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Summary of Hotmaps Handbooks for Strategic Heat Planning

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The Hotmaps project

The EU-funded project Hotmaps aims at designing a toolbox to support public authorities, energy agencies and urban planners in strategic heating and cooling planning on local, regional and national levels, and in line with EU policies.

In addition to guidelines and handbooks on how to carry out strategic heating and cooling (H&C) planning, Hotmaps will provide the first H&C planning software that is

-  **User-driven:** developed in close collaboration with 7 European pilot areas
-  **Open source:** the developed tool and all related modules will run without requiring any other commercial tool or software. Use of and access to Source Code is subject to Open Source License.
-  **EU-28 compatible:** the tool will be applicable for cities in all 28 EU Member States

The consortium behind

Scientific partners



Pilot areas for developing and testing the tool



Executive Summary

This document outlines guiding principles for strategic heat planning. These are general guidelines that in principle can be followed at all levels of governance, both at local, regional and national level.

The guidelines emphasise that strategic heat planning in contemporary Europe should address a radical change focusing on minimising fuel consumption for the purpose of heating. This necessitates a technical analysis which is not limited by policies and institutional structures inherited from fossil fuel-based energy supply. Strategic heat planning requires changes at both technical, organisational and institutional level. The 3-phase model outlined in this chapter is a possible procedure which can be followed to support and facilitate the strategic heat planning process.

In the technical analysis, it is important to have an energy system perspective to the heat planning in order to avoid suboptimisation. Likewise, the search for solutions should have a long-term, socioeconomic perspective.

The establishment of district heating systems as an infrastructure for utilising sustainable heat sources requires policies addressing the organisation of the systems. This includes questions about ownership models for monopoly structures and price regulation. It is a key point that these two regulatory elements should be seen in coherence for the purpose of ensuring consumer acceptance, access to capital, and the organisational capability to maintain a long-term focus in the heat planning.

This document is a summary of the content in the Hotmaps handbooks on strategic heat planning. This includes “Hotmaps Handbook I: Definition and experiences of strategic heat planning” and “Hotmaps Handbook II: Guidelines for comprehensive assessment of efficient heating and cooling”. These documents are supplemented by the appendix report “Case descriptions”, describing cases of district heating planning from various contexts across Europe, and the Hotmaps wiki page describing how the Hotmaps toolbox can be applied in heat planning.



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Summary of the Hotmaps Handbooks in strategic heat planning

This document outlines general tools and procedures that may support strategic heat planning processes carried out at European, national and local governmental levels.

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The outline of the document consists of an overall approach to strategic heat planning and steps in the technical analysis, it outlines main elements to be considered in the organisation and regulation of the sector and it outlines how responsibilities in general can be allocated across governmental levels.

Strategic heat planning is not business as usual

Strategic heat planning starts with a preparatory phase of strategic considerations of the problems facing the current heat supply system. These considerations are then translated into key objectives that the future technical system should meet. On this basis, the technical analysis of available alternatives to realise the strategic goals can be carried out.

For the European Union, phasing out fossil fuels in the energy supply holds a three-fold promise: it may reduce CO₂-emissions, improve the security of supply and improve the economic balance by circulating a larger share of energy costs within the Union.

Realising the potentials promised by transitioning the heating sector to a sustainable path requires a strategic heat planning process. This can be defined as *action plans for realising long-term visions of radical change in key parameters of the heat supply*. Historically, key parameters include fuel demand, environmental factors and security of supply.

The applied definition emphasises that the plans are oriented towards action, where that action is based on a long-term perspective and analysis and strives for radical change. This definition is shaped for the current situation in Europe, where radical change away from a fossil fuel-based energy supply is required. Radical changes necessitate strategic analysis and long-term perspectives on the single initiatives.

Approach to strategic heat planning

A synthesis for generic steps in strategic heat planning can be formulated into three phases. Although the process is described in three phases, it will likely be part of an iterative and continuous process.

Phase 1: Construct technical scenarios for a strategic heat supply

In this phase, the possible technical scenarios are identified, evaluated and described. This process may follow the 7-step procedure described below. Based on the procedure, a solution can be chosen that can meet the strategic objectives.

- 1) Quantify heat demand
- 2) Assess and quantify the availability of heat resources in the area
- 3) Assess and quantify the potentials of heat savings in buildings
- 4) Identify a balance between investments in heat supply and heat savings
- 5) Align with national, regional and/or local energy plans
- 6) Develop technical alternatives and scenarios for a strategic heat supply plan
- 7) Iterate steps 4–6 to search for the best solution

Phase 2: Evaluate existing framework conditions and identify key stakeholders

In this phase, economic and political barriers and opportunities are identified. A part of this process involves mapping central stakeholders and analysing which roles they are likely to play in a transition process and which roles they can have in a future heat supply.

