

# SunHorizon project overview.

## Sun-coupled innovative heat pumps



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## Our vision and objectives

**The SunHorizon 5 Technology Packages (TP) aim at covering at least 80% of the Heating & Cooling needs of refurbished and new single/multi-family/tertiary buildings.**

Demonstrate up to **TRL 7** innovative and reliable HP solutions that acting properly coupled and managed with advanced solar panels can **provide heating and cooling to residential and tertiary building with lower emissions, energy bills and fossil fuel dependency.**



- Increase SunHorizon H&C technologies performances
- Promote cloud based functional monitoring for H&C purposes
- Reduce SunHorizon H&C technologies CAPEX and OPEX
- Demonstration of SunHorizon Innovations indifferent EU countries and type of buildings
- Promote the replication of SunHorizon Concept
- Dissemination and Capacity Building



# Consortium – 21 partners



An Industry driven Consortium:

- 5 top level Academic Polytechnic Institutions
- 12 industrial partners:
- 5 Large Enterprise (LE)
- 7 Small and Medium Enterprises (SMEs)
- 4 association and stakeholders acting as demo site

# SunHorizon TPs

The demo site needs, are supplied with **5 different technology combinations**, that combines the following technologies:

## Heat pumps



**FAHRENHEIT**  
Cooling Innovation.



**BDR THERMEA GROUP**

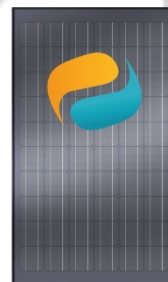


**BOOSTHEAT**  
ENERGY UNITES PEOPLE

## Solar technologies



**BDR THERMEA GROUP**



**DUALSUN**

## Storage



**ratiotherm**



**BDR THERMEA GROUP**

## Needs

Space cooling

