequisites*: short term or seasonal **thermal storage to increase the efficiency** and solar fraction, but also effective without storage
- *DH suitability*: **best with modern** (prefabricated) **or low-temp DH**, or in certain older hot water DHSs (e.g. domestic hot water in summer or <90°C space heating), but not really suitable for steam DH
- *Operations*: **20-50% solar fraction** of DH can be very effective, but also works well in combination with any other sustainable energy source

Greenhouse gas emissions: **0 kg/MWh**

Solar thermal has no GHGs of its own.

Stakeholder engagement:

Beyond the general stakeholders and their roles mentioned near the end of this booklet, and providers of needed technologies, solar thermal requires special involvement with:

- **Local/regional/national public authorities** - necessary for making public land/buildings available for installing solar collectors
- **Land/building owners and developers** - key for making (private) land/buildings available for installing solar collectors
- **Solar energy experts** - for ensuring ideal solar-resource conditions for exploitation through suitable technologies

Financial data:

- *Upfront costs*: **200-500 €/m²**, with ground-installations being less expensive, as well as those integrated into more advanced DHSs
- *O&M costs*: **1 - 3 €/MWh**
- *Payback period*: **6-15 years**
- *Jobs*: **0.81/MW**

Geothermal

Geothermal installations harvest energy from the **natural heat right under our feet**. The ground has a natural tendency to store heat regardless of above-ground seasons and actually becomes warmer the deeper you go due to geophysical processes. From a district heating (DH) perspective, **usable heat even at shallow depths** underground are adequate for heat production, while deeper installations can yield even stronger potential for exploitation. In either case, naturally-occurring water reservoirs and rock porosity underground can help ensure that heat efficiently flows upwards into your DH.

Other than the fact that geothermal **requires no fuel** at all, and has **very low greenhouse gas** (GHG) emissions only from those occurring naturally from certain underground processes, a distinct advantage of this source is that, like solar thermal, it is theoretically **available everywhere**. All around (central and eastern) Europe there is exploitable geothermal potential below the surface with sufficient potential for DH purposes. Of course, if you are an area with even stronger temperature gradients particularly suited to geothermal exploitation (including even higher efficiencies through cogeneration applications), then you really have no excuse for not tapping into this ground-breaking resource.

Image: Pxhere / CC

Technical characteristics:

- *Plant capacities*: **1-50 MW**
- *Supply temperature*: **around 80-100°C**
- *Resource needs*: **>50°C enthalpy at 1-3 km deep**, ideally >90 mW/m^2 heat-flow density
- *Technical prerequisites*: for DH purposes, only **moderate drilling depths** should suffice
- *DH suitability*: **best with modern** (prefabricated) **or low-temp DH**, not as much for older hot-water DH, and not really suitable for steam DH
- *Operations*: works well **in combination with any other sustainable energy** source to supply the base-load

Financial data:

- *Upfront costs*: **0.7-1.9 M€/MW**, most of which is usually for drilling costs and completion of wells
- *O&M costs*: **2.5%** of investment
- *Payback period*: **5-10 years**
- *Jobs*: **1.7MW**

Stakeholder engagement:

Beyond the general stakeholders and their roles mentioned near the end of this document, and providers of needed technologies, geothermal requires special involvement with:

- **Local/regional/national public authorities** - necessary for issuing drilling permits and facilitating land-rights issues
- **Land owners/developers** - key for making (private) land available for geothermal exploitation
- **Geology/drilling experts** - for ensuring ideal geothermal conditions (e.g. rock types, thermoclines, water flow…)

Greenhouse gas emissions:
0-10 kg/MWh

The upper value takes into account the entire geothermal process, but otherwise geothermal frequently is just considered to be **emission-free**.

Heat Pumps

Normally heat travels on its own from warm to cold, but a heat pump reverses this process with a relatively small external energy-input (i.e. electricity or excess heat – ExH) to generate a larger amount of thermal energy, through the "magic" of thermodynamics. The other key ingredients are to deliver the output energy to have a heat sink, meaning your district heating (DH) network, with a higher temperature than your residual- or environment-based heat source, the former usually being ExH and the latter typically ground, water or air.

