Summary of the project
The main goal with the project is to provide guidance in choosing connection principle when district heating and an exhaust heat pump are combined in Swedish buildings.

It has become more common for district heating in Sweden to be supplemented with other heat sources in buildings, especially exhaust air heat pumps. The reason is that the combination makes it possible to reduce the amount of purchased energy. It is important to know that both the performance and function of the district heating plant are affected when it is being combined with an exhaust air heat pump. This research project identifies the conditions under which a combination is appropriate from both the property owner and the district heating supplier’s perspective.

There are different ways to connect an exhaust air heat pump to the existing district heating system depending on the conditions. The heat pump could be used together with district heating for both space heating and domestic hot water (DHW) production or the heat pump could be used to deliver space heating only.

**District heating and heat pump for both heating and domestic hot water production**
If the heat pump is combined with district heating for both heating and domestic hot water production, then a relatively complex connection is recommended to favor both the district heating network and the heat pump. One variant means that the space heating and DHW systems are connected in parallel. The heat pump is in this case used as a heat source
between the two heat exchangers. District heating is used for preheating and reheating. The main heat source is the heat pump. When the heat production from the heat pump is to low the valves for district heating opens. This principle makes sure that the returning water temperature to the heat and power plant remains low since the heating process is divided in three steps. The deliveries of heat are reduced for the district heating supplier throughout the year and may be non-existent during summer. The heat pump has the right conditions for a high coefficient of performance since its working against the highest temperature. This connection principle is advantageous when there is a small difference in price between electricity and district heating. Also, when the need for space heating and domestic hot water is large.

**Heat pump for heating only**

Using the heat pump for space heating only and not for production of domestic hot water means easier and cheaper connection between the heat pump and district heating. The heat pump is used to a lesser extent while district heating supplies remain during summer time. This means reduced variation in delivered district heating effect.

There are different ways to connect a heat pump to district heating for heating only. One way is to have the heat pump as heat source and on the domestic hot water side there is a connection in two steps. On the space heating side there is a pipe that will take a sub flow through the heat pump and another sub flow past the heat pump. One part of the water in the heating system is being preheated by the heat pump and then the two sub flows meet and are finally heated by district heating.

The DHW production is connected through a two-step solution where the returning water from the district heating is used to preheat the entering cold water in a first heat exchanger. The water is then being heated to the correct temperature by district heating in the second heat exchanger where also the domestic hot water circulation is connected.

Preheating the entering cold water to the system gives a low returning temperature of the water to the heat and power station. The connection principle enables a high coefficient of performance. This connection principle is suitable for a new building where the domestic hot water demand is high in relation to the heat demand. The principle is beneficial if the price for district heating is lower than the electricity price.

**Results**

- Improved knowledge in combining exhaust air heat pumps with district heating leading to more energy efficient systems.
- Increased interest in connecting an exhaust air heat pump to an existing district heating system.
- Guidance on choosing connection principle ensures that any negative impact on the district heating network is minimized while meeting the needs of the customer.

**FACTS ABOUT THIS PROJECT**

**Building type:** Single- and multi-family houses

**Heat source:** Exhaust heat pump combined with district heating

**Participating countries:** Sweden

**Time frame:** 2012

**Research program:** Fjärrsyn (financed by Swedish Energy Agency and the Swedish District Heating Industry)

**Project leader:** RISE - Research Institutes of Sweden

**Link to web page or report:** [https://energiforskmedia.blob.core.windows.net/media/1267/fjaerrvaermecentral-och-fraanluftsvaermepump-fjaerrsynsrapport-2012-11.pdf](https://energiforskmedia.blob.core.windows.net/media/1267/fjaerrvaermecentral-och-fraanluftsvaermepump-fjaerrsynsrapport-2012-11.pdf) *(in Swedish)*

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