

## De State, Amsterdam, Netherlands

Newly built 70 meters low energy high apartment building equipped with individual domestic hot water systems with the MultiBoiler heat pump concept for space heating and hot water.

### Key facts

#### Building

Location	Amsterdam, Netherlands
Construction	March - 2020
Heat distribution	in building
Heated area	32,500 m <sup>2</sup> living
Level of insulation	high

#### Heat pump and source

Number of heat pumps	100
Installed capacity	4.5 kW
Operation mode	monoenergetic
Heat source	ground
Brand and type	<a href="#">ITHO-Daalderop WPU5G</a>
Refrigerant	R134a
Sound level	35 dB

#### Heating system

Heat demand	
Heating temperature	35°C

#### Domestic hot water

Type of system	see overview
Max. Temperature	60°C
Circulation system	individual
Legionella measures	thermal
Storage size	150 – 200 litres
Number of storage tanks	- 320
Storage losses	40Wh
Temperature control	Comfort/ECO

#### Other information

Electric energy	
Consumption year	kWh
Investments costs	unknown
PV installation	1,045 panels
Solar thermal	none

#### Lessons learned

The 'multi-boiler' concept has been developed upon experience in earlier projects, see Example projects at Annex 46 website.



The 70-meter high "State" residential tower is based on the architecture of the New York "Flatiron Building". The tower, which will be completed March 2020, is located in Amsterdam, has a floor area of 32,500 square meters on 23 floors. The building will include 102 social rental apartments and 150 free rental apartments, 43 owner-occupied apartments, ranging from 50 to 400 m<sup>2</sup>. It also has a penthouse of 400 m<sup>2</sup> and a swimming pool. The project is part of the development "Amstelkwartier" Bouwinvest is the owner of the building, the construction of which is estimated at 25.5 million euros.

The shape of the building was a challenge. Normally there is a square or rectangular tower with an equal number of houses per floor. In the State-Building there is a different number of apartments per floor and it was a challenge to make the shafts in the right way, while maintaining a good layout. The great variety in apartments has been one of the biggest challenges in the technical installations of the State tower. Some apartments have their own heat pump and others share one heat pump with four or five apartments for heating, cooling and hot water. Each apartment has its own storage tank for hot water of at least 150 liters. A number of very luxurious expensive apartments have two 200-liter storage vessels for hot water. It is clear that the choice for individual heat pumps reduces the transport losses significantly.



VORM has made 305 apartments in a seventy-meter high residential tower of 23 floors. A striking detail is that 102 of the apartments are intended for the social rental sector, which was a requirement from the municipality of Amsterdam, and 160 apartments in the free housing sector. In addition, a further 43 owner-occupied apartments have been realized.

Due to the large number of apartments, one option in the area of heat supply was already ruled out in advance, Air source heat pumps were not possible, due to the large number of outdoor units that should have been installed. Another option was to connect to the Nuon district heating network, but was too expensive. Together with Klimaatgarant the obvious choice was to develop a collective ground source field with 104 closed ground loops under the building. This has the advantage over glycol-based systems that there is no environmental risk and that the heat pump has a higher efficiency and a longer service life.

The installations used in State require care throughout the entire construction chain. The system only works if there is good cooperation throughout the entire chain. The insulation of the entire building must be good and airtight. This also means that air vents above the windows are not possible, because they can cause cold falls. Thus balanced ventilation is installed. If these measures have been taken in the right way, it is possible to work with a low temperature heater with a very low temperature of 27 to 31 degrees.

### Domestic Hot Water

The apartments are equipped with individual storage vessels for domestic hot water. The capacity of storage vessels is limited, but the buffering of energy matches the characteristics of the sustainable system. The residents have to be instructed how to use the system as the heat pump is not a continuous flow that most residents are used to with the gas boiler. During residents' evenings this is explained and the majority understand and accept that unlimited hot water is no longer available. If the water really runs out, residents can heat the storage tank again, but that will take a while. So people have to learn to deal with it.