Heat pumps are already quite common as decentralised units for (modern) individual buildings, but are also gaining steam as a **viable technology for DH**. Electric heat pumps are among the most common, and very efficiently convert a small amount of mechanical-electrical energy into a larger amount of thermal energy via vapour-compression processes (essentially functioning like an inside-out refrigerator) – this also means their greenhouse gas (GHG) emissions depend on the electricity mix being used. Though not quite as efficient, absorption heat pumps get their external energy-input from already-existing ExH processes, instead of electricity, means that they actually end up as **more cost-effective**, not to mention can also be considered **emission-free**. Whichever type you find more practical for your own needs, be assured that this mature technology is ripe for pumping profits into your DH.

Image: LETA / Ieva Luka

Technical characteristics:

- *Plant capacities*: **1-10 MW** (electric); **2-15 MW** (absorption); ~**2-7 COP*** values' range depends on source-type and temperature
- *Supply temperature*: **70-100°C** (lower supply temperatures result in a higher COP)
- *Resource needs*: **residual heat source**, from the environment or ExH processes
- *DH suitability*: **best with low-temp DH**, possible with some modern (prefabricated) DH, but not really suitable for steam or older hot-water DH
- *Operations*: works best to supply the **base-load** in **combination with any other sustainable energy** source for the peaks

Financial data:

- *Upfront costs*: **0.45–0.85 M€/MW** (electric), **0.35–0.5 M€/MW** (absorption)
- *O&M costs*: **2-3%** of investment
- *Payback period*: **8-9 years** (ground source)

Stakeholder engagement:

Beyond the general stakeholders and their roles mentioned near the end of this booklet, and providers of needed technologies, heat pumps require special involvement with:

- **Local/regional/national public authorities** - necessary for issuing drilling/environmental permits and facilitating land-rights issues (mainly important for ground- or water-sourced heat pumps)
- **ExH providers** - key for supplying ExH (from e.g. industrial/commercial processes, sewage treatment, thermal storage, district cooling, etc.) to an absorption heat pump

Greenhouse gas emissions: **0 kg/MWh**

Absorption heat pumps produce no additional GHGs of their own. Electric ones produce none locally, but overall emission cuts seem to range from 31-88%, depending on the electricity mix.

* COP = Coefficient of performance

Excess Heat

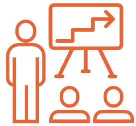
ExH can be an excellent resource to harvest for DH, by simply taking advantage of **surplus heat resulting from existing industrial and commercial processes**. The idea, put very simply, is to attempt to **recycle and recover wasted energy** from other processes whose main purpose is not even to generate thermal energy. To some degree, CHP plants or even waste-incinerators can be considered as ExH sources, but for our purposes we prefer to focus more on tapping into non-energetic activities for ExH.

One of the huge advantages of integrating ExH into DH is the diversity of countless viable ExH sources, above all in urbanised areas where DH makes the most sense anyway, such as various industrial facilities (e.g. factories or paper mills) or commercial activities (e.g. sewage treatment, underground metros or data centres). The beauty of harvesting ExH is that these processes happen anyway, and any heat recovery is a way of **increasing system-wide efficiency and cost-effectiveness**. Furthermore, because the GHGs produced by their manufacturing, transport, etc. are already counted for those activities, DH based on ExH is **considered to be emission-free**. Therefore, it should be clear that your DH accessing others' excess is a smart investment to make.

Image: Pxhere / CC

Technical characteristics:

- *Supply temperature*: **higher-temperature** ExH makes DH more (cost-)efficient
- *Technical prerequisites*: via **heat exchangers** exchangers (typically installed within the ExH provider's facilities) or **heat pumps**
- *DH suitability*: **best with modern (prefabricated) or low-temp DH**, or cogeneration-excess for older hot-water DH, but not really suitable for steam DH
- *Operations*: works well in **combination with any other sustainable energy** source



Stakeholder engagement:

Beyond the general stakeholders and their roles mentioned near the end of this document, and providers of needed technologies, excess heat requires special involvement with:

- **ExH providers** - ExH as a by-product from their industrial/commercial processes, and possibly also might share costs (e.g. infrastructure within their facilities)
- **Local/regional/national public authorities** - quite beneficial as liaisons between DH companies and ExH providers, while certain ExH providers (e.g. heavy industry) may be subject to special oversight from national authorities

Financial data:

- *Upfront costs*: quite low (e.g. **0.45-0.85 M€/MW** for industrial ExH), with costs possibly shared by the DH company and/or ExH provider(s)
- *O&M costs*: **4%** of investment
- *Payback period*: varies (e.g. **7 years** for one Austrian paper mill)

Greenhouse gas emissions: **0 kg/MWh**

Making use of ExH for your DH generates no additional GHGs beyond those emissions already counted as coming from those processes supplying it to your DH.

