ROBUR

caring for the environment

Air conditioning systems with gas absorption heat pumps

Natural gas/LPG fired

2 MegaWatt-project Haarlem, Holland

2 MegaWatt-project description

A few distinguishing features make the 2 MW-project a very unique project.
First of all there is of course the very rare combination of sustainable energy techniques, which has never been shown before at such a large scale in the existing home-buildings.
Besides that, the larger part of the homes has been renovated, which reduces the demand for energy.
Also the cooperation between various parties makes this project characteristic; the local authority (Haarlem), the energy company (Eneco Energy), various housing associations and contractors have made this project to a success. The name of the 2MW-project refers to the central heating plants.
The maximum capacity of this installation is 2 MW during the season.
Most of this energy is not produced by natural gas or coals. Therefore the installation has an emission of CO_2 of just 1,000 tons (=1,000,000 kg) per year. This can be compared to the capacity of 100 acres of forest (around 200 soccer fields of surface).
The project saves 520,000 m^3 of natural gas per year in total.
That is roughly 200,000 € of economical saving per year, at the current natural gas price (standard winter conditions).

From idea to actual project

The 382 apartments needed a new heating system. Normally all the homes would get their own individual new gas boiler. After close contact with Eneco Energy and the local authority of Haarlem the building associations decided to take a different, more sustainable, approach and invest into a sustainable heating system.
The ideas were elaborated into a technical design. Because of this project being a pilot, extra subsidy was needed to carry out this project.

Benefits for the occupants

The current occupiers of the homes were very enthusiastic about the plans for this project. Most houses would be renovated completely.
Lots of energy saving measures have been taken, like the removal of the old kitchen gas boiler. This all results into a lower energy bill and a substantial improvement of the living comfort. The occupants can now regulate their own temperature for instance.
Another advantage is that every occupant gets his or her own energy bill. Efficiency gets rewarded that way!
Another advantage is that the occupants do not pay more money than they did for a conventional heating system.

Most important facts about the 2 MegaWatt-project

- Most sustainable heating system in the Netherlands.
- Innovative, but with sustainable techniques that have proved themselves.
- Heat supply is guaranteed by Robur gas absorption heat pumps and gas boilers.
- Costs for the occupant are the same as condensing gas boilers.
- Insulation measures reduce the amount of energy used by 45%.
- Gathering and sharing new knowledge gained from this project.

Techniques use in the 2 MegaWatt-project

In the 2 MW-project a unique combination of sustainable techniques is being used. Sun-collectors, Robur GAHP and underground heat storage are all well known techniques and have been used before.

Benefit of the combination

If one would use just sun collectors the amount of heat produced in the summertime is more than is needed to make hot sanitary water. The heat can not be stored, without some sort of buffer tank. If the temperature setpoint of the placed buffer tank is reached, the surplus of heat has got nowhere to go, and will be lost. By storing this extra heat in the ground, the heat can be used. During wintertime, when the demand for heat and hot sanitary water is big, the stored heat can be pumped up again. The heat can be distributed directly to the buffer tank and can be used by Robur GAHP. The combination of the various systems is the biggest advantage of the 2 MegaWatt-project.

How does the storage of heat work?

The surplus of heat produced during summertime is transported into the ground and stored into a layer of sand and water at more than 100 m below the surface. At this dept the ground water is nearly standing still. Two watertight layers of clay enclose the layer with sand and water. This can be compared to a giant thermos can.
The layer with sand and water is called an aquifer. The natural temperature of the water in the thermos can is around 12 °C. In the summertime this can go up to 45 °C. The temperature needed for the heating system is around 60 to 70 °C.
An ingenious system of Robur GAHP and gas boilers makes sure these temperatures can be reached.

Extra insulation

The efficiency of the entire system is the highest when the required temperatures for heat transfer in the houses are as low as possible. Therefore the houses got extra insulation and oversized radiators. Where needed extra radiators have been placed.

Substantial energy saving

In the old situation every home used around 1930 m^3 of natural gas for heating and hot sanitary water per year. By improving building materials (better insulation) the energy-use is reduced to 1020 m^3 of natural gas per year. The total 2 MW-project reduces this value to 525 m^3 per home per year.
That means a reduction of approximately 70% of the original situation!
At top of that the apartments can be used for another 15 years, thanks to the renovation measures.
Therefore the project does not just fit the sustainable building policy, but also can be set as an example for sustainable home management.

How do the sustainable energy techniques work?

The scheme below shows the different techniques integrated into the 2 MegaWatt-project.

1. Suncollectors

The sun collectors are placed on the rooftop. The collectors contain dark collared tubes that are covered by a glass plate. The sunlight heats up the water that flows through the tubes. The hot water is distributed quickly to a buffer tank.

2. Buffer tank

The sun collector produces more heat than is needed for the heating of the buildings and the producing of hot sanitary water. The surplus of heat coming from the collectors is being stored in a buffer tank. If the occupiers open their hot water tap cold sanitary water flows through the hot buffer tank to the tap. If the buffer tank is full of heat, the extra heat is being distributed to an underground storage (ground-water).

3. Sanitary water

The hot sanitary water can be used directly for consumption.

4. Roomheating

The heated water is being used to heat the various apartments.

