USES4HEAT – Demonstration of innovations at the MT - ATES site in Andel, the Netherlands

Geothermal Innovation Days
14th October 2026 – Delft, the Netherlands
Bas Godschalk – DTESS – consortium member

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor CINEA can be held responsible for them.

Co-funded by the European Union

Who is DTESS?

- **D**utch
  - Independent specialist consultancy based in the Netherlands
  - Active in: BE, DE, JP, KR, UK, US, EU, CA, AU
  - Founded and led by Bas Godschalk
- **T**hermal **E**nergy **S**torage
  - Shallow and deep geothermal energy projects
  - Focus on ATES, HT-ATES, BTES, surface-water energy
  - Innovations in thermal energy storage
- **S**olutions
  - Project Management
  - Business Development
  - Knowledge Exchange



bas.godschalk@dtess.com

+31 6 3088 7473

https://dtess.com

01

What is USES4HEAT?

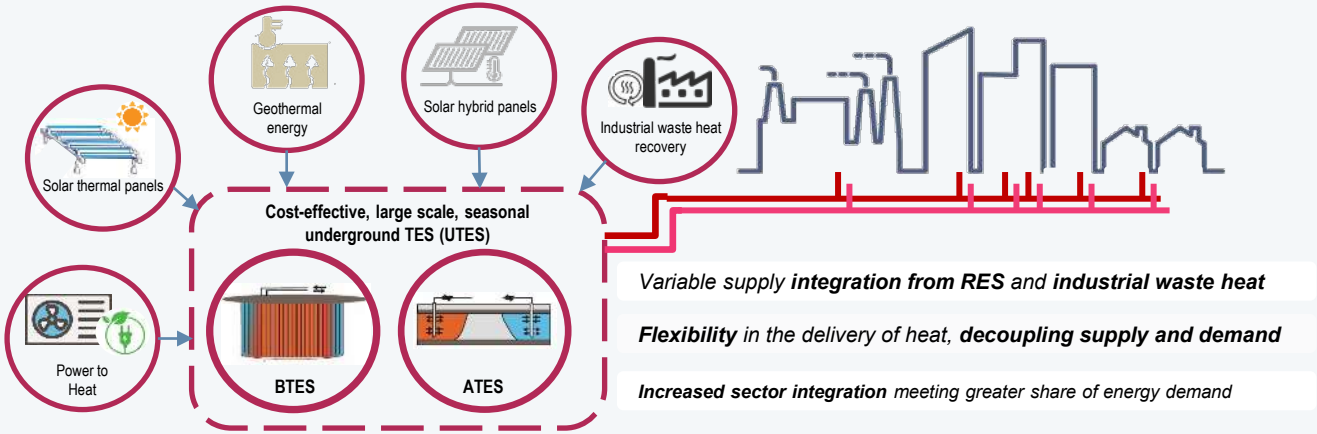
This project has received funding from the European Union's Horizon research and innovation programme under grant agreement No 101136136

USES4HEAT

USES4HEAT

USES4HEAT | Underground Large-Scale Seasonal Energy Storage for Decarbonised and Reliable Heat

USES4HEAT aims to demonstrate innovative, large scale, underground seasonal thermal energy storage **(UTES) solutions** integrated in local district heating networks **harvesting locally available renewable sources of heat** such as waste heat, solar thermal, geothermal or power-to-heat.



Web page: https://www.uses4heat.eu/

USES4HEAT

Co-funded by the European Union

USES4HEAT PARTNERS



Amendment – Sept 2026

- Six new partners; three withdrew
- New ATES demo Andel, the Netherlands
- New BTES demo Litomerice, Czech Republic

27 Partners

8 Countries

- **Two large partners' clusters** in relation to demo sites (Nordics and Italy)
- **Six major EU district heating companies:** Norway, Sweden, Spain, Italy, Greece, Croatia

Budget 12.4 M€
(EU funding 9.7 M€)

Coordinator:

KTH Royal Institute of Technology

KTH VETENSKAP OCH KONST

Sweden's largest technical university

USES4HEAT INNOVATIONS

- Advanced drilling equipment and machines for aquifer thermal energy storage (ATES)
- Innovative piping for high temperature borehole thermal energy storage (BTES)
- Groundwater high temperature heat pump (HP) integrated with ATES and DH
- Efficient photovoltaic thermal (PVT) integrated with ATES
- Integrated solar thermal collectors (STC) for BTES charging and district heating connection
- Intelligent Energy Management Hub