Which sustainable energy is optimal for your district heating system?

Having understood the diverse opportunities for each sustainable energy as a source for your district heating (DH), you should be able to realise by now the distinct advantages all of them hold over traditional fossil fuels for your future DH. Since any of these greener energies can really offer a great alternative in most cases, it now becomes a question of **choosing the right fit for you**. You should reflect on the current and future needs of your DH company to see which of these renewable energy (RE) and excess heat (ExH) options have the technical capacity and resource supply-availability to match your heating demand into the long-run.

In a general sense, most of them are **more technologically-suitable and/or cost-effective if integrated into a modern (prefabricated) or low-temp DH system** (DHS). Unfortunately, many older steam or hot-water DHSs unfortunately cannot exploit them to their fullest without significant retrofits of their infrastructure. If your DHS is one of these older networks, you should likely first prioritise modernising your DH boilers, insulating your pipes, reducing losses, etc. to make your system as efficient and low-carbon as possible. Even so, retrofitting your DHS is the ideal moment to simultaneously implement (ahead of time) measures which still **ensure your DHS will be fully prepared** to integrate sustainable energies.

Some DHSs may prefer a more gradual switch to RE and/or ExH sources, through

incremental increases in the share of sustainable sources, but still retaining (for the time being) some traditional fossil-fuel burning heat generation. This can be fine in certain cases, but it still misses out on the opportunity to start reaping all the **operational, financial, environmental, socio-economic or political profits of sustainable DH** even sooner by switching to RE and ExH sources now.

Even if you decide to go this slower route, you should still always keep in mind the overall goal to **minimise our addiction to fossil fuels as soon as possible**. This means also avoiding a needless swap from one fossil fuel to another, such as natural gas being claimed as a so-called "bridge technology" for DH, despite its obvious drawbacks mentioned previously. But if you are already willing to upgrade your DHS anyway, why not just **skip unnecessary steps and invest directly into long-term solutions like RE and ExH** technologies from the start? It just makes more (economic) sense to go green sooner.

You can expedite this sustainable switch by getting a strong handle on the precise kinds of **sustainable resources at your disposal**. This means you need to study in depth their **local to regional availability**, be it biomass fuel supplies, solar irradiance, geothermal temperature gradients, heat pump sources or nearby industrial/commercial ExH facilities. Furthermore, you should also be aware that you **need not rely just on a single energy source** – most of these alternative energies **work excellently in combination**. Once you have mapped out (literally and figuratively) the RE and ExH possibilities available across your region, you are sure to find plenty of sustainable energy options as optimal solutions matching regional supply to your DH needs.


Image: Alamy Stock / Matthias Naumann

How can cooperative efforts make district heating upgrades more sustainable?

Though clearly district heating (DH) companies are in the driver's seat when it comes to deciding to shift their DH systems (DHS) towards a more sustainable pathway, they do not need to do it alone. In the previous pages, special types of **stakeholder engagement** have already been outlined for each renewable energy (RE) and excess heat (ExH) source. Even so, there remain for local to national actors many general roles to play in supporting the green-DH switch, no matter the type of specific sustainable energy being exploited.


Image: Thermos

PUBLIC SECTOR

- **Local authorities**, even if not (co-)owners of the DHS, should streamline procurement and permit procedures (including in cases of environmental/cultural protection) and prioritise sustainable DH within the legal framework and all planning processes (e.g. SECAPs*, smart city strategies, circular economy plans, new zoning, business development, etc.), including with dedicated budget lines.
- **Regional authorities**, depending on their mandate within the country, might play a similar role to local counterparts, but can at least already integrate green-DH into their Smart Specialisation strategies (i.e. via the Heat Synergy Region concept) and capitalise on Structural and/or Just Transition Funds in a strategic manner to finance a sustainable heating which is affordable to all.
- **National authorities** should ensure that both RE/ExH-DH and DHS-retrofits are adequately prioritised in all relevant national policies (i.e. NECPs**, circular economy strategies, etc.) and the national legal framework, including with special funds/grants set up just for green-DH in order to support their contributions to national climate goals.

