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Sun coupled innovative Heat pumps

D8.6 – First stakeholders' vision document

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1 Introduction

Within the SunHorizon Task T8.2 “Stakeholders engagement and events” is foreseen the organisation of stakeholders’ groups and events to continuously query the SunHorizon objectives and results from perspectives out of the SunHorizon consortium. One stakeholders’ group is dedicated to the solar and one for the heat pump sector. The activities of the two groups shall be coordinated by CEA (for solar) and CARTIF (heat pumps), with full support from task T8.8 leader EHPA and RINA. All the consortium is required to provide and support the stakeholders mapping activities. This D8.6 report describes the activities to constitute and animate the SunHorizon stakeholders’ group during the first half of the project, September 2020, towards SunHorizon Replication.

In brief, SunHorizon is in-situ demonstration of solar coupled heat pump solutions for building. Why focusing stakeholders’ engagement on solar? Because solar can enhance the performance of required flexible HP (electrical efficiency) and enables self-sufficient building both for H/C and electricity.

The stakeholders’ engagement strategy for the SunHorizon project is composed by different steps, as follow:

1. creation of a sign-up page on the project website,
2. creation of a database with the subscribed stakeholders,
3. creation of ad hoc campaigns on social media to promote the T8.2 activities and the subscription as stakeholders,
4. create ad hoc newsletter/email for the stakeholders, keeping them informed on the main activities,
5. organisation of the first stakeholders workshop dedicated to the solar thermal technologies deployed in the project,
6. share the material of the event and present the forecast activities related to T8.2 to them.

2 Stakeholders platform

All the consortium has been active in selecting and reaching external stakeholders who could have been interested in the SunHorizon thematic and activities.

To each partner has been asked to personally engage with its group of stakeholders and provide them all due information on the stakeholders' platform functionality.