02

ATES Demo in Andel

Butterfly orchids

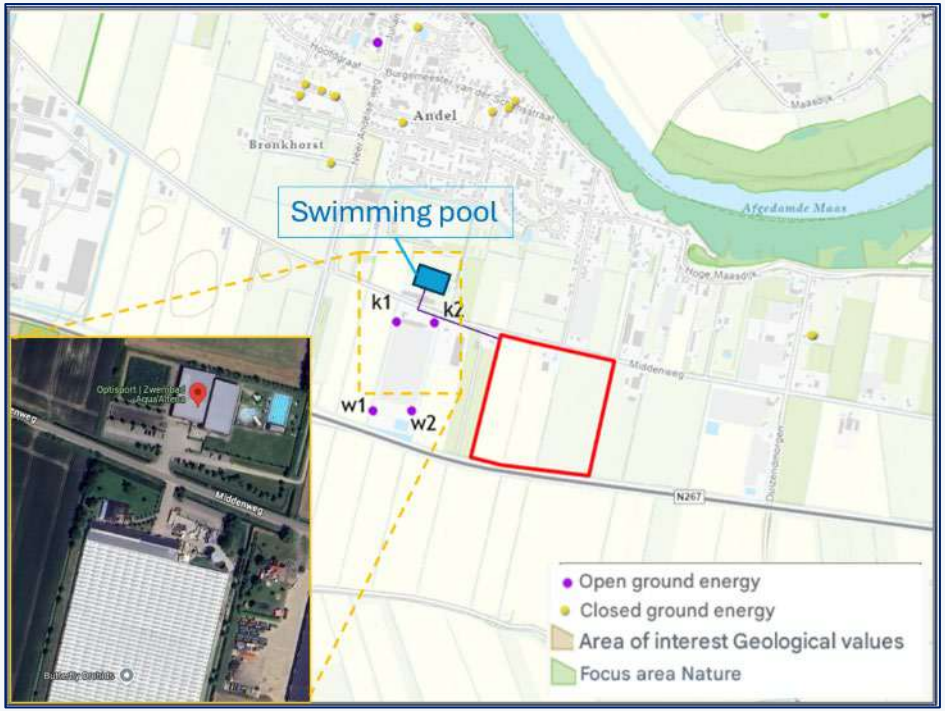
USES4HEAT

Site Overview – Butterfly Orchids

- Around 3.5 hectares
- Operates with 3x NG CHP, HP, PV panels, storage tanks (hot and cold) and LT-ATES system.
- Supplying the Swimming Pool nearby
- Will be connected to the new Greenhouse.

Energy Concept	LT–ATES
Storage Aquifer	Shallow Aquifer (20-55 m b.g.l.)
Number of Wells	2 cold wells – 2 warm wells
Injection Temperature Max	25 °C
Flow rate Max	150 m^3/h
Heating Power	1,750 kW
Cooling Power	1,050 kW
Storage Capacity	2,600 MWh

LT-ATES features currently operating in the existing greenhouse at the demonstration site.