* SECAP = Sustainable Energy and Climate Action Plan

** NECP = National Energy and Climate Plan

PRIVATE SECTOR

- **Banks, financial institutions and other investors** should set up special funding mechanisms/instruments and preferential conditions (e.g. low-interest rates) and green-prerequisites for loan-approval to encourage DH companies' sustainability ambitions, as well as grants for technical assistance to kick-start bankable DH projects and accelerate their transition to more sustainable practices.
- **Companies supplying RE technology/ fuel or ExH sources** should be pro-active in promoting the synergetic opportunities and (mutual) benefits they can offer as best solutions to DH companies, while also building the capacities of DHS staff, public authorities, investors and other actors to understand the value of integrating their sustainable solutions.
- **Real estate owners/developers and construction companies**, whether working on individual buildings or whole neighbourhoods, should be sure that they already integrate technologies and infrastructure prepared for RE/ExH-DH, in order to support DHS connections and expansions from the start.

OTHER EXPERTS

- **Energy agencies** are often key **advisors** and **capacity-builders**, not only to DH companies, but also to public authorities (e.g. supporting SECAP development), and therefore should serve as general expert consultants on DH transitions, as well as liaisons between DH companies and public/private actors.
- **Researchers, universities, think-tanks and (private) consultancies** can fill some of the same roles as energy agencies, but are particularly suited to providing in-depth studies with comprehensive data/analyses (i.e. on local/regional resource availability or cost-benefits) which DHSs rely on for decision-making.


Image: ICLEI / Stephan Köhler

What are the next steps to move forward sustainably?

Now it should be clear why we should all heavily **prioritise renewable energy (RE) and/or excess heat (ExH) in district heating (DH)**, as well as how to choose your own sustainable pathway to make the switch, including roles of various stakeholders in the process. A simple question remains: **what now**? At a basic level, the answer to that question is equally simple: **start now**!

1. If needed, retrofit your DH system efficiently to make it ready for new energies;
2. Determine which RE/ExH options match your needs/context;
3. Identify and apply for available financing opportunities to make your switch;
4. Find key stakeholders to cooperate towards this common goal;
5. Use these efforts to transition away from fossil fuels as soon as possible and start reaping the diverse benefits.

In order to help you on your way, you are highly recommended to look further into the **KeepWarm** project (keepwarmeurope.eu) responsible for this booklet, including its Learning Centre. There you can find resources from KeepWarm and many other related projects and **European initiatives***, to numerous **guidebooks**, **tools and other useful materials** to help you on your way to achieving a sustainable DH switch, such as:

- case studies of DH retrofits and green-energy upgrades
- spatial mapping about supply and demand
- thermal planning software
- policy recommendations
- insights into finance and technical assistance...

KeepWarm
Renewing district heating

* Particularly interesting for consideration, among others: the European Investment Bank's European ENergy Local ENergy Assistance, Council of Europe Development Bank's Green Social Investment Fund, EU Just Transition Mechanism and European City Facility.

KeepWarm is also proud to promote the inspirational work being done by front-running DH companies across central and eastern Europe which are actively participating in our project. They demonstrate to their peers how effective DH retrofits and RE/ExH switches can be achieved on, and under, the ground.

Finally, it is worth highlighting that the KeepWarm project is especially well-suited to use its competence to **help you achieve your own energy transition**! Our project partners – made up of development/energy agencies, city networks, researchers and other key experts – are all located in central and eastern Europe, and so are especially suited to supporting work in that region, but also have great **experience all across Europe** as well. Contact us so we can know how our expertise can benefit your work **towards DH energy-switches and retrofits**:

- Technical consultancy
- Feasibility studies
- Financial guidance
- Strategic action-planning
- Policy/market integration
- Staff/stakeholder trainings
- General advice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Imprint

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June **2020**

The data provided within this document represents the best information readily available to the authors, but not necessarily precise for every case. Therefore, this booklet should be used for the purpose of general guidance only and you should let it serve as an inspiration to conduct more in-depth studies yourself to steer true decision-making, especially taking into account specific factors relevant to your own context, which always vary from case to case.

List of abbreviations:

CHP	Combined heat and power
COP	Coefficient of performance
DH(S)	District heating (system)
EE	Energy efficiency
EU	European Union
ExH	Excess heat
GHG	Greenhouse gas
O&M	Operations and maintenance
RE	Renewable energy

Notes:

KeepWarm
Renewing district heating

www.KeepWarmEurope.eu
@KeepWarm_Project

Project partners

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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VINČA Institute of Nuclear Sciences

ZREA

ICLEI Local Governments for Sustainability

In support of

Covenant of Mayors for Climate & Energy
www.eumayors.eu

Supported by

DHC+ Technology Platform

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N°784966. Views expressed are those of the project.

This project has received co-funding from the German Federal Ministry of Economic Cooperation and Development.