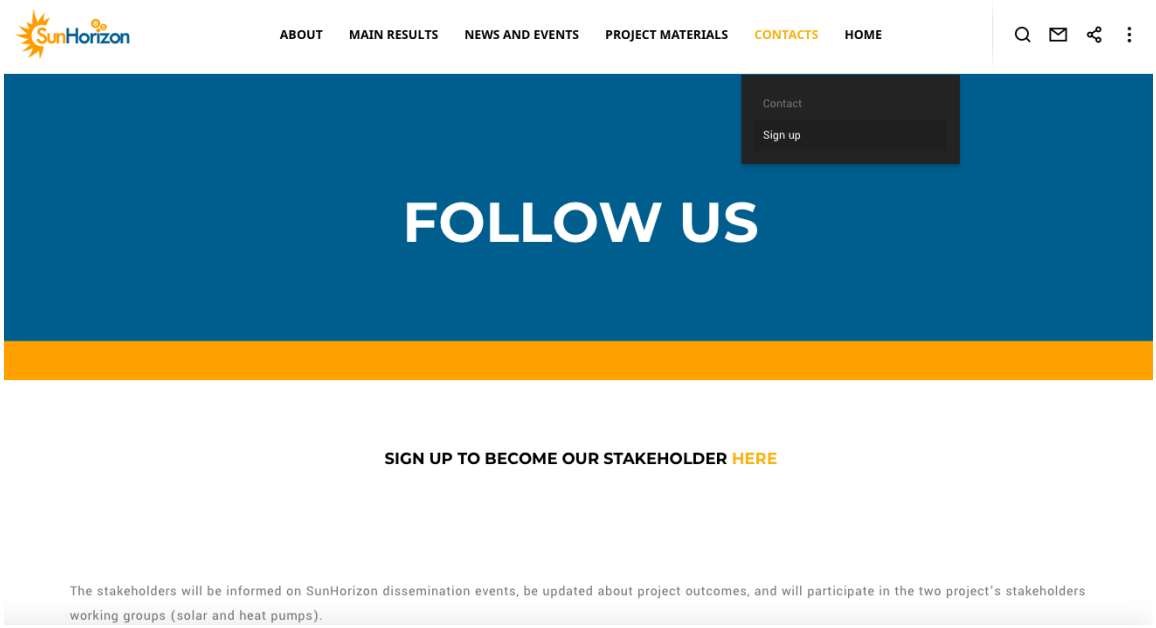

Figure 1 picture of the stakeholders' platform in the website

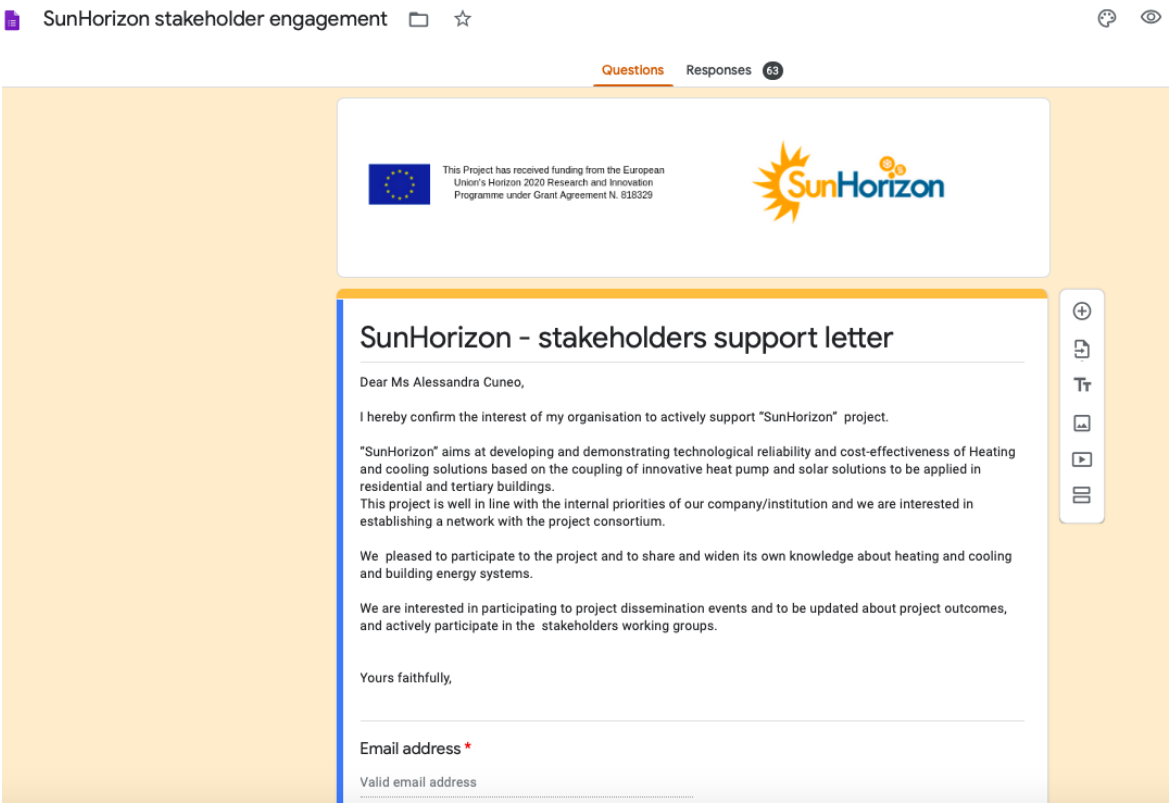

Figure 2 picture of the sign-up format

Since the creation of the stakeholders' platform on the project website, we have collected up to September 2020 the subscription of **63 people** (**from 59 different organisations**), both from the solar and Heat Pump sectors.

Full list of companies and organisations engaged in the SunHorizon stakeholders' activities:

Name of the Company	Name of the Company
AMPERE POWER ENERGY S.L.	JKP Gradska toplana Niš
Area cooling solutions	Kryvyi Rih National University
Aspiration Energy Private Limited	Laborelec s.a.
ATLANSUN	Maya Enterprises
AZUR SYSTEME SOLAIRE	MICROPLAN
BATIRAMA	NTB Interstaatliche Hochschule für Technik Buchs
BlueTerra Energy Experts B.V.	PassivSystems Ltd.
CEIS	Prime Laser Technology
City of Niš	SARP Industries Pôle Centre-Est Méditerranée
Climate Futures	Solar energies and strategies
Climatech limited	Solar Heat Europe/ESTIF
CRES	Solar Tomorrow Inc.
De Beijer RTB bv/SolabCool bv	Swedish refregiration and heatpump association
Department for Business Energy and Industrial Strategy	Tarbiat Modares University
Easy Smart Grid GmbH	TECSOL
EGEC - European Geothermal Energy Council	The University of Nottingham
EndeF Engineering	Tweles Beteiligungsgesellschaft mbH
energy-serv	UCSA - UFFICIO COMUNE PER LA SOSTENIBILITA' AMBIENTALE
Eurac Research	Université de Perpignan
EUREC	University of Bologna
Euroheat & Power	university of catania
European Copper Institute	University of La Laguna
GRE-Liège (Groupement de Redéploiement Economique)	University of Stuttgart
GreenStorm Consultants	University of Twente
HEAT GmbH	UPV
INSA Lyon	Veotherm
Interreg France Channel England SunPeople project consortium	Vibhu Solar Energie
Jurmala District Heating Company	vivacitas homes
	W/E consultants

list updated on the 18th of September 2020

The recruiting of new stakeholders is a constant priority for the development of T8.2, for this reasons EHPA periodically publish dedicated posts on social media and on the project newsletter to promote the stakeholders' engagement and platform.

See in Figure 3,4 some examples.

Figure 3 example of social media promotion

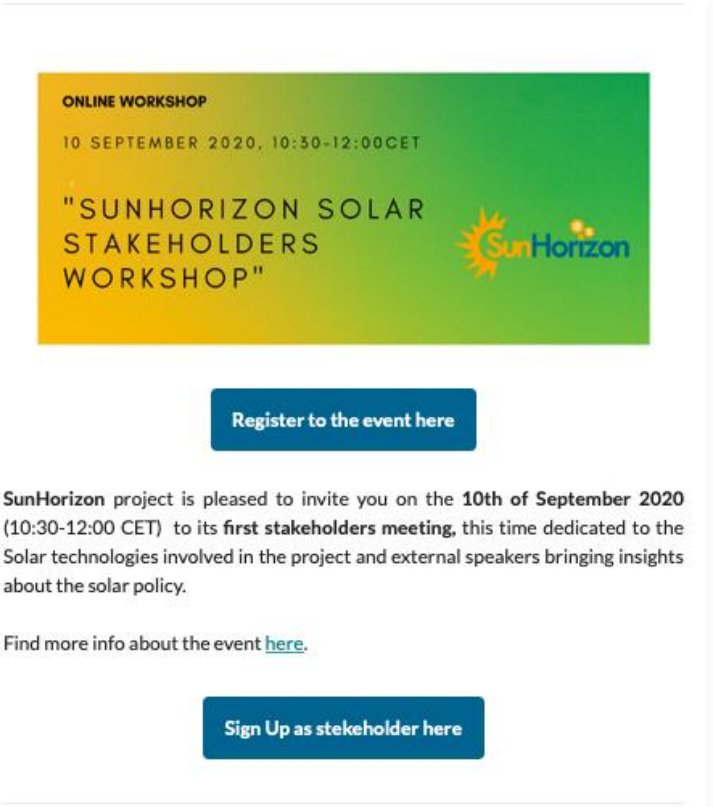

Figure 4 example of promotion in the project newsletter (June 2020)

To accomplish the first stakeholders' analysis, we organised the first stakeholders' workshop on the 10th of September 2020. A dedicated analysis of this event is provided in chapter 3.2.

3 Recruitment of solar stakeholders

This section summarizes the specific activities performed to invite new stakeholders to join SunHorizon demonstration initiative and leads to the first solar stakeholders' workshop event.

3.1 Specific networking and presentations

Dualsun, as PVT panels manufacturer and CEA, as simulation support for system integration, SunHorizon partners, are participating to the IEA SHC task60 PVT applications (Hadorn, 2018). This Task60 focuses on the application of PVT collectors with the aim to assess existing solutions and to develop new system solution principles in which the PVT technology really offers advantages over the classical "side by side installations" of solar thermal collectors and PV modules. Energy production, competitive cost, safety and reliability of systems are therefore in the scope of the Task. Around fifty experts from PVT technologies all over the world are meeting here twice a year since 2018 following the objectives:

1. Provide an overview on the present (2018-2020) state-of-the-art of the PVT technology worldwide.
2. Gather the results and the operating experience made with the systems in which PVT collectors are integrated.
3. Improve the testing, modeling and adequate technical characterization of PVT collectors in order to enhance (and simplify) the correct inclusion of the PVT technology in simulation programs and planning tools.
4. Address all types of PVT collectors since the current markets have made no clear choices.
5. Find more typical PVT solutions beside the two applications which are well known, i. e. regeneration of bore-hole storages and pre-heating of DHW for multi-family houses.
6. Explore potential cost reductions in the balance of systems, i.e. piping technology and materials, hydraulics, controls etc.
7. Increase awareness of PVT.
8. Support the "re-start" of the PVT industry.

