

# FME HighEFF

## Centre for an Energy Efficient and Competitive Industry for the Future



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Abstract
<p>This policy brief is based on more than three years of data collection and analysis, especially through HighEFF WP5.1 activities. The data base consists of, among other things, document analyzes, interviews of industry, research and political actors, media analyzes, industry visits, workshops and more. Together, this constitutes a heterogeneous picture of the situation, and this document summarizes the conclusions from the material for specific policy recommendations.</p>

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## 1 Policy Ready Recommendations for Utilizing Surplus Heat in Norwegian Industry Collaborations

This policy brief is based on more than three years of data collection and analysis, especially through HighEFF WP5.1 activities. The data base consists of, among other things, document analyzes, interviews of industry, research and political actors, media analyzes, industry visits, workshops and more. Together, this constitutes a heterogeneous picture of the situation, and this document summarizes the conclusions from the material for specific policy recommendations.

**There is a need** for considering local by-product exchanges when localizing new industry plants (both heat producers and consumers). Here, local municipalities or energy companies can take a leading role (in which some already does). Regional mapping of waste sources and end-use can be a valuable tool.

**Institutional framings and regulations** should include surplus heat that are by-products from industry processes outside organizational boundaries.

**Key Performance Indicators** and certification schemes measuring energy efficiency should include interaction effects between companies (e.g. cluster, industrial symbiosis) and the community, regional and national level (e.g. district heating networks).

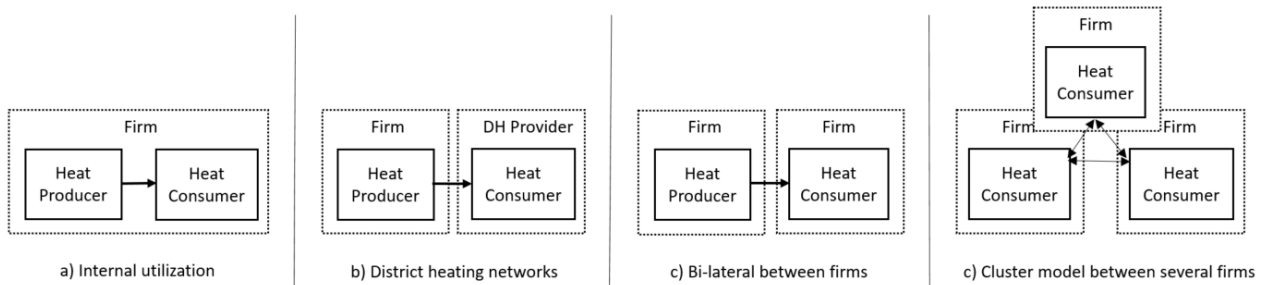
**Local and regional government actors** (e.g. municipalities, energy companies, county councils) have a role in facilitating inter-organizational networks and consequently informal networks and trust, lowering collaboration barriers towards CE.

**Firms and stakeholders** should assess which modes of valuation and principle of circulation that make up the context for the case in question.

## 2 Background

We can separate between four concepts of utilizing surplus heat based on whether and which organizational boundaries it crosses, and which types of organizations that are involved. The first type (a) involves *internal* utilization of surplus heat within a firm. In these cases, companies utilize waste heat recovered from one industry process for other purposes elsewhere. When constructing new industry plants, firms are often searching for ways of aligning surplus heat streams with usage areas such as heating office buildings or other industry processes.

The second type (b) involves distributing surplus heat from a firm to a local district heating provider. This is a common way of organizing surplus heat exchange in Nordic countries. Surplus heat is the main energy source for Norwegian district heating networks and accounts for approximately 49 % of the energy in these local grids. Many district heating networks in Norway is the result of long-term collaborations between local municipalities and 'cornerstone' metal and processing companies. In these cases, the companies sometimes provide the surplus heat free or at reduced costs to the district heating provider. Many district heating networks are only utilizing a small portion of the available surplus heat. Thus, new buildings and firms in these areas that connect to the network would essentially improve the saturation rate.



**Figure 1 Utilization concepts for surplus heat exchange**

The last two types involves distributing surplus heat *between firms*. Here, the surplus heat moves across organizational boundaries either *bi-laterally* (c), involving two firms, or involving several in *cluster-models* (d). As long as the firms involved are located outside a regulated area for district heating, there are few regulations the firms must follow. Thus, the involved parties are free to decide on its price, ownership and operations concept. This allows for a multitude of different ways of organizing and valuating the waste resource.