- 1) Identify economic and political barriers
- 2) Identify economic and political opportunities
- 3) Identify supporting and resisting key stakeholders
- 4) Develop ownership and business models that align with strategic objectives

Phase 3: Make an implementation plan

In this final phase, the relevant authority searches for possibilities to modify or change existing regulations to support the best solution. This phase also involves consideration of the shaping of key organisations to transition and operate the heat supply system. This involves dealing with ownership and price models to ensure consumer and citizen acceptance,

mobilising capital and creating an institutional platform for strategic actions and long-term planning.

- 1) Identify which framework conditions can be changed by the relevant planning authority
- 2) Design new regulations and framework conditions
- 3) Identify opportunities to involve stakeholders that can play a constructive role in realising the heat plan
- 4) Design and/or redesign organisations to deal with planning and coordination challenges

Consider the whole energy system, not only the heating sector

When identifying the technical solutions, the most efficient alternative can be identified through a technical analysis that includes synergies between heating supply and energy savings, but also synergies between the heating sector and other energy sectors. The search for available alternatives in strategic heating planning can follow the 7-step model outlined in Phase I above.

Considerable synergies are available when looking at energy planning from a holistic point of view. Although heat planning is the focus of this document, it is important to include other energy domains such as electricity and gas, as well as electricity, transport and cooling demands. The purpose is two-fold: to identify synergies across sectors and possible bottlenecks of limited resources.

Align scenarios with future long-term goals

Investments in heating infrastructure typically have long lifetimes, and this is especially the case for district heating networks and cogeneration plants build today that could be in place after 2050. It is therefore important to align investments and strategic decisions with climate goals, such as EU 2050 climate targets and the Paris agreement. Investments in other technologies might result in stranded assets or operation under other political regimes.

Organisation, ownership & price regulation

The establishment of district heating infrastructure entails an economic condition of ‘natural monopoly’. The natural monopoly condition is derived from the large investment costs that establish the fact that having competing district heating network pipes in the same area is too costly.

The specific design chosen for ownership and price models must address three priorities: 1) ensure consumer acceptance of the system; 2) ensure access to capital; and 3) ensure a basis for carrying out strategic heat planning. Priorities 2 and 3 can possibly be provided through complementary institutions.

To establish an overview of these different solutions, it may be helpful to establish a two-dimensional framework. One dimension is the ownership model. The other dimension is the price regulation model. A matrix model illustrating the possible combinations is found below.

Table 1: A matrix illustrating the possible combinations of how a district heating system can be organised and regulated.

	Consumer ownership	Municipal ownership	Private commercial ownership
True Costs			
Price cap			
No price regulation			

A third dimension of the organisational model is the degree of unbundling between different stages of the system, from heat generation over transmission and distribution to heat consumption.

Diversification of ownership is widespread – especially in larger systems. However, there is no widespread experience with combining unbundling with market competition in production like the market organisation developed in the electricity sector.

In practice, however, many district heating systems operate with third-party access based on bilateral contracts negotiated between suppliers and the grid-owning company. Some of the largest economic and environmental potentials for district heating grids are located with these third parties – that is, with the industries producing excess heat. Third-party access would therefore be an important element of optimal utilisation of district heating grids across Europe.

Three types of ownership

Three basic forms of ownership models can be defined. In practice, hybrids of these three models may be observed or developed, but the three following types are the most common:

- *Consumer ownership*
Consumer ownership is a private ownership model where the heat consumers own the system. This model can take different forms, but the main characteristic is that

consumers control the local district heating supply company through democratic procedures.

- *Municipal ownership*
In the municipal ownership model, the district heating system is controlled through a company controlled by the municipality or directly by the municipality itself.
- *Private commercial ownership*
This category of ownership covers ownership models where the district heating system is controlled by a private company operating under commercial conditions.

Three price regulation models

Three basic price regulation models can be defined. In practice, hybrids of these three models may be observed or developed, but the three following types are the most common:

- *True costs*
The true cost principle implies that consumers can only be charged a heat price equivalent to the costs of delivering that heat. The true cost principle can also be termed 'the consumer profit principle', as any efficiency gains are distributed as profit to the consumers through lower heat prices.
- *Price cap*
Price cap is a principle where district heating companies are allowed to charge a heat price based on some reference price. For example, this reference price can be based on the cost of alternative heat supply options, such as natural gas, or it can be based on benchmarking of other, similar district heating companies.
- *No price regulation*
Prices are controlled through the market forces that happen to be present at the given time and space. The monopoly power can possibly be delimited through competition from individual heating alternatives.