In this Task60 frame, CEA prepared project presentations for the meeting Oct 18-19, 2018 in Zaragoza (Spain) and Dualsun provides update about CEA's preliminary simulation results in 4th meeting, Oct. 10, 2019, Lyngby (Danemark). In this group are particularly discussed the TP2 and TP4 where PVT or TP4' separate PV+Th are involved. Moreover the topic of Key Performance Indicators (KPIs) for fair evaluation of such systems in building is really challenging: The Task60 discussions served to elaborate the SunHorizon D2.4 (led by CARTIF) report about the selection and definition of relevant KPIs that can find an awareness beyond the project consortium. As the task60 is coming to the end in 2020, leaders of the subtask C, simulation and control, are interviewing SunHorizon partners about the PVT-specific control strategies that they developed and simulated before the deployment in 2021. This content will be also published through the accepted paper and video recording (to be available online by the end of 2020) in Eurosun2020 conference (Sept. 3-5, 2020), (Chèze et al., 2020).

This general Task60 collaboration is issuing successfully as SunHorizon was awarded in August 2020 under Task60 banner in the "Today in the lab, tomorrow in Energy" TCP SHC challenge. IEA SHC will promote the SunHorizon objectives and results through its website.

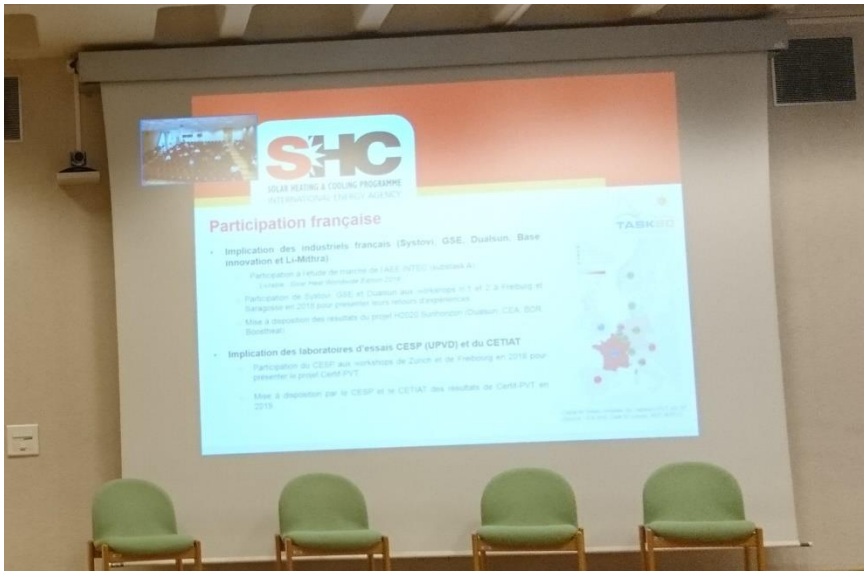

Figure 5: Illustration of option to participate in IEA SHC tasks (T60) through H2020 project SunHorizon case

In parallel, CEA also participated in national event, called "Journées Techniques Solaires Thermiques", https://www.ademe.fr/recherche-innovation/programmes-recherche-internationaux/journees-techniques-solaire-thermique-lademe , 26/09/2019 in Sophia FRANCE, managed by French national agency for energy ADEME, reaching about 80 people during IEA SHC session where SunHorizon project was mentioned. Afterwards CEA had opportunities to discuss with participants about SunHorizon project during the social sessions and to invite them to become SunHorizon stakeholders.

