SunHorizon
Sun Coupled Innovative Heat Pumps
Introduction to SunHorizon 5 innovative Technology Packages

“Working towards the same mission with innovative heat pump solutions: SunHorizon in the context of Horizon Europe” 12.05.2021
Contents

• Project introduction – How SunHorizon addresses in EU H&C strategy
• 5 innovative Technology Packages
• Quick overview of results from simulations
Key Message: As stated in EU Strategy on H&C (2016), “large-scale demonstration projects of energy-efficient and low/zero-carbon technologies are needed to help reduce technical and market barriers by providing robust data to evaluate their performance in each market segment”. At this purpose SunHorizon aims to be a breakthrough demonstration to market project involving 21 partners’ expertise and 8 Demonstration Sites all around EU, focusing its activities on “reducing system costs and improving performance as well as optimising existing technologies for H&C applications and for some of the most promising market segments”

- The project will demonstrate up to TRL 7 innovative and reliable Heat Pump solutions coupled with solar technologies
- To provide heating and cooling to residential and tertiary buildings with lower emissions, energy bills and fossil fuel dependency.
- The technologies will be properly managed by a cloud based functional monitoring platform with services such as demand prediction, proactive and predictive maintenance tools, or a Hybrid advance controller, supported by a smart user interface; the services will help on maximizing solar exploitation and give to the manufacturer inputs for new installation design.

6 Technologies to be integrated
5 Technology Packages
8 Demos (9 buildings)
An Industry Driven Consortium

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

SunHorizon project will be demonstrated in different EU contexts (8 demos) to evaluate different climatic and energy market solutions.
- small and large scale residential (single house and apartment blocks)
- tertiary buildings (public buildings, sport centers).

Third Parties involved:
- IES UK (LTP of IES Ireland)
- GNSE and GNS (LTPs of GNF)
SunHorizon TPs

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

**Heat pumps**

**Solar technologies**

**Storage**

**Needs**

- Space cooling
- Space heating
- Pool heating
- DHW

5 technology packages
SunHorizon TPs

Technology package 1 (TP1): innovative gas-fired heat pump with high-vacuum solar panels

**Needs**
- Space heating
- DHW

Application in:
- Berlin + Verviers

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>TVP+BH</td>
<td>Parallel integration TVP for space heating + DHW; BH to cover non solar periods</td>
</tr>
</tbody>
</table>

This Project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement N818329
SunHorizon TPs

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

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP2</td>
<td>DS+BH</td>
<td>BH for space heating + DHW support; DS PV-T thermal output to assist BH evaporator and cover preheating of demand; + electricity for appliances</td>
</tr>
</tbody>
</table>

**Verviers only**

Application in: Nunrberg + Riga + Verviers

This Project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement N818329
Tecknology package 3 (TP3): hybrid adsorption-compression chiller with high-vacuum solar panels

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP3</td>
<td>TVP+FAHR</td>
<td>Solar-driven HP for cooling. TVP for space heating + DHW in winter + activation of the thermal compressor of the adsorption chiller (FAHR)</td>
</tr>
</tbody>
</table>

Application in: Sant Cugat
SunHorizon TPs

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

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP4</td>
<td>DS+BDR</td>
<td>Mixed solar-assisted/parallel integration</td>
</tr>
</tbody>
</table>

DS PV-T thermal output to cover part of SH and DHW heat demand + electricity production to cover reversible HP electricity consumption

Needs
- Space heating
- DHW
- Space cooling

Application in: Madrid + Piera

This Project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement N818329
## SunHorizon TPs

Tecknology package 5 (TP5): hybrid adsorption-compression chiller with high-vacuum solar panels innovative gas-fired heat pump

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP5</td>
<td>TVP+BH+ FAHR</td>
<td>TVP for space heating + DHW; BH to cover non solar periods; FAHR adsorption chiller activated only by BH or also by TVP</td>
</tr>
</tbody>
</table>

*In apartment building*

Needs

- Space heating
- DHW*

Only in simulations

---

This Project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement N818329
SunHorizon TPs

It has been estimated that TPs will allow to save 33-70% GHG emissions and 30-85% operation costs in the different demo sites

<table>
<thead>
<tr>
<th>SunHorizon TP</th>
<th>Solar-HP integration concept</th>
<th>Results from simulations:</th>
</tr>
</thead>
</table>
| TP1           | TVP+BH  Parallel integration| In Berlin: 43% of primary energy savings, and 37% of costs savings for the user
|               |                             | In Verviers: ~30% of primary energy and costs savings. |
| TP2           | DS+BH  Mixed solar-assisted/parallel integration| In Nurnberg: ~33% of primary energy and costs savings, 80% of el. Self consumption ratio (SCR).
|               |                             | In Verviers: ~25% of primary energy and costs savings, 95.1% of SCR
|               |                             | In Riga: ~37% of primary energy and costs savings, 43% of SCR |
| TP3           | TVP+FA HR Solar-driven HP for cooling| In Sant Cugat ~35% of primary energy and costs savings** |
| TP4           | BDR  Mixed solar-assisted/parallel integration| In Madrid ~76% of primary energy and 84% of costs savings, and 37% of SCR
|               |                             | In Piera ~59% of primary energy and 53% of costs savings, and 47% of SCR |
| TP5           | TVP+BH + FAHR Mixed solar-driven/parallel integration| TP only tested in simulation, in 3 locations and 2 types of buildings (tertiary and apartment building) |

*Most of them compared with the current gas-fired systems, and/or individual splits for space cooling...
** compared with air handling unit supplied by an old reversible heat pump
Conclusions

- A pre-industrial project with high TRL that combines different types of heat pump with solar technologies that will help to meet the H&C demand with lower emissions, energy bills and fossil fuel dependency.
THANK YOU FOR YOUR TIME

www.sunhorizon-project.eu

Please follow us on FB, Twitter, Linkedin

CARTIF

Andrea Gabaldón Moreno – andgab@cartif.es