

17/12/06

# *Heat pumps in northern Europe: how can they provide demand response services and thermal comfort in colder climates?*



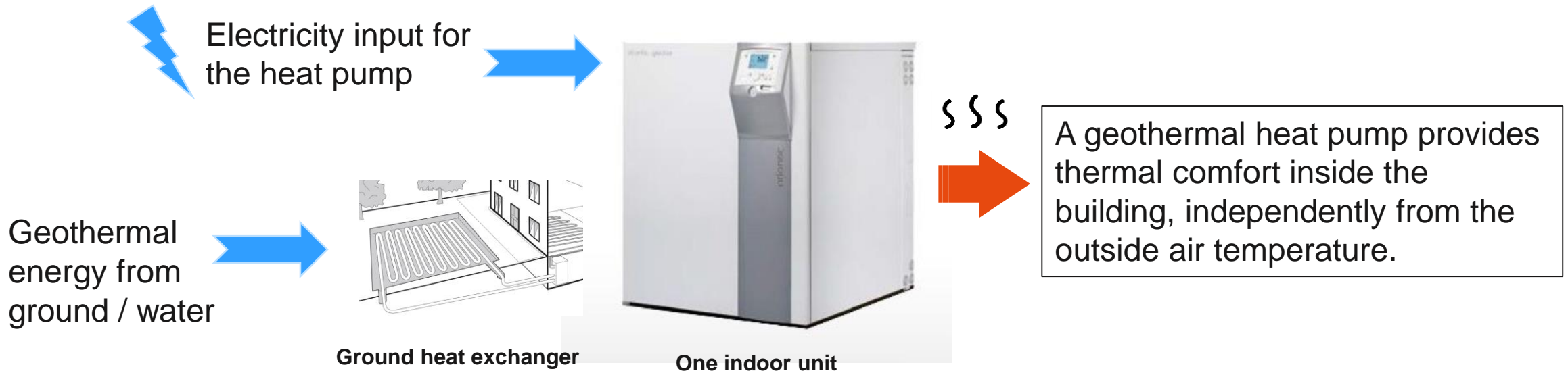
# Agenda

- ① In cold climates: electric and hybrid heat pumps
- ② French case study
- ③ Benefits

# Electric Heat Pumps - use in cold climates

Geothermal heat pumps operate independently from external air temperature

- Electric heat pumps are versatile heaters, which provide thermal comfort by collecting heating energy from outside the building.
- But what if the air outside is too cold?



# What is a hybrid heat pump ?

## Definition

/ A hybrid heat pump is a **multi-energy solution**, combining flexibility of energy sources & energy efficiency without compromising comfort.

/ Hybrid heat pump composition:



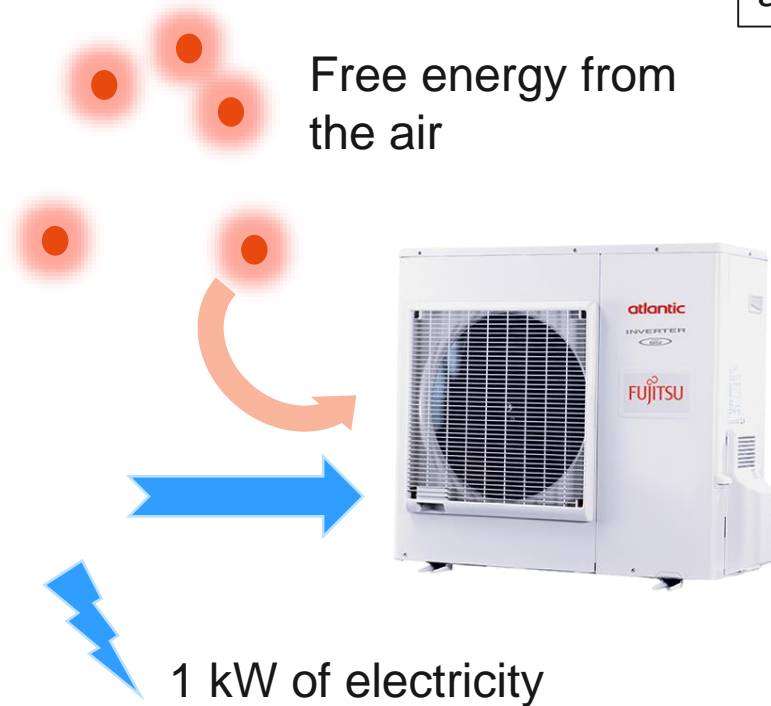
# What is a hybrid heat pump ?

## Composition

The hybrid heat pump system is composed of a heat pump and a boiler in the same unit:

Heat Pump

Heat pumps are drawing heat out of the ambient air.



