Ronduit Utrecht, Netherlands

Sustainable Utrecht luxury and flexible housing with a special inner court, with individual heat pumps with low temperature solar PVT as heat source.

Key facts

Building
Location *Utrecht, Netherlands*
Construction *June, 2019*
Heat distribution *in building*
Heated area *m² living*
Level of insulation

Heat pump and source
Number of heat pumps 40
Installed capacity 8 *kW*
Operation mode *monoenergetic*
Heat source solar panel
Brand and type Triple Solar®/NIBE F1255
Refrigerant R407C
Sound level 28 *dB*

Heating system
Heat demand
Low temperature floor heating
Heating temperature *30°C*

Domestic hot water
Type of system *monobloc*
Max. Temperature *60 °C*
Circulation system
Legionella measures *thermal*
Storage size 180 *litres*
Number of storage tanks
Storage losses 1.37 W/K.
Temperature control

Other information
Electric energy
Consumption year *kWh*
Investments costs *unknown*
PVT installation 25m2/house

More information:
Declaration of equivalence
Solar Heat Pump Standard Assessment Model

Ronduit Utrecht is a development of LINQ projects. 40 houses and apartments are being built. Ronduit Utrecht is centrally located in Leeuwesteyn, near the Dafne Schippersbrug.

Every home gets its own heat pump with Triple Solar® PVT heat pump panels and extra PV panels. Heat pump panels are constructed differently than regular solar collectors, even if there is no sun, the heat pump panel pays off. They have no insulation at the rear, so they can extract as much heat as possible from the environment. Energy is extracted both at night and in winter to feed the heat pump. Together they ensure a completely energy-neutral solution. In total there are 800 panels on the roof in the Ronduit project.

Water heaters

- The hot water supply runs from the individual double function heat pump with integrated storage tank.
- Type and manufacture of heat pump and storage tank NIBE
- The hot water is supplied by a 180 liter tank in a monobloc domestic hot water heat. At 60°C, this is sufficient to shower for approximately 60 minutes using a water-saving shower head at a maximum of 6 liters per minute and a water temperature of 38°C. The moment the storage tank is empty, it takes about 1.5 hours before it is fully up to temperature again.
- Every supply device has its limitations with regard to a continuous supply of hot water. If you need more hot water, you can choose the "extra hot tap water" option. This option provides an additional storage capacity of 120 liters set at 85°C. This can be used to shower for approx. 60 minutes longer with a water temperature of 38°C.

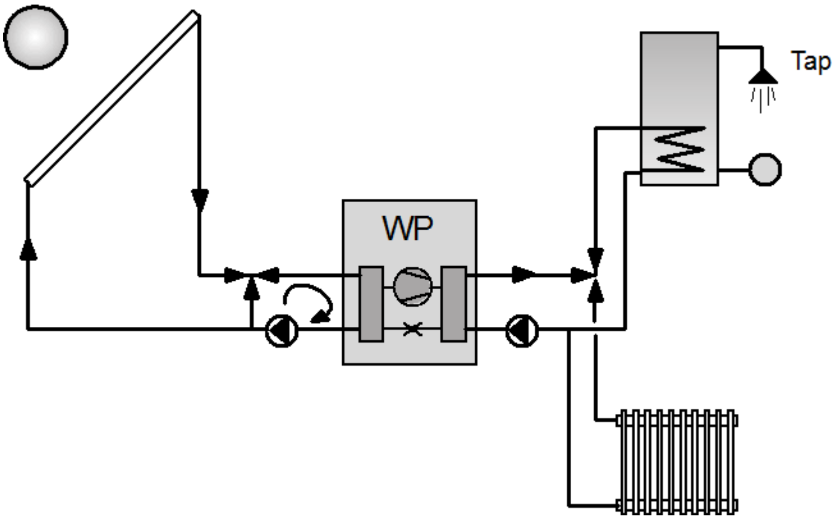
ENVIRONMENTAL COLLECTOR / HEAT PUMP SYSTEM OF TRIPLE-SOLAR

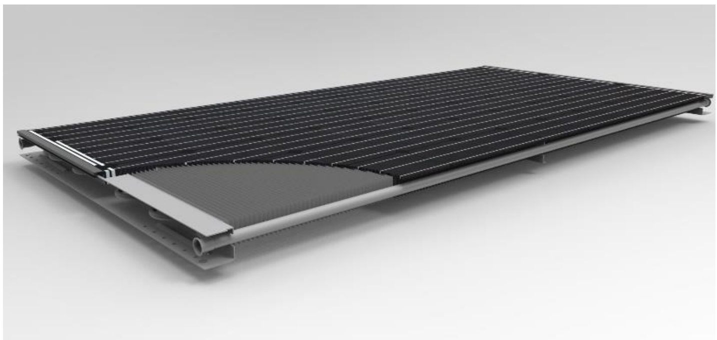
This being the first to get a declaration of equivalence for the energy performance in accordance with NEN 7120 (EPG), for an individual heating device, not belonging to heat supply by third parties. This equivalence statement has been drawn up in accordance with NEN 7120 (EPG), including supplement sheet for June 2017, for a system according to the following installation scheme:

1. Applied in a newly-build house (WN) with an energy requirement of <150 MJ / m2.
2. For one heat pump:
   a. NIBE F1255 6 kW, with performance data (COP and P_{th}) according to EN14511 and EN14825 tests, performed by AIT-Austria and NIBE.
   b. With maximum temperature of the evaporator 30ºC.
   c. With cut-off criteria for (too) low evaporator and (too) high condenser temperatures.
3. And a storage tank:
   a. With a capacity of 180 liters, with thermal layering.
   b. Storage tank loss equal to 1.37 W/K.
4. With an environmental collector:
   a. With thermal performance data (IAM and loss coefficients c1 to c6) according to measurements from TNO.
   b. With PV performance data: Efficiency of 17.1% and temperature coefficient for power of -0.39% / K
   c. Oriented with azimuth between 90 and 270 ° (East-South-West) and a slope between 30 and 45 °.
   d. With weather data (meteo) according to NEN5060A2 (De Bilt).
   e. Without shading.
   f. A surface of 25 m^2.
5. For the supply of space heating with a Low Temperature central heating system:
   a. Gross heat demand $Q_{H;dis;nnrenes}$ of the home: 5-10-20-30-40-50 GJ / year.
   b. With a design supply temperature of <30ºC, with a dT of 5 K. Base point of the heating curve is 12ºC.
   c. For an indoor temperature of 20ºC, without night reduction.
6. And for delivery of domestic hot water:
   a. With a hot water load $Q_{W;dis;nren}$ in accordance with equation 19.11 of NEN7120, for 5-7-9-11-12-15 GJ / year, with a draw off pattern scaled within tap class 4.
7. With which the energy performance (required drive energy for the supply of space heating and domestic hot water is calculated with the method described in [Berkel, 2016] and an associated calculation tool:
   a. Where for every hour sequentially, for an entire year (8760 hours), the system condition is calculated in Excel.
   b. With an explicit time integration, from one hour to the next hour.
   c. Taking into account the thermal capacities of the collector and the storage vessel.
   d. With input for weather data NEN5060 and hourly values for heat load for space heating and tap water.
   e. The output yields efficiencies on space heating and domestic hot water.
   f. The program has been checked and validated by simulation with the commercial system software program PolySun and the NEN7120 calculation tool for Air/Water heat pumps.
8. The generation efficiency includes electric resistance for peak loads and all auxiliary energy.
9. The tables show the generation efficiency for space heating and domestic hot water, depending on the heat requirement for space heating and domestic hot water, as well as the electrical output of the PVT collector for unshaded application.

	Collector surface area 25 m2					
Space Heat demand QH;dis;nren [GJ]	5	10	20	30	40	50
COP space heating	4,71	5,12	5,24	4,99	4,58	4,13
Hot water demand QW;dis;nren [GJ]	5	7	9	11	13	15
COP hot water	3,30	3,69	3,73	3,72	3,81	3,92

Ronduit Utrecht, Netherlands, Technical details





The Triple Solar®-system has got PVT heat pump panels. The front consists of photovoltaic cells (PV) that convert sunlight into electricity. The rear is a thermal exchanger (T). Together with the silent water/water heat pump, this provides heating and hot water.

Technical specifications

Description of the technical concept

Declaration of equivalence, This is the first declaration which has been developed as a model and method described by Jacob van Berkel and presented at the 12th IEA Heat Pump Conference in Rotterdam. Jacob van Berkel, Onno Kleefkens, Felix Lacroixc, Solar Heat Pump Standard Assessment Model, paper at 12th IEA Heat Pump Conference 2017, May 15-18 2017, Rotterdam – Netherlands.
The concept of a low temperature non-glazed and non-insulated solar collector as source for a heat pump was already proposed in the thesis 'Theoretisch en experimenteel onderzoek aan warmwater zonnecollectoren', O. Kleefkens M.Sc. September 1975, Leerstoel Klimaatregeling – Techn University of Delft.

Ronduit at Oeverpark Utrecht consists of 32 spacious mansions and 8 apartments. The sustainable homes are flexible and varied and with the annex concept, living, working and caring are effortlessly brought together under one roof. The difference in height was used for a half-sunken garage with storage and parking spaces. A green oasis is created on the inside. Actually, every home in the plan is different due to typological and architectural differences and the many possibilities for buyers to personalize homes. There are four types of annexes: the lounge annex (with an additional living room), the work annex (with an independent work space on the ground floor), living-xl annex (with many bedrooms) and the pouch annex (with an independent home on the ground floor). The generous private gardens and terraces lie on it.

In addition to being architecturally and programmatically special, the plan is also extremely sustainable. EPC scores of an average of -0.2 and an average GPR of 8.4. Much attention has been paid to climate adaptation (in particular water infiltration) and biodiversity (in the special inner garden). An underground parking garage makes the special green courtyard possible that also solves the differences in height wheelchair-friendly