5. Gas boiler

If the water from the buffer tank is not hot enough the gas-boiler will bring the temperature to the wanted level. This process is called reheating. This reheating of the water also makes sure no Legionella can appear.

6. Storage

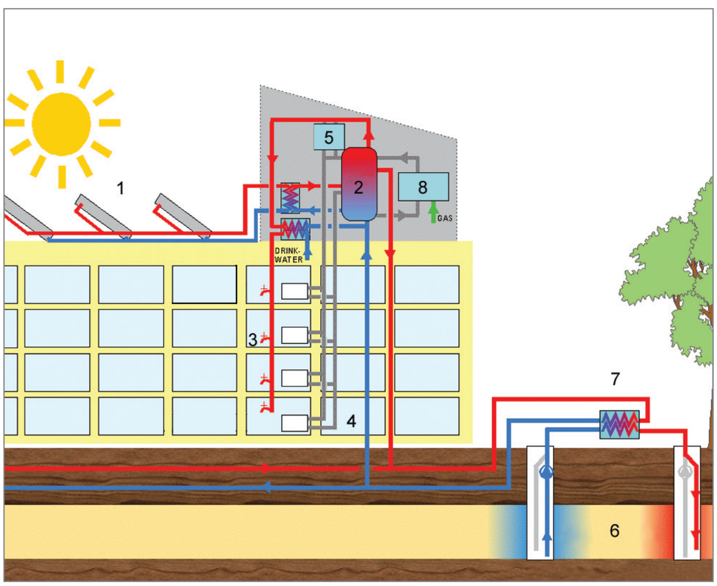
As temporary storage space for the surplus of heat a waterleading sandlayer at around 110 m below the ground surface is being used. This sandlayer is called an aquifer. The storage system contains two wells drilled 80 m apart from each other and a plate heat exchanger. In the summer time the surplus of heat is exchanged onto the ground water from the well. The warm water is stored in the warm well. During wintertime, the heat is extracted from the warm well (via the heat exchanger) and pumped into the cold well.

7. Heat exchanger

The heat exchanger transfers the heat from the water pipes onto the ground water, so that it can be stored in the well. And vice versa.

8. Robur GAHP

A GAHP extracts heat from the well during winter time and produces hot water for heating water and sanitary water with an efficiency over 150%. In the 2 MW-project a total of 16 gas absorption heat pumps have been placed. They make it possible to produce hot water (for heating or sanitary use) using the lower temperature of the ground water.



CONDENSER PERFORMANCE CONDITIONS (1)

Heating capacity (W10/W50)		kW	38.8
Water flow rate	nominal (ΔT = 10 °C)	m^3/h	3.3
	maximum	m^3/h	5.0
	minimum	m^3/h	1.4
Pressure drop at nominal flow rate		kPa	38
Inlet water temperature	maximum	°C	50
	minimum	°C	2
Outlet water temperature	maximum	°C	65
Chilled water flow (ΔT = 5 °C)		m^3/h	2.8

EVAPORATOR PERFORMANCE CONDITIONS (2)

Cooling capacity (W7/W40) (3)		kW	18.4
Water flow rate	nominal (ΔT = 5 °C)	m^3/h	3.2
	maximum	m^3/h	4.7
	minimum	m^3/h	2.3
Pressure drop at nominal flow rate		kPa	37
Inlet water temperature	maximum	°C	45
	minimum	°C	6
Outlet water temperature	minimum	°C	3
Hot water flow (ΔT = 10 °C)		m^3/h	3.6

BURNER FEATURES

G.U.E. cooling efficiency based on gas consumption (4)			2.27
Nominal heating input		kW	25.2
Gas consumption	natural gas G20 (5)	m^3/h	2.67
	natural gas G25 (6)	m^3/h	3.10
	LPG G30/G31 (7)	kg/h	1.96

ELECTRICAL DATA

Required voltages	230 V – 50 Hz	
Nominal electrical power (8)	kW	0.54

INSTALLATION DATA

Weight on operation		kg	286
Sound pressure (9)	at 10 meters	dB(A)	47
Connections	water	"F	$1^{1/4}$
	gas	"F	3/4
	flue exhausted pipe	mm	80
Dimensions	width	mm	842
	depth	mm	655
	height	mm	1310

(1) Nominal conditions according to EN 12309-2 norm, table 12.
(2) Nominal conditions according to EN 12309-2 norm, table 5.
(3) Characteristics under nominal conditions: outside air temperature 30 °C; outlet water 7 °C.
(4) Simultaneous utilization of thermal and cooling energy.
(5) Lower heating value 34.02 MJ/m^3 (9.45 kWh/m^3) at 15 °C - 1013 mbar.
(6) Lower heating value 29.25 MJ/m^3 (8.13 kWh/m^3) at 15 °C - 1013 mbar.
(7) Lower heating value 46.34 MJ/kg (12.87 kWh/kg) at 15 °C - 1013 mbar.
(8) ± 10% tolerance to allow for different electrical voltage and power absorption of the electrical motors.
(9) Free field, frontally, directivty factor 2.

NOTE: the technical table is taken from the Robur GAHP catalogue, edition 02/2007.

Due to continuous product innovation and development, Robur reserves the right to change product specifications without prior notice.

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