It is important to note that both ownership model and price model should be seen in relation to each other. The choice of ownership model cannot be evaluated coherently without considering the price regulation that complements it. Likewise, the properties of a price model must be seen in light of the ownership model. For example, the Danish case shows good experiences of combining the true costs pricing principle with consumer ownership or municipal ownership. However, the Danish case also shows the true costs principle has not been able to protect consumers sufficiently in district heating systems subject to private commercial ownership.

Experiences from Sweden shows that reforming municipal ownership to private commercial ownership in some cases has weakened the capability to carry out long term planning.

In general, authorities should be very careful if allowing private commercial ownership of the district heating systems as it takes a very complex supplementing regulation to ensure

consumer protection and acceptance and to ensure an institutional capability to carry out coherent strategic heat planning.

Institutional context for strategic heat planning

Concrete heat plans are often shaped as local projects at the city level. However, proper strategic heat policies must be embedded and coordinated at all levels of governance across all energy-related policy areas. Likewise, the institutional structure and policy elements influencing the viability of the concrete local project must be identified in the strategic heat planning process. Identifying and mapping relevant policy elements that influence the concrete project occurs during Phase 2 in the model for strategic heat planning outlined earlier.

The mapping of policies that influence strategic heat planning has two dimensions: a geographical dimension and a sector dimension. For example, a concrete district-heating project might be subject to legislation directly aimed at district heating projects. This project regulation might originate or be implemented in local, national and European legislation. The particular project may also be influenced by general heating and building regulations, as well as legislation at the energy system level. All of these policies are also shaped by legislation at all governmental levels.

The matrix below is a possible framework representing both dimensions of regulations that can be used in Phase 2 of strategic heat planning when mapping the policies and institutional structures.

Table 2: Matrix for mapping regulations that affect strategic heat planning.

	Project regulation	Heat and building regulation	Energy system regulation
Local regulation			
National regulation			
European regulation			

Responsibilities in heat planning

Based on the experiences of strategic heat planning in various contexts, some general guidelines for the responsibilities in the strategic heat planning process may be outlined.

First of all, national and European governance structures must formulate and implement long-term strategic goals. Local authorities often possess knowledge of local conditions and, given that heat supplies are often local in nature, the local authorities will often be the initiators and responsible for concrete heat planning. However, high-level governance structures must initiate mapping of technical potentials. The comprehensive assessment of

efficient heating and cooling required by the European Energy Efficiency Directive is a good framework to promote awareness and initiate strategic heat policies.

The Hotmaps Handbook II on 'Guidelines for comprehensive assessment of efficient heating and cooling' provides recommendations on how Member States may utilise this European framework. It improves the quality and direction of local heat planning if national authorities provide a framework within which the local planning process is to be carried out. This can, for example, be a heat supply act that outlines the process for developing district-heating projects and specifies the tasks for municipalities. Such legislation can also establish the overall strategic indicators that the local policies should fulfil. For example, the Danish national heat supply regulations give responsibilities to municipalities, but also outlines overall requirements regarding socioeconomic viability and environmental priorities. Rules regulating the monopoly structure of district heating grids should also be initiated nationally outlining ownership models, company structures, price regulation and the obligations and rights of the consumers.

National and European governmental bodies can also promote local energy and heat planning by supporting the process through provision of data and guidance on methodology. This may further be coordinated with overall strategic objectives regarding sustainability and socioeconomic viability.

Besides this distribution of responsibility, establishing forums where experiences are exchanged between local and national planning agencies is also recommended. Knowledge about regulatory barriers at the local level could then be conveyed to the central level where regulations can be changed. When regional governmental bodies are present, they can play an important role in coordinating municipal heat plans to avoid local sub-optimisation in energy planning. Regional energy plans where the heating strategies are developed in the context of an energy system analysis are recommended. Resources such as biomass often have conflicting uses across energy sectors and municipal borders. Likewise, the development of fluctuating renewable energy sources would benefit from being part of a coordinated strategic plan across energy sectors and municipalities. Summing up This document outlines guiding principles for strategic heat planning. These are general guidelines that in principle can be followed at all levels of governance, both at local, regional and national level.

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The establishment of district heating systems as an infrastructure for utilising sustainable heat sources requires policies addressing organisation of the systems. This includes questions about ownership models for monopoly structures and price regulation. It is a key point that these two regulatory elements should be seen in coherence for the purpose of ensuring consumer acceptance, access to capital and organisational capability to maintain a long-term focus in the heat planning.

Summing up

This document outlines guiding principles for strategic heat planning. These are general guidelines that in principle can be followed at all levels of governance, both at local, regional and national level.

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