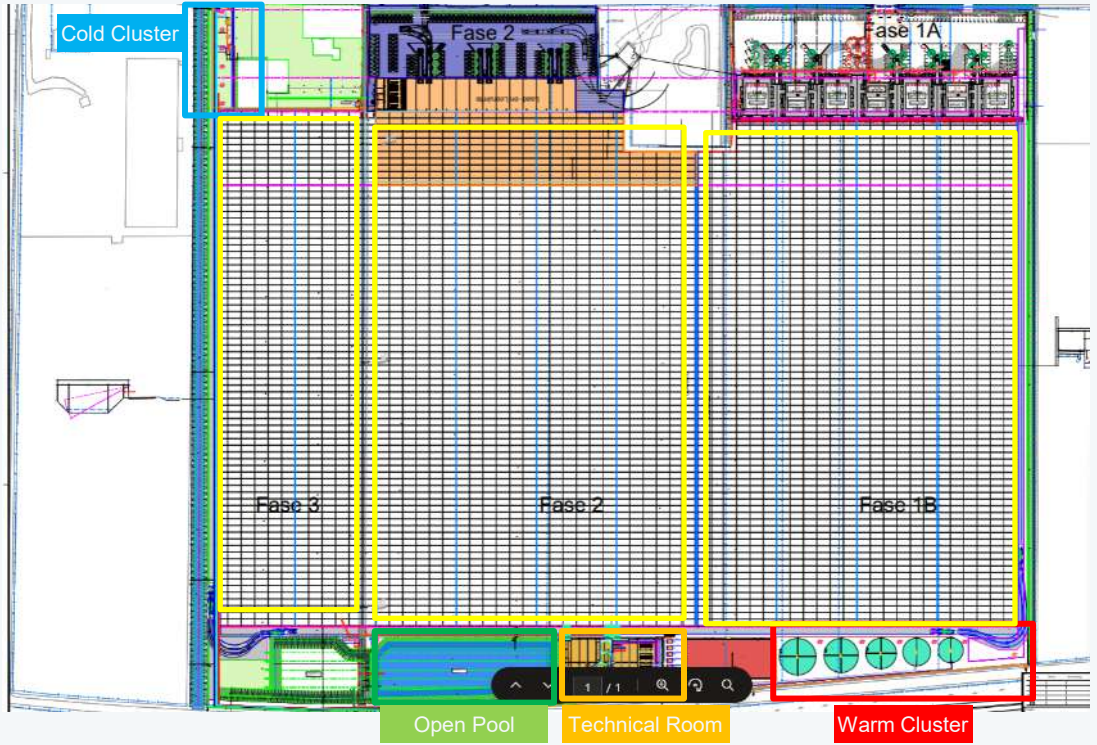


Demo area, highlighting the location of the new greenhouse (in red) and the connection between the energy system, existing greenhouse, and swimming pool.

Site Overview – Butterfly Orchids – New greenhouse

- Around 12 hectares covered area
- No natural gas connection will be installed.
- Energy system will be connected with the current greenhouse.
- Energy supplier components:
  - 4x 1,5 MW GWHPs (6 MW in total)
  - MT-ATES system
  - PV & PVT panels

In line with the national strategy to increase the share of renewable energy in the electricity mix, the integrated system is expected to operate on 100% renewable energy in the near future.

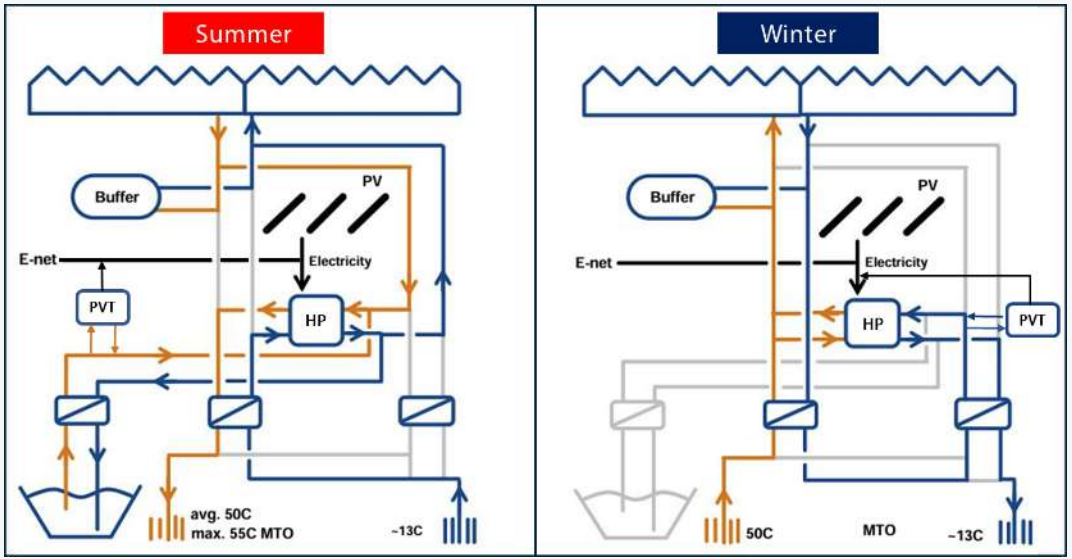


Planned phases for the construction of the greenhouse and the areas designated for the warm and cold clusters of the MT-ATES system.

Site Overview – Butterfly Orchids – New greenhouse – Operation Concept

	Year 5		Year 10	
	Summer	Winter	Summer	Winter
Cold supply	7 GWh		10 GWh	
Heat load		10.5 GWh		18.5 GWh
ATES	21 GWh *(charge)*	9.5 GWh *(discharge)*	21 GWh *(charge)*	17 GWh *(discharge)*
GWHP	4.2 GWh_{el}	0.9 GWh_{el}	4.2 GWh_{el}	1.7 GWh_{el}
PVT Panels	Annual Supply ≈ 62.5 MWh_{el} & 68.5 MWh_{th}			

Designed Energy flow for the operation of the energy system in the new greenhouse.



Schematic representation of the energy system and the integration of its components across the seasons.