Space heating

DHW

**5 technology packages**

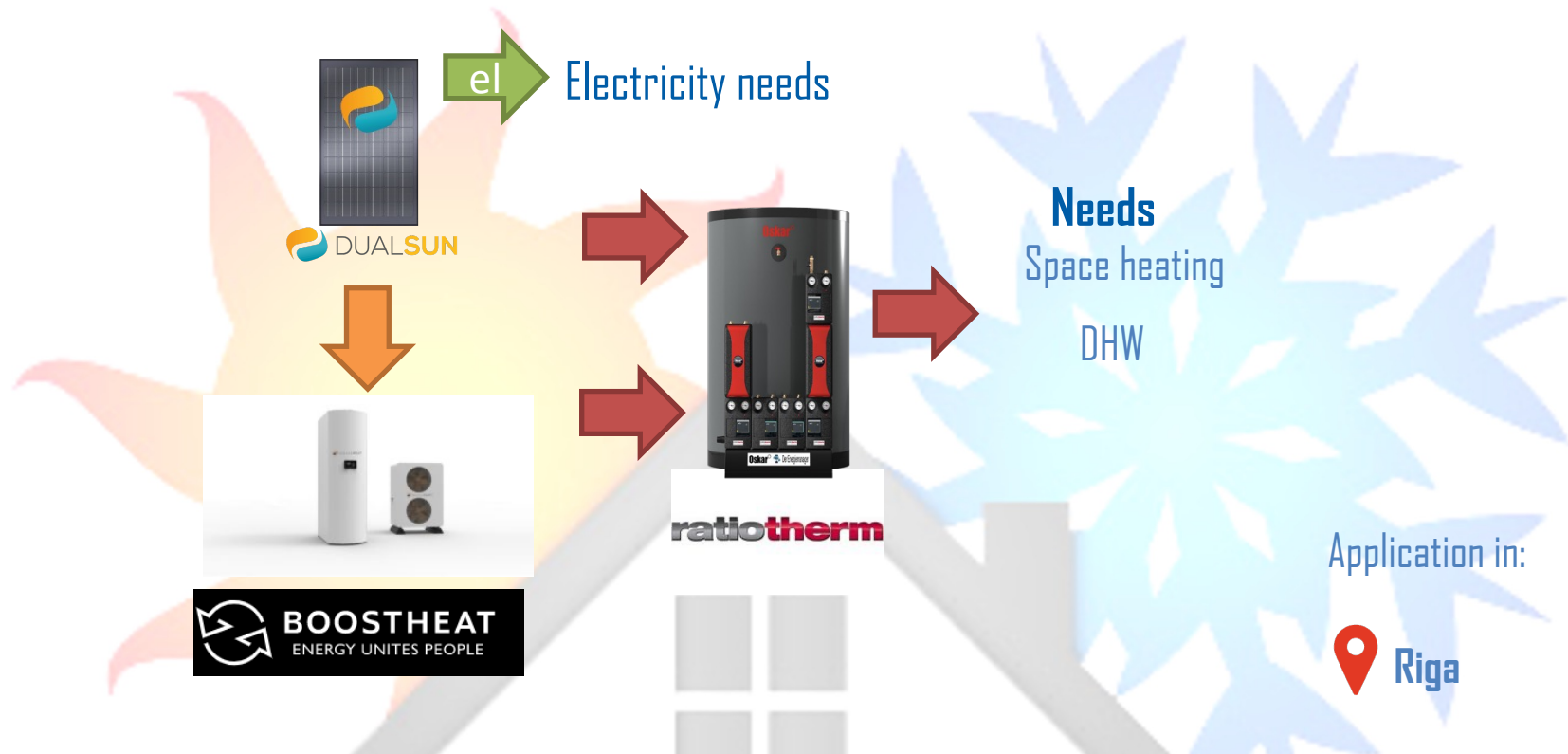
# SunHorizon: Demosites



Nº	Location	Climate	Building type	SunHorizon TP
1	Berlin (Germany)	Cold	Small residential	<b>TP1:</b> TVP+BH
2	Nürnberg (Germany)	Cold	Large residential	<b>TP2:</b> DS+BH
3	Saint Cugat (Spain)	Warm	Tertiary (Civic centre)	<b>TP3:</b> TVP+FAHR
4	Madrid (Spain)	Average	Large residential	<b>TP4:</b> DS+BDR
5	Cluj-Napoca	Cold	Dormitory	<b>TP1:</b> BH+TVP+DS
6	Riga (Latvia)	Cold	Small residential	<b>TP2:</b> DS+BH

# SunHorizon TPs: TP2

## Technology package 2 (TP2): innovative gas-fired heat pump with improved PVT solar panels



SunHorizon TP		Solar-HP integration concept	Description
TP2	DS+BH	Mixed solar-assisted/ parallel integration	BH for space heating + DHW support; DS PV-T thermal output to assist BH evaporator and cover preheating of demand; + electricity for appliances





## RIGA

Single houses (2) in Latvia.

Lessons learnt:

- PVT panels with polypropylene caused a **variation of pressure** in the commissioning that affected the installation
- Gas-driven CO<sub>2</sub> heat pump could not run with pressure variations. For several reasons, it had a lot of **leaks and stopped running**
- Nevertheless, in Sunisi **1733.2 kWh of gas were saved** in the period of February to August. It did not lead to cost savings due to the **increasing cost of gas**; comfort is always met
- CO<sub>2</sub> heat pump will be replaced with a **hybrid concept** (compression HP+ gas boiler for peaks) which will allow self-consume the PV production for the electric heat pump