### Solar Panels

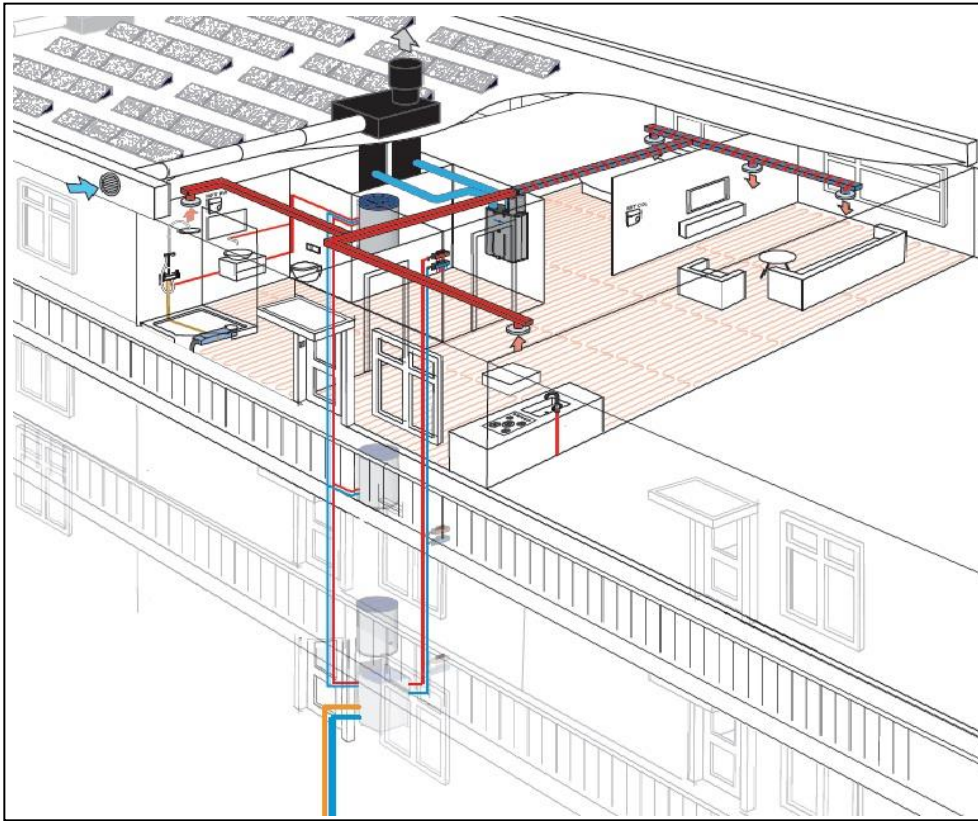
State was designed to have an Energy Performance Coefficient of 0.15. Thus a large part of the in-building energy used is generated with solar panels. There are 1,045 solar panels on the lower part of the tower, which amounts to approximately five solar panels on average per apartment in the lower part. There are no solar panels on the high tower, among other things because the penthouse has a roof terrace and swimming pool. But with these types of high-rise buildings, installing solar panels is a challenge anyway because of the limited roof space for all apartments.

Finding a place for the heat pump and boiler is not always easy in this type of projects. The available space in the apartment is often a challenge. The technical heat pump installations by ITHO Daalderop are becoming smaller and smaller, but take up because of the storage tank more space than a gas boiler and a mechanical ventilation unit. In the State building the heat pumps are placed in the corridor zone outside of the apartment. That is also nice for maintenance as the residents don't have to stay home and the technician can always get to the installation.

### Facts

- Client: VORM Development, Papendrecht
- Design: ZZDP Architecten, Amsterdam
- Execution: VORM Bouw, Papendrecht
- Investor rental properties: Bouwinvest, Amsterdam
- Constructor: Van Rossum Consulting Engineers, Amsterdam
- Ground sources: Klimaatgarant, Schiedam
- Installation of heat pumps + storage: Giesbers InstallatieGroep, Rotterdam
- Building-related installations: HEk Installatiemaatschappij, Den Bosch
- Solar panels: Klimaatgarant, Schiedam

## De State, Amsterdam, Netherlands, Technical details



The multi boiler concept is based upon a low energy demand for space heating. Therewith a small heat pumps (4.5 kW) can service the demand for more than one apartment. This same heat pump can feed the demand for a number of apartments, storing in individual storage tanks.

## Description of the technical concept



Flat Energy Cube as standard plug & play solution for multifamily buildings is potentially tailor made, installed in the corridor zone outside of the apartment. Thus easily serviced by the EsCo when occupants of the apartments are not at home (source [ITHO-Daarderop](#)).