Since SunHorizon is essentially dealing with system integration challenges, combining solar, thermal storage and heat pump for increased non-renewable energy and CO_2 emissions savings in building environment, CEA also participated to experts discussions, chasing potential stakeholders at workshop from IEA HPT-Annex 55/ ECES Annex 34 (Wagener, 2019), 18/10/2019, in Freiburg, Germany. Integrated systems consisting of heat pumps and storage are an important technological option in order to accelerate the use of renewable energy for heating and cooling. By combining heat pumps and storage, several issues are addressed, such as:

1. Balancing & controlling electricity grid loads;
2. Capturing a large (or larger) share of renewable (local/regional) power input (e.g., solar thermal, solar PV);
3. Optimizing economics, CO2 emissions, total fuel use over time;
4. Providing optimal supply security to buildings.

In this context Annex 55 aims to accelerate market development of Climate and Comfort box solutions. The technical challenge is the smart combination of different technologies in one system. Specialists from various fields of technology are required, and need to cooperate in order to accelerate product development and market introduction of combined heat pump / storage packages: The Comfort and Climate Box (CCB). The goal is to develop nearly market ready systems, including, as a minimum, a heat pump and a storage system.

All these specific actions to recruit stakeholders together with the infrastructure development, public social media broad communication led to achieve a significant list of stakeholders for our first solar stakeholder workshop, in the following section.

3.2 First solar stakeholder Workshop

The first stakeholders' workshop has been focused on solar technologies and innovation on this field within SunHorizon project. The idea was to present not only the overall project and main results but focused the discussion on the innovations and preliminary results from experimental tests of SunHorizon solar technologies (TVP, DS).

3.2.1 Description

The event, under the organization of CEA, EHPA and RINA-C has been structured with the following agenda:

Welcome speech by **Serena Scotton** (European Heat Pump Association)
SunHorizon project presentation by **Alessandra Cuneo** (RINA Consulting S.p.A) presentation
Presentation of the project preliminary results and workshop goals by **David Chèze** (CEA-INES) presentation
SunHorizon technologies and WP3 presentation by **Andrea Frazzica** (CNR) presentation
SunHorizon Solar technologies:
Presentation of hybrid PV-T solar technology by **Jean- Marie Drap** (DualSun) presentation
Presentation of high vacuum solar thermal technology by **Guglielmo Cioni** (TVP Solar) presentation
External speakers:
R&I solar policy insights by **Pedro Dias** (Solar Heat Europe) presentation
Solar PV and thermal cooling by **Daniel Mugnier** (TECSOL / IEA SHC) presentation

Figure 6 banner of the event

We aimed at providing to the participants a general overview of the SunHorizon project and all technologies involved in the project.

Then go into more details within specific and deepen discussion about the solar thermal technologies deployed in the project: PV-T solar and high vacuum solar thermal technologies.

For this workshop the aim was to provide not also technical details but also give an overview on the policy aspects relevant for the solar market, thus to identify possible barriers and/or incentives. For this reason, two external relevant speakers has been invited, who were both registered in the stakeholders' platform, to provide their relevant inputs: Pedro Dias (secretary general of Solar Heat Europe) and Daniel Mugnier (from TECSOL and IEA SHC).

This combination of technical discussion and policy inputs have been positively evaluated from the audience and a fruitful Q&A session has been set-up.

The workshop was held online, its recording has been shared within the participants and on the SunHorizon channels (LinkedIn, Twitter, YouTube, website) as well as all the other presentations.

The workshop was attended by **60 participants**, and there were 120 people registered to the event.

After the event a survey was shared among the attendees, thus, to evaluate the level of their satisfaction and to investigate how we can improve in the next similar activities (paragraph 3.2.3).

Figure 7 speakers' pictures

3.2.2 Insights about external speakers' presentations

The presentation of Pedro Dias focused on R&I solar policy insights, from his Solar Heat Europe perspective. The presentation and question from Q&A channel were around the understanding of the main barriers at policy level for solar thermal/renewable heat market. It emerges from the SET plan historical analysis for instance that most of the calls were addressing all electricity solutions while not covering the heating source, supposing addressed under more general calls like Building, Industry or Transport, while 1.2 TWh is the highest contribution of renewable heating and cooling in the EU total final energy demand, Figure 8. Pedro Dias also underlined the challenge when competing with very big players from power world (larger scale than Europe) or from renewable gas world, while renewable heat is local European scale player. Hard competition also regarding the complexity of decentralized, low concentrated small-scale thermal production / consumption network compared to large-scale centralized electricity power case. He is defending the orientation towards separate Power electricity and Heating&Cooling policies through differentiated support (R&I calls) of each with regard to above historical limitations and size of the players. To overcome these challenges, he also underlines the need of R&I actions on low-mid TRLs on Collectors (PVT, polymer, high vacuum), Solar cooling, Materials and Storage materials.