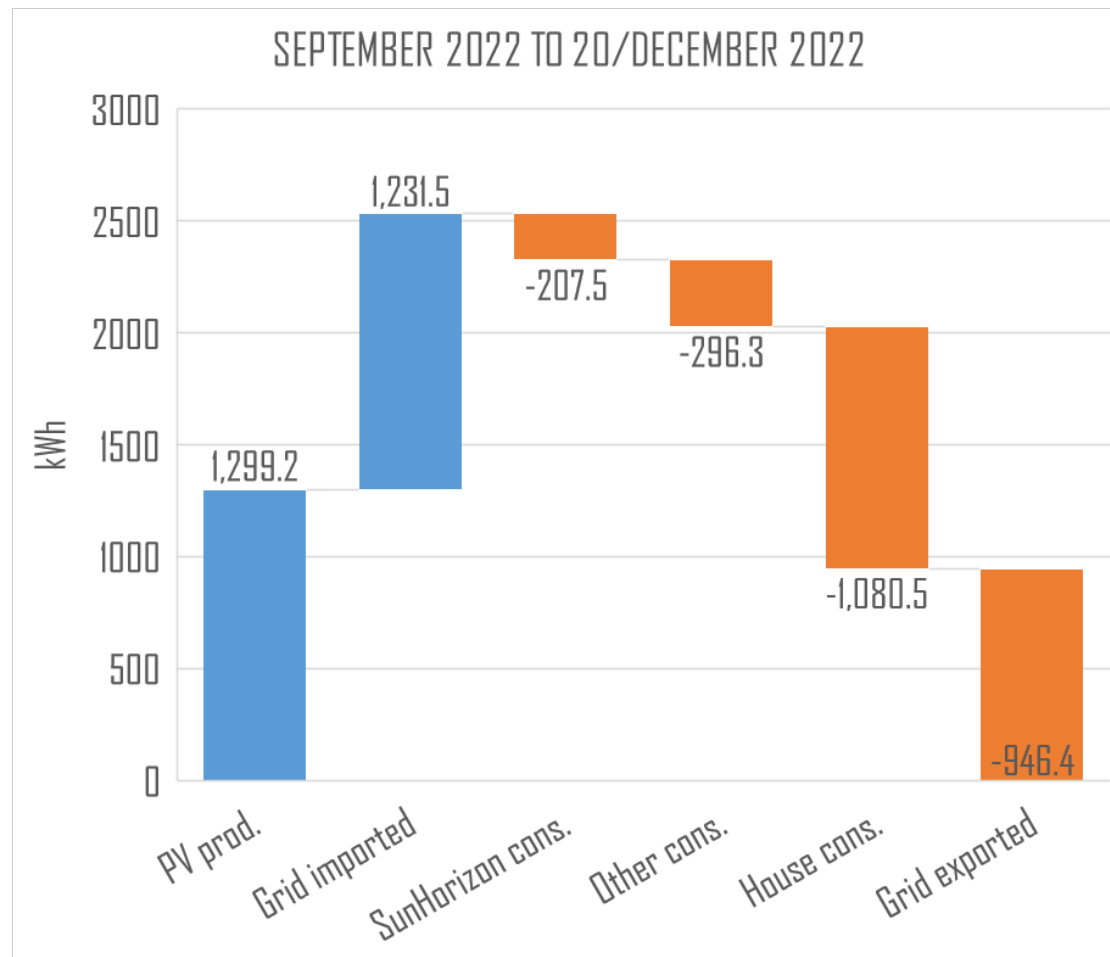
## RIGA: SUNISI

From the period of Sep. 22 to Dec 22

The electricity Balance in Riga shows that:

- **40.1%** of the energy produced by the PVT is **self-consumed** in the house for appliances as well as SunHorizon loads (which are low)
- A **solar electric efficiency of 17.7 %** is obtained
- The **excess of energy** is exported to the grid (-946.4 kWh)
- That causes **~370€ savings \***