Boiler

Thermal loss in combustion phase



# What is a hybrid heat pump ?

Operation mode of hybrid heat pump

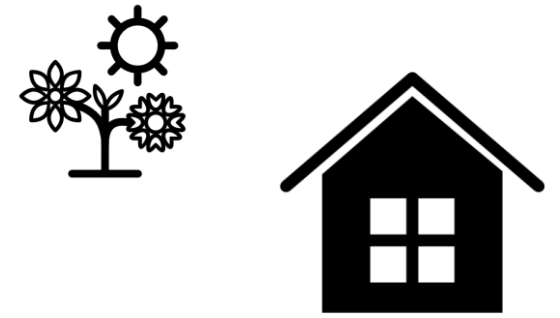
It uses the best energy at the best moment



Energy efficiency is too low. Heat pump stops, the boiler provides all the heating needs.



The energy efficiency of the heat pump is not optimal. The boiler starts and completes the demand.



The energy efficiency of the heat pump is optimal, no boiler need.

Energy use



-10° C



0° C

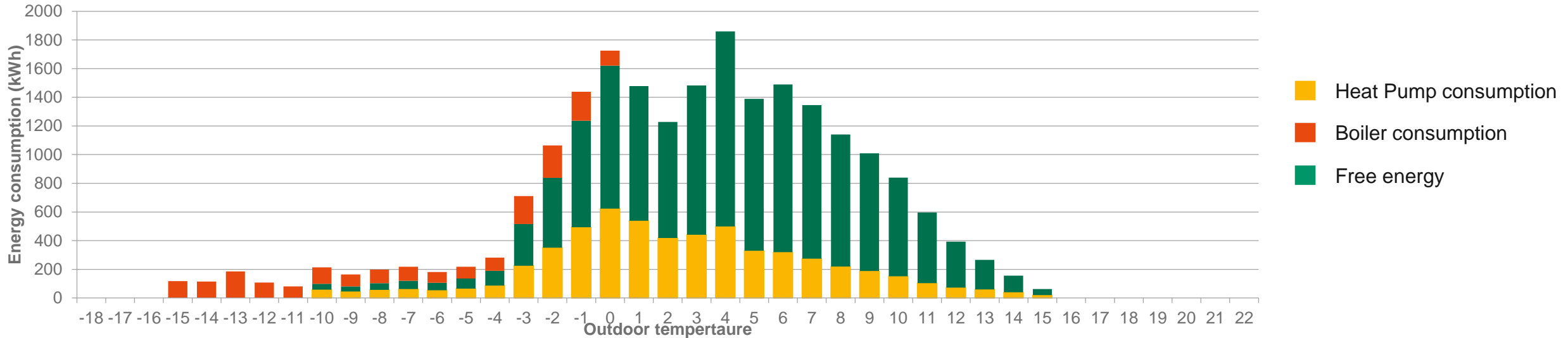


Ambient temperature

# French case study

100 m<sup>2</sup> dwelling in Strasbourg – Heating only mode – Hybrid heat pump

Annual consumption depending on outdoor temperature



Annual energy consumption

Number of days per year with boiler continuous operation

CO2 emissions per year

With an hybrid HP:

1080€

3,6 days

1,6 T

With a standard boiler:

1964€

47,8 days

7,9 T

# French case study

100 m<sup>2</sup> dwelling in Strasbourg – Heating only mode - hybrid Heat Pump

## Conclusions:

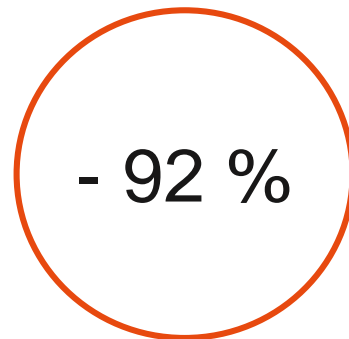
- Energy efficiency during the heating season
- Comfort guaranteed even with low ambient temperature
- An environmentally friendly solution

## In total: hybrid system vs. standard boiler

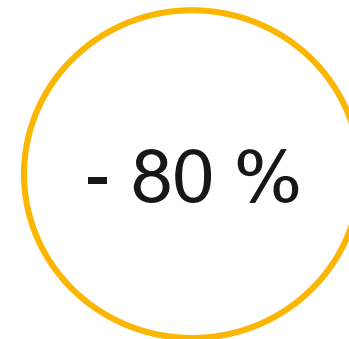
Money saving



Less fossil energy consumption



CO2 emission per year



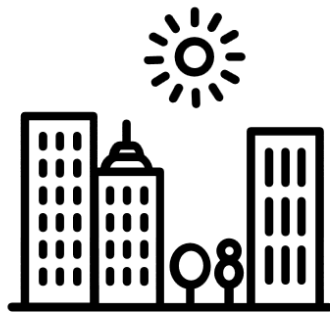


# Hybrid Heat Pump: a smart grid ready solution

Example with hybrid Heat Pump in France

Hybrid systems can get off the grid during peak electricity demand

3 million oil boilers  
installed



If we replace them with

1 Heat Pumps 



Electric demand  
would be around

23 GW

= 23 nuclear reactors 

2 Hybrid heat pumps 

No new investment needed,  
hybrid heat pumps are going off  
the grid during peak days

# Hybrid Heat Pump: a solution to intermittent renewable energy sources

Hybrid heat pump can use thermal storage to balance the grid

1 In sanitary hot water tank



2 In buffer tank for space heating



Thank you

 GROUPE  
ATLANTIC