03

New Seasonal Large - Scale Aquifer Thermal Energy Storage

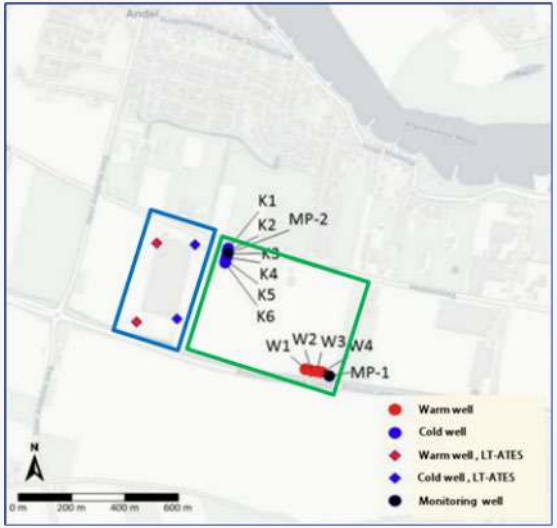






New Seasonal Large -Scale Aquifer Thermal Energy Storage
General info

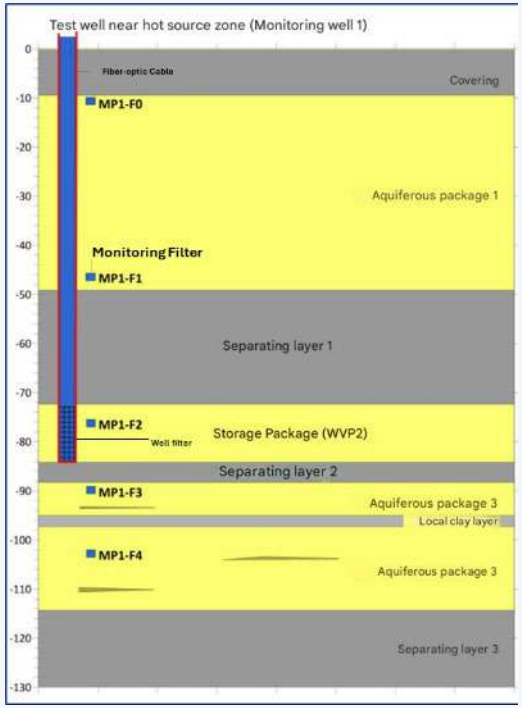
- 10x Wells:
- 6x cold wells
- 4x warm wells
- 2x monitoring wells



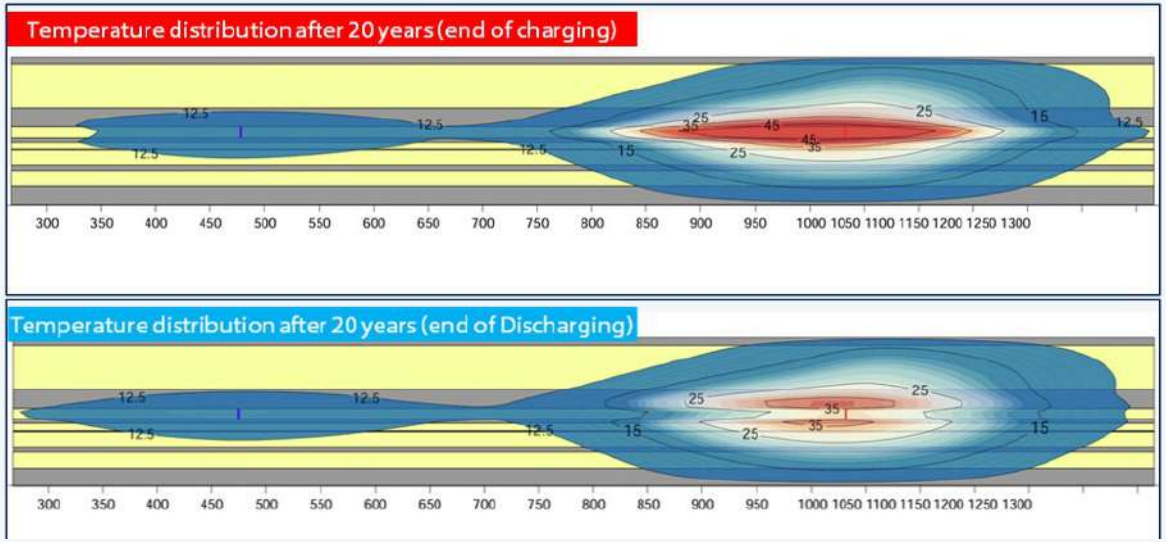
Parameter	Unit	Summer	Winter
MT-ATES mode	[-]	Charging	Supply
maximum water volume to be pumped	[m^3/season]	620,000	750,000
average water volume to be pumped	[m^3/season]	520,000	635,000
maximum flow rate	[m^3/h]	390	390
average injection temperature	[°C]	50	13
min/max injection temperature	[°C]	55	5
cut-off temperature	[°C]		25
subsurface-side capacity	[kW]	7,600	7,400
average transferred energy amount	[MWh_{th}/season]	21,000	17,000
Average heat supply MT-ATES + HP	[MWh_{th}/season]		18,500

MT-ATES system principles and general characteristics.

