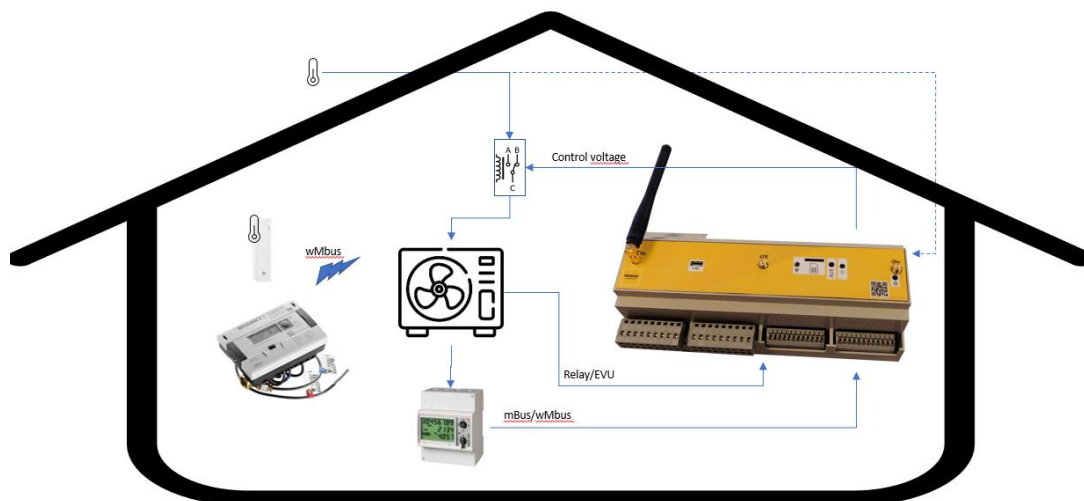


## PreHEAT for Heat Pumps by Neogrid Technologies ApS



**Figure 1: Hardware setup for PreHEAT Heat Pump Controller.**

PreHEAT for Heat Pumps is developed by Neogrid Technologies with the purpose to save energy and reduce the cost of heat, by optimizing the heat pump operation in relation to demanded energy from the building and local electricity prices and tariffs. This enables customers to adapt to market flexibility and at the same time to save energy without compromising indoor comfort requirements.

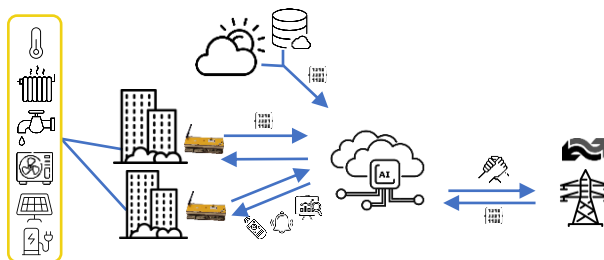
By collecting data from the heat pump, it is possible for Neogrid to deliver three categories of services:

The **first category** are services available as soon as data is collected from the heat pump and connected meters. If external control is activated, extra services like MPC to control, can secure a lower operation cost of the heat pump. This category “only” requires a bilateral agreement with the heat pump owner and a cloud connected operator.

In **category 2** variable prices, tariffs and services to the DSO are taken into account. Variable prices and tariffs are rolled out over most of Denmark, but DSOs flexibility demand to cope with bottlenecks is still limited in Denmark.

In **category 3** specialized services to the electricity markets are delivered. This might be regulating power and frequency reserves. Those services require separate settlement of the electricity to the heat pump and an aggregator is required to pool a number of heat pumps.

From, sensor data like indoor temperature, consumed electricity and delivered heat are collected, and send to Neogrid PreHEAT Cloud.



**Figure 2: Neogrid PreHEAT Cloud.**

In the Cloud, the data is analyzed and optimal operation schedules are send back to the pump.

Establishing connection the heat pump installation, can be implemented in different ways dependent on the type of heat pump. Older and/or simpler heat pumps requires a gateway to provide online access, and to collect all sensor and meter data. Control is established via the heat pumps relay input or by manipulating the outdoor temperature sensor.

Other heat pumps have a communication interface where data and control capabilities are available to access via a local gateway.

Modern heat pumps are “born” online and have the possibility to collect data from external sensors and meters. Here, the heat pump manufacture typically operates a cloud where all data are collected and available for a third-party actor, like Neogrid, via an API.

### Neogrid Heat pump aggregator

The aggregator method provided by Neogrid, pools a number of heat pumps together and control the heat pumps as a swarm. I.e. we are allowing / blocking the individual heat pump operation to provide an overall behavior of the pool. This is done by complying with the constraints of each heat pump operation. The pool can then be adjusted according to market changes.

Figure 3 illustrates the installations as a normalized energy storage, where heat pumps are charging/ discharging the storage also fulfilling the run-time constrains of the heat pump.

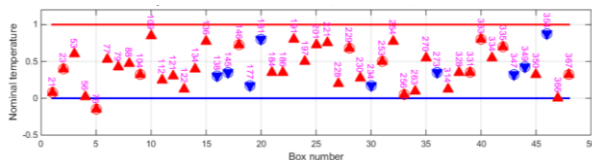


Figure 3: Swarm controller in operation.

### Learnings

Heat pumps using the optimized control and flexibility service can provide costumers with energy savings without compromising indoor climate and comfort. Neogrid can optimize a heat pumps energy consumption by 5-15 %.

Multiple factors have an impact on the possible energy savings, but demonstrations have shown that value proposition for the heat pump owners are:

- Online access to key data from heat pump
- Low operation cost
- Improved comfort
- Lower energy bill
- Reduced CO2 footprint

### About Neogrid Technologies

Neogrid Technologies have more than 12 years' experience in providing smart energy solutions for

cloud-based heating control in buildings, as well as data collection from IoT devices and smart meters.

Neogrid have extensive knowledge within the smart grid and smart energy systems, which have been obtained by participating in a number of research- and demonstration projects both on a national and international level and by performing business development within this field.

The knowledge gained from these projects is used for commercial activities, and PreHEAT by Neogrid is operating commercially in more than 400 buildings in Denmark, with 24/7 active online control and surveillance.

### FACTS ABOUT THE PROJECT

**IoT Category:** Optimized heat pump operation

**Goal:** Save energy and reduce cost of energy without compromising end user comfort. Deliver real-time monitoring of the heat pump.

**Beneficiary:** User, Society

**Data required:** Access to heat pump sensor data, energy and electricity meter and weather forecasts

**Analysis method:** Data analytics, model- and control engineering

**Control method:** MPC

**Technology availability:** TRL 8

**Link to webpage:** <https://neogrid.dk/>

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