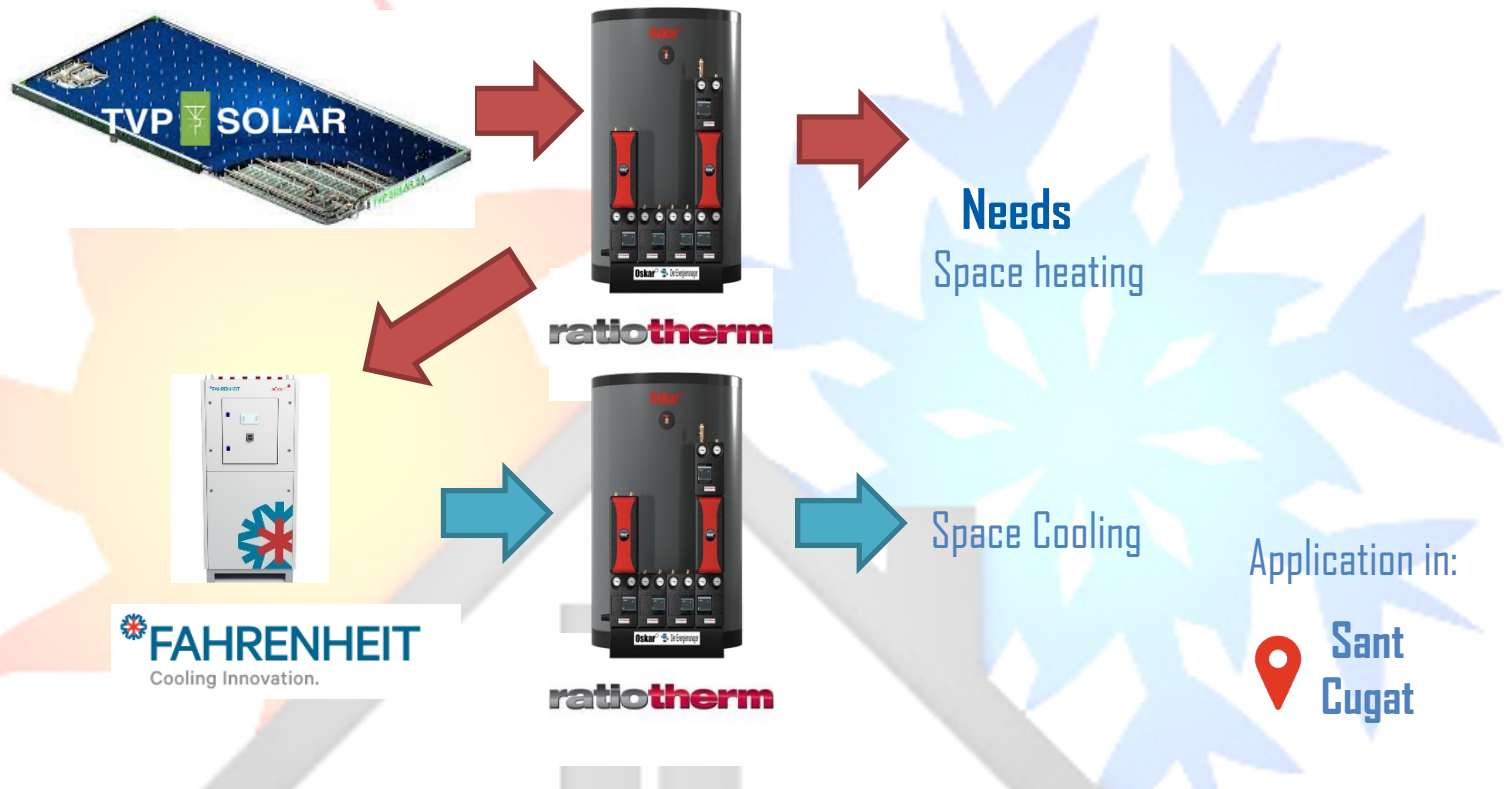
*\*With average prices: 0.321739 EUR/kWh (average 2019 market price) and a discounted price of 0.0493196 EUR/kWh for the energy amount resulting of the net metering*





# SunHorizon TP3

Technology package 3 (TP3): hybrid adsorption-compression chiller with high-vacuum solar panels



SunHorizon TP		Solar-HP integration concept	Description
TP3	TVP+FAHR	Solar-driven HP for cooling	TVP for space heating + DHW in winter + activation of the thermal compressor of the adsorption chiller (FAHR) for cooling in summer