Test drilling – Butterfly Orchids – New greenhouse – Subsurface Stratigraphy



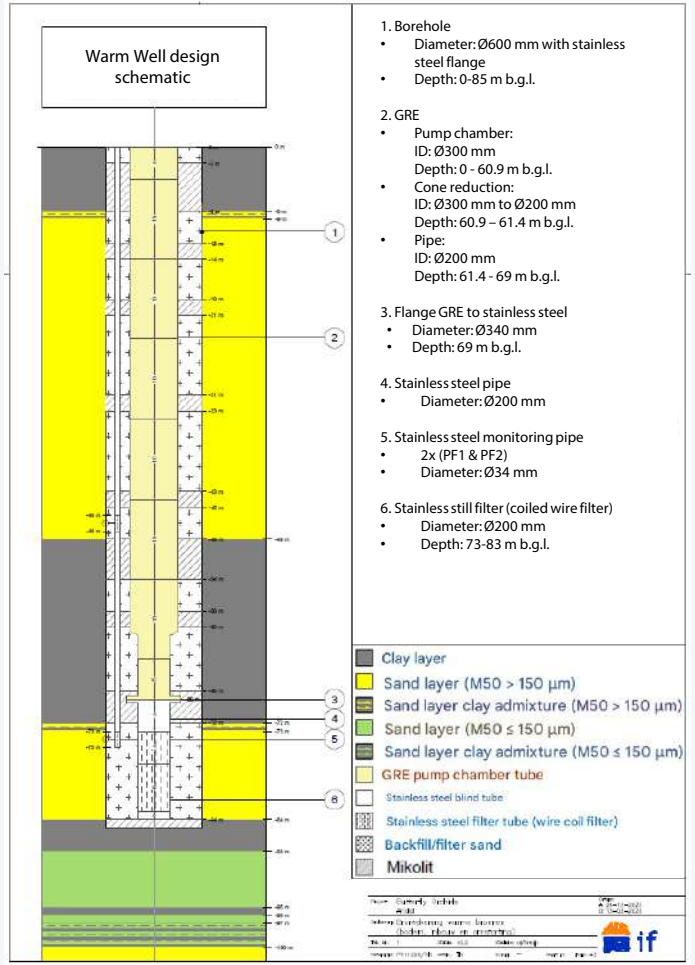
Schematic representation of the underground layers, highlighting the position of the test wells and monitoring filter screens.



Calculated temperature distribution [°C] after 20 years of MT-ATES operation.

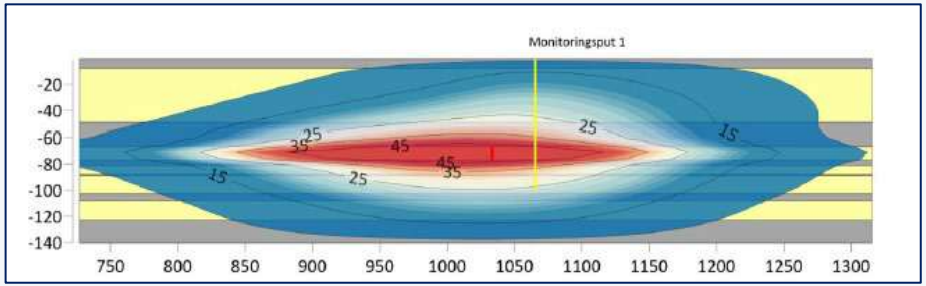
Well Design
Warm Cluster

- 4x wells at warm cluster
- Material selection:
  - GRE tube (Glass Reinforced Epoxy)
  - Stainless steel filter (wire coil filter) at storage aquifer
  - Backfilling materials
- Drilling depth up to 85m b.g.l.
- Borehole diameter: 600mm
- Screen slot size
- Connections
- Well housing
- Monitoring wells



Monitoring

- **2x Monitoring wells** (1x @ Warm cluster and 1x @ cold cluster) + **warm and cold well**
- **Three reasons:**
  - Technical performance
  - Required for the permit
  - USES4HEAT
- **Temperature increase:**
  - Grow of microbes
  - Calcite precipitation
  - Change in chemical composition groundwater



Position of monitoring well (MP1) at warm cluster.