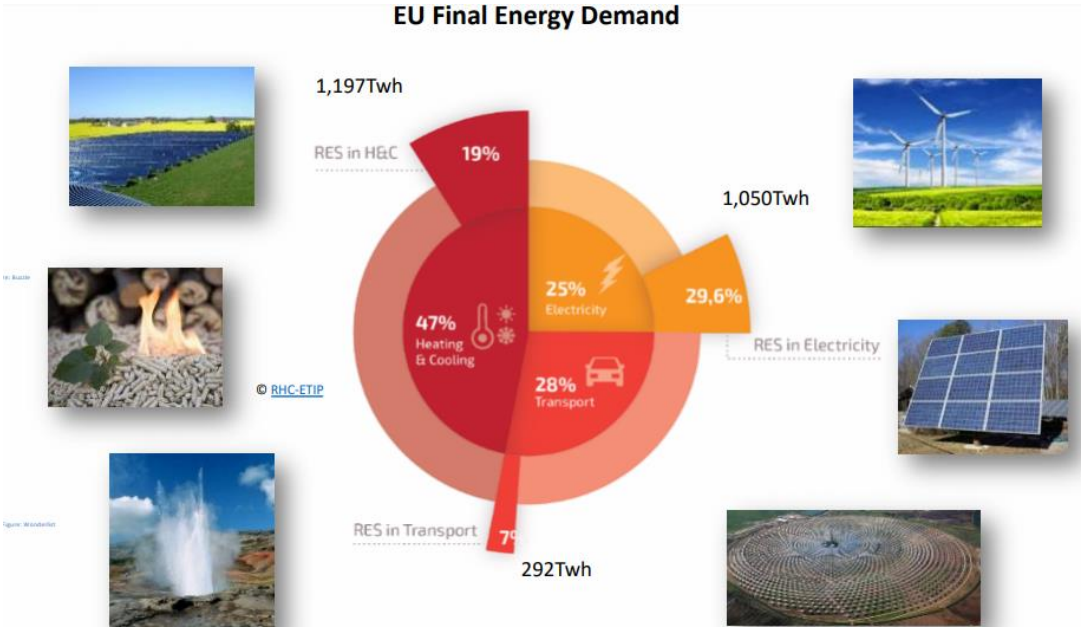

Figure 8 : EU final energy demand, REN in H&C is the highest contribution – source Pedro Dias

Daniel Mugnier, from SHC chair perspective, emphasized that we will manage the challenge of renewable cooling for next decade, provided we can rely on solar thermal driven and/or PV driven chiller solutions. He introduces the IEA SHC "Task65 Solar cooling in the sunbelt", just started in July 2020, with the view of participating interested countries all over the world, Figure 9. Even if significant increase in cooling demand foreseen, most of the market growth is in India, China and other emerging economies, single largest use of electricity in buildings (2015:10%; 2050 : 30%) and the second largest electrical end use after industrial motors. The share of cooling in electricity demand increases everywhere bar China and most notably in India and Brazil. Target size segment on cooling and air conditioning between 2 kW and 5,000 kW (PV and ST). From the Q&A channel, a comment was querying if relevant to include the combination of solar cooling (ST, PV, PVT) with geothermal cooling in the scope of Task65. Daniel Mugnier reminded that whenever each is to perform quite well with regard to the savings/costs ratio, these technologies put together will show yet increased performance, but significantly increased costs as well, uncertain to still fit to a smooth transition from now on.