# Sant Cugat

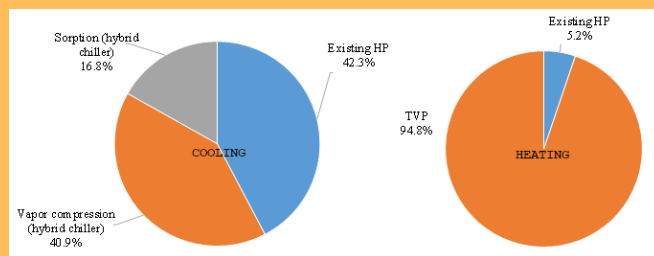
Civic center in Spain

35.5<sub>SH</sub>/83.8<sub>SC</sub> MWh demand :

- 220 m<sup>2</sup> TVP LTpower panels
- 10 m<sup>3</sup> buffer tank Ratiotherm
- 50<sub>VCV</sub>/20<sub>SORP</sub> kW Fahrenheit hybrid chiller
- $f_{\text{sav,GHG}} = 33\%$ , and 35% of cost sav.

Lessons learnt:

- **Reinforcement** of the floor was needed for the storage, which was not foreseen at the proposal stage
- The TVP will allow to reduce the consumption from the existing heat pump, provide nearly all heating in Winter.

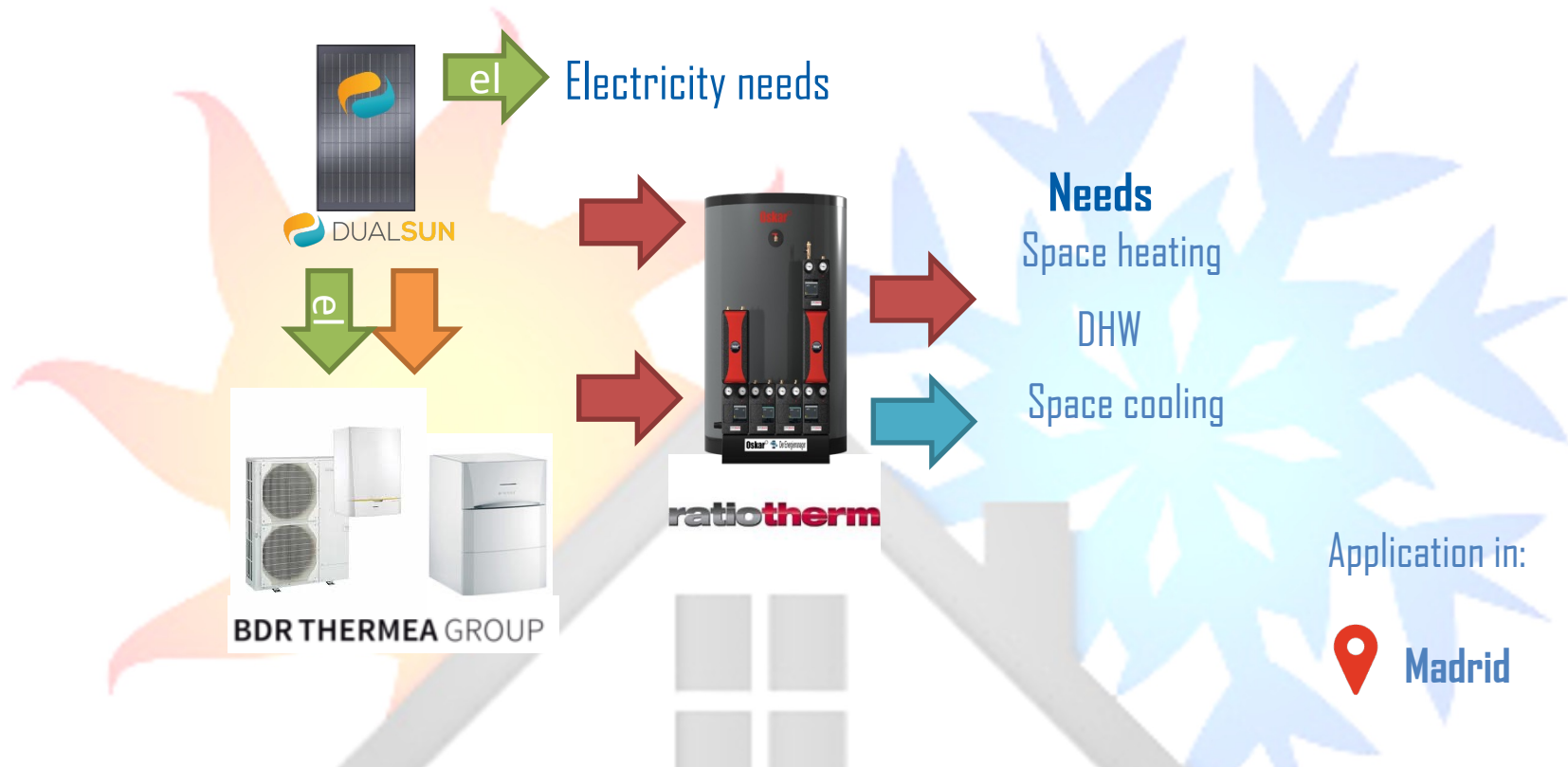


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# SunHorizon TPs

## Technology package 4 (TP4): brine water heat pump assisted with improved PVT solar panels



SunHorizon TP		Solar-HP integration concept	Description
TP4	DS+BDR	Mixed solar-assisted/ parallel integration	DS PV-T thermal output coupled with heat pump to cover part of SH and DHW heat demand + electricity production to cover reversible HP electricity consumption





## Madrid

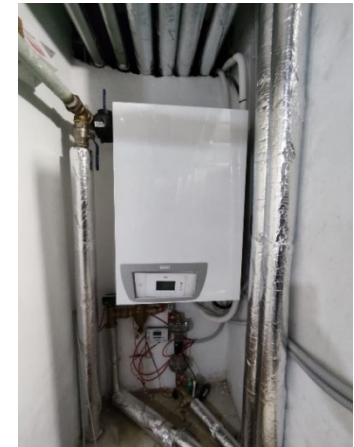
Social housing demo in Spain

35.5<sub>SH</sub>/83.8<sub>SC</sub>/5.5<sub>DHW</sub> MWh demand :

- 50 m<sup>2</sup> DualSun PVT panels
- 1.0<sub>SC/SH</sub> / 1.3<sub>DHW</sub> m<sup>3</sup> Ratiotherm tank
- Reversible HP 9<sub>BW</sub>/27<sub>AW</sub> kW BDR Thermea
- $f_{\text{sav,GHG}} = 54\text{-}70\%$ , **37% cost savings**

Lessons learnt:

- PVT panels with polypropylene caused a **variation of pressure** in the commissioning that affected the installation
- The **brine-water heat pump** coupled with PVT has **not** been **run** yet due to a difference of pressure between tech. Room downstairs and upstairs
- **AHP** is able to supply all demands: **heating (Winter), cooling (summer), domestic hot water**



\*54% if baseline was with HPs. 70% with boiler  
DualSun solar PVT integration increased SCOP in 0.89 points



## Other lessons learnt

In general in SUNHORIZON there has been collaboration, but it was **difficult to coordinate and integrate inputs from various technology providers in all the demo sites.**

**Low social acceptance** of unknown technologies.

Furthermore, the inclusion of installers had a language barriers (all studies were translated), and **shortage of installers and supplies**, specially in **risky TP**s such as SUNHORIZON's.

Many uncertainties lead the demonstrations in other demo sites to be delayed.

**Collaboration is the key for the success of the Project goals.**



# Thank you !

Do you want more information? Contact us:

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<https://sunhorizon-project.eu>