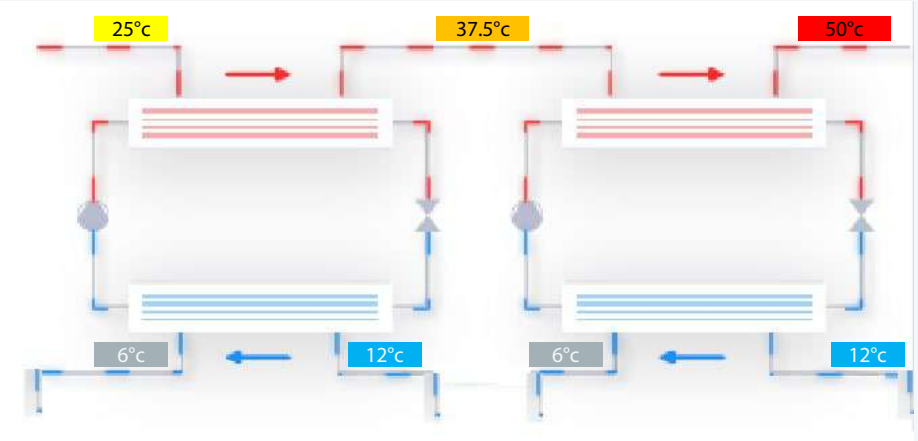
Cold well.

04

New Ground Water Heat Pump

Design operating conditions and performance targets

- 4 Unit of industrial Water/Water chillers to provide both cooling and heating.
- Series arrangement → on the hot side (condenser)
- Parallel arrangement → on the cold side (evaporator)



Schematic layout of water connection

Unit 1 – Heating@25/37.8 °C;12/6 °C;100%;		
Heating capacity	kW	1572.8
Water Flow user side	l/h	105676
Water Pressure drops user side	kPa	66
Water Flow source side	l/h	187941
Water Pressure drops source side	kPa	59
Total Power input	kW	275.4
Total Absorbed Current	A	470
COP	W/W	5.71

Unit 2 – Heating@37.8/50 °C;12/6 °C;100%;		
Heating capacity	kW	1490.2
Water Flow user side	l/h	105046
Water Pressure drops user side	kPa	66
Water Flow source side	l/h	166125
Water Pressure drops source side	kPa	44
Total Power input	kW	348.6
Total Absorbed Current	A	595
COP	W/W	4.27

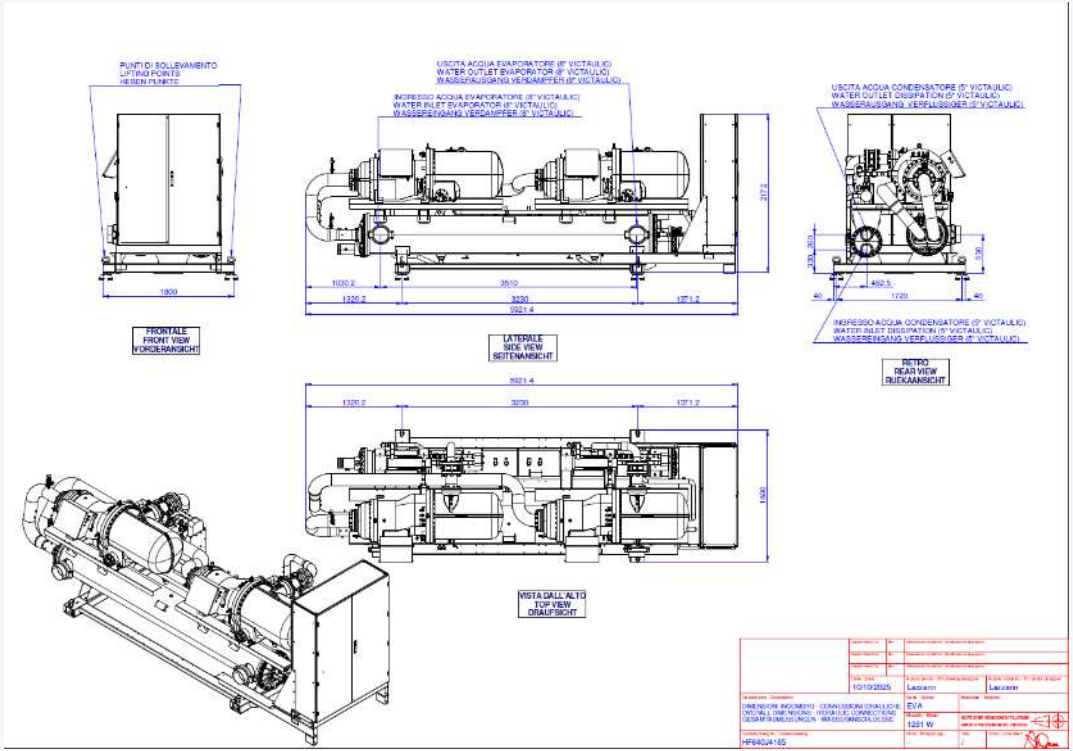
Preliminary simulation results for the GWHPs in a series configuration.