### 3 Barriers Towards Matching Producers and Users

Potentials and barriers Identifying and matching heat sources with possible heat users is not a straightforward task. There is, as of yet, no available databases of surplus heat sources in Norway. A larger challenge is to identify and connect these to possible heat users. Essentially, every firm consumes heat for office space heating or other industry processes. The introduction of novel solutions such as industrial heat pumps and energy storage have made the technical aspect of this matching process somewhat easier. Now, surplus heat can more easily be stored until needed, elevated to the required temperature levels and aligned with needs. In this way, the range of usage areas has increased overall. Nevertheless, due to costly infrastructure there is a need for identifying users requiring a higher volume of heating for an exchange concept to be economically viable. Onshore fish farms and greenhouses are examples of industries with heating demand where it would be economically profitable to utilize surplus heat to reduce primary energy consumption. However, a main barrier hindering such concepts is localizing new industry establishments with high heat demand close to surplus heat sources.

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## 4 Valuating Surplus Heat in Local Contexts

After identifying or co-locating heat producers and heat users, integrating these energy flows involves establishing surplus heat as a commodity (and sometimes even a gift) and agreeing on its *value*. Valuating surplus heat is not an easy task, as actors sometimes value this commodity differently, or does not think of it as a commodity at all. One recurring issue is the (philosophical) question of ‘whom is doing whom a service’ since surplus heat exchange are benefiting both heat producer and user. We find several ways of valuating, as well as legitimizing the value, of surplus heat.

A recurring valuation of surplus heat is as a *market commodity*. Here, the mode of valuation revolves around organizing the exchange with formal contracts assigning it an *economic value* and facilitating its trade by establishing local heat markets. Another way of valuating surplus heat is as a ‘*common good*’. This kind of valuation highlight the synergy between firms and essentially that a whole is greater than the sum of its parts. In addition to being valued in economic terms, the presence of the giver and receiver is embedded within it. Such collaborations often rely on a form of *self-organization* with no centralized party enforcing the exchange. Finally, in several municipalities, large processing plants provide surplus heat to the district heating networks or other users free of charge or at a reduced price. This does not mean that the surplus heat is *value-less*. Rather it is valued in non-economic terms serving other purposes.

### 4.1 Modes of Valuating Surplus Heat

Establishing local circular economies for utilizing surplus heat involves processes of framing and valuating it as a *thing*. The second step is to specify this entity as a scientific object, separated from all other objects by its measurable characteristics (e.g. kWh, Celsius degrees, price, etc.). The third step is to legally and formally assign the object an ownership so that it can be given or sold as either a gift or commodity.

These archetypes are not necessarily mutually exclusive, nor exhaustive. However, different or conflicting valuations of surplus heat between parties can certainly be a barrier towards a utilization. In line with Webb and Hawkey (2017), we find that applying models grounded in market framings can make it difficult to enroll actors around a common good framing of heat networks. This illustrates the challenges of assigning surplus heat an objective value *across* localities or ‘*constructing a national heat market*’ as suggested by one of our informants. The different framings and valuations of surplus heat are rarely complementary.

**Tabell 1 Archetypes of Utilization Concepts of Surplus Heat**

	<i>Market Commodity</i>	<i>Common Good</i>	<i>Regional Anchoring</i>
<b>Mode of valuation</b>	Market commodity de-contextualized from the relationship between firms and individuals	Contextualized commodity or part-gift, embedded with cultural and social values	Commodity or part-gift where the value lies in legitimizing the firm and region as sustainable and making them inter-dependent
<b>Principle of circulation</b>	Market relations and economic rationalities	Inter-organizational networks, trust and shared values (win-win) between participants	Formal long-term contracts ensuring local embeddedness of company.

<b>Main Barriers</b>	External or internal events can trigger re-valuations of commodity and potentially disrupt collaboration	Valuation dependent on relations between individuals. Sensitive to changes over time.	Power asymmetry between heat provider and consumer (community). Exit of company would be detrimental
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## 5 Policy Ready Recommendations

Involvement of policy makers, regional public actors and firms, is essential in order to unleash the potential for surplus heat utilization. This document presents the advices derived from WP 5.1 data that best facilitates the utilization of this potential:

- There is a need for considering local by-product exchanges when localizing new industry plants (both heat producers and consumers). Here, local municipalities or energy companies can take a leading role (in which some already does). Regional mapping of waste sources and end-use can be a valuable tool.
- Institutional framings and regulations should include surplus heat that are by-products from industry processes outside organizational boundaries.
- Key Performance Indicators and certification schemes measuring energy efficiency should include interaction effects between companies (e.g. cluster, industrial symbiosis) and the community, regional and national level (e.g. district heating networks).
- Local and regional government actors (e.g. municipalities, energy companies, county councils) have a role in facilitating inter-organizational networks and consequently informal networks and trust, lowering collaboration barriers towards CE.
- Firms and stakeholders should assess which modes of valuation and principle of circulation that make up the context for the case in question.