Unit selection

- Screw Compressors
- Low noise set-up
- R515B (GWP=299) – non flammable, non-toxic, synthetic refrigerant as replacer of R134a (77% lower GWP).
- High temperature range
- Simple non-reversible reverse cycle to achieve high COP



EVA1281W DX – HIREF GWH

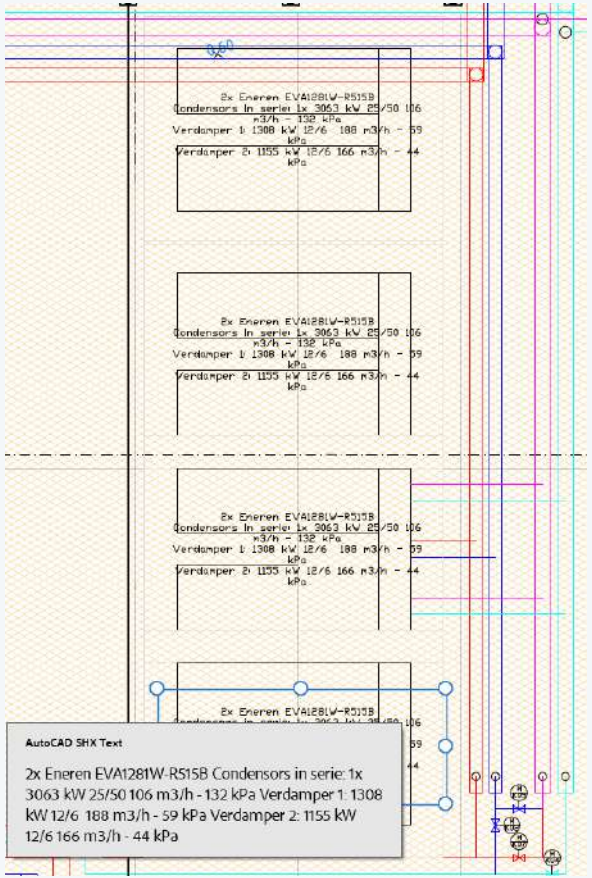


Dimensional drawing

Site Overview – Butterfly Orchids
Development of the new Greenhouse



4x units of GWHP delivered to the technical room.



Integration of GWHPs with the energy system.

05

Integration of Hybrid Solar Panels with ATES

enef Solar Solutions.

USES4HEAT

Objectives of this study

Main objective

To develop and experimentally assess water-based PVT prototypes that combine a **high-efficiency PV module** with compact heat exchangers (HXs) suitable for low-temperature operation

- To incorporate TOPCon N-type silicon cells
- To adopt an industry standard for large-format, high-power panels
- To adapt the conventional HXs to this large format
- To achieve a feasible, cost-effective, efficient and reliable for real-world installation

Description of the PVT components

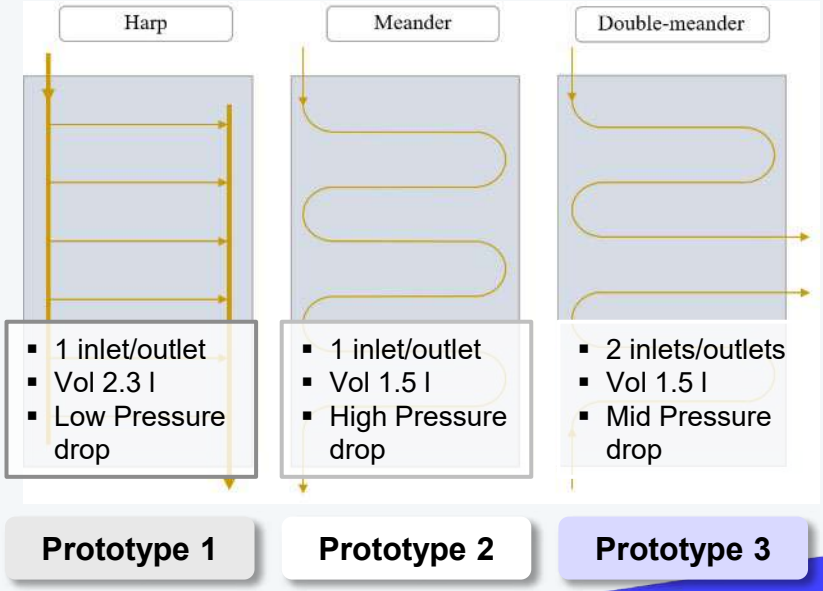


PV module:

- TOPCon N-type cells
- 620W, 2.7 m^2
- Height: 30mm
- Weight: 23 kg

Heat Absorber:

- Cu-Al based / Sheet and tube design



Other components:

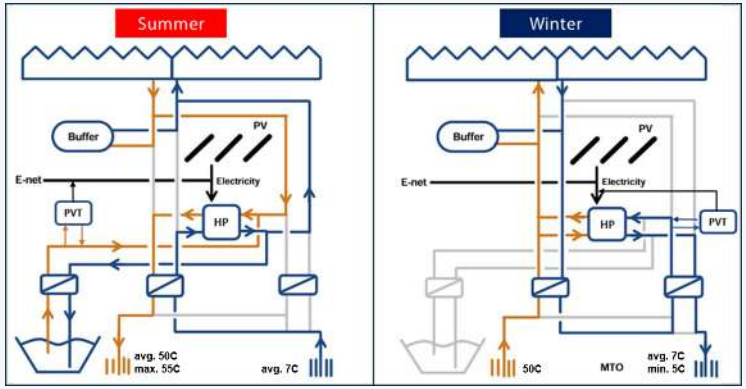
EU PVSEC 2025. Lucía Cano, Raquel Simón-Allué, Raúl Villén, Yolanda Lara, Isabel Guedea. Materials Assessment for PV-T Modules Thermal Performance Improvement. doi: *10.4229/EUPVSEC2025/3AV.1.11*

Future work

PVT integration on demo site

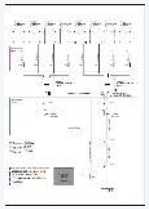
IN PROGRESS

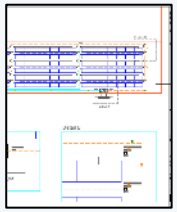
Schematic representation of the energy system and the integration of its components across the seasons.



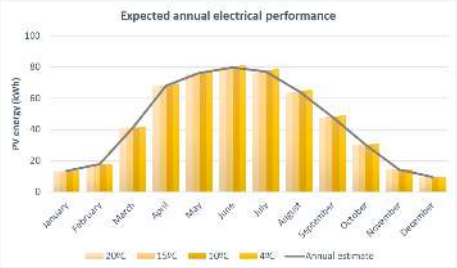
Technical project

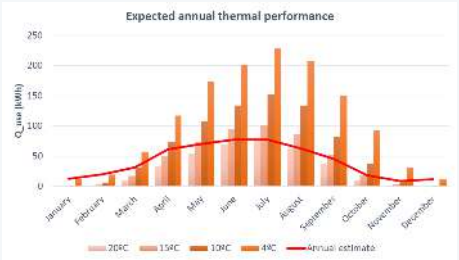






- Current layout 126 PVTs (75,6 kW).
- Installation planned for 2027
- Different thermal scenarios





PVT production estimated

Electrical energy: 62.4 MWh/year

Thermal energy: 68.3 MWh/year

Main conclusions

Experimental assessment of three PVT prototypes incorporating high efficiency large–format PV laminate and different HX configurations. Winter and spring performance is analysed.

- The three prototypes showed broadly **comparable electrical and thermal power outputs**, while the main differences were observed in the fluid temperature rise. This is influenced by the fluid flow but also by the geometry.
- Winter results identified the meander and double-meander configurations as the most promising designs, and spring results showed similar performance → selection must be done under practical issues.
- **Double meander configuration** presents more favourable balance between thermal performance and hydraulic resistance, it is selected for the ATES application.
- An installation of 126 PVT panels is envisaged to be integrated with a heat pump and a seasonal storage (ATES) providing 62.4 MWh of electricity and 68.3 MWh of thermal energy per year

This project has received funding from the European Union's Horizon research and innovation programme under grant agreement No 101136136

06

Intelligent Energy Management, Monitoring, and predictive O&M

ENERGENIUS
SMART ENERGY SOLUTIONS

USES4HEAT

Intelligent Energy Management, Monitoring, and predictive O&M

- **EMS Evolution**
  - Parallel development by MAPS of a new, advanced Energy Management System.
  - Transitioning from the GEM platform to the new Brainwatt ecosystem (https://energy.mapsgroup.it/en/brainwatt-platform/).
  - Developing a strategy for greenhouse growers to reduce energy costs through the optimal use of available energy sources and by purchasing electricity wisely on the electricity market.
  - This also helps to alleviate grid congestion issues.

Thanks for Your Attention!

Geothermal Innovation Days
14th October 2026 – Utrecht



