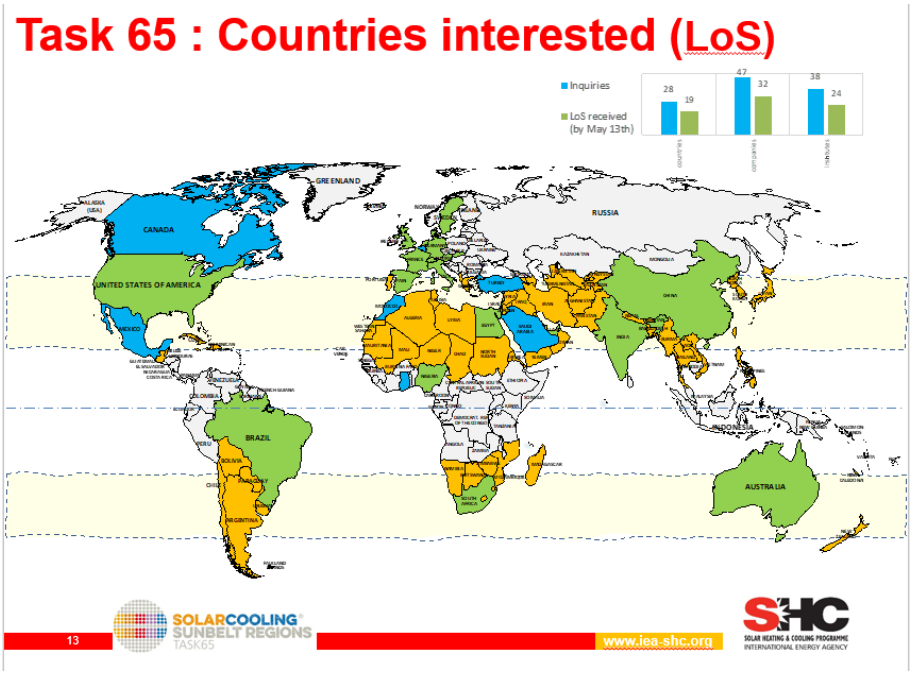

Figure 9: Interested countries in IEA SHC Task65

SunHorizon is then paving the way in the directions drawn by external speakers' messages: indeed within SunHorizon, all real demonstration cases are addressing thermal demand from solar thermal, and aggregated altogether, they achieve comparable scale to the power sector large-scale demonstrators. They are relying on balanced contribution from solar thermal and solar PV on thermal and electricity demand at demo site level.

A question from the Q&A channel to David Chèze's presentation (outlook of eight SunHorizon demo cases and expected CO_2 emissions savings) was inquiring about some costs figures, as payback time, to balance the large CO_2 emissions savings in the demo cases. At this stage, prototypes costs with redundant safety measures (noisy outdoor air/brine units on top of silent PVT panels for instance) have been considered for supply and installation of the TPs components, ending with payback time larger than 10 years in all the demo cases. A demo case optional indicator was calculated as the CO_2,eq emission cost to move the payback time down to 10 years. Later on in the project, the cost assumptions will be revised considering market costs evolution perspectives. More results including costs investigations will be presented in the next stakeholder workshop.

To conclude, the workshop queried SunHorizon stakeholders for further research:

- to elaborate separate electricity, H/C indicators ratio to final energy demand type (not all mixed), including respective self -consumption and –sufficiency
- to investigate further how much solar TH and PV support HP in current SunHorizon cases,
- to look for replication perspectives as recommended solutions, understanding the balance between solar thermal and PV or PVT with HPs, with regard to climate and building final energy consumption profile (baseline in final energy demand not only existing energy demand)
- to look for further understanding of how the cooling demand is pushing for PV solutions (increased local productivity when profuse solar resource available) for electrical vapour compression chillers (from preliminary assessment studies, these cases are achieving the highest CO2 emissions savings scores among the SunHorizon demo sites).

3.2.3 Stakeholders' workshop outcomes

3.2.3.1 Survey results

To investigate the level of satisfaction among the stakeholders who attended the webinar, a survey post event has been shared. In the survey we asked about the level of satisfaction within the presentations, which were considered the most interesting topics, if they will attend in other similar events in the future and if they had any suggestions to be share.

Analysing the data, it appears that the 20% of the participants answered to the questions. They joined the workshop form the following countries: Albania, Germany, Belgium, France, Ireland, Greece, Italy. The presentation of the solar thermal technologies from DUALSUN and TVP SOLAR involved in the project has been considered the most interesting session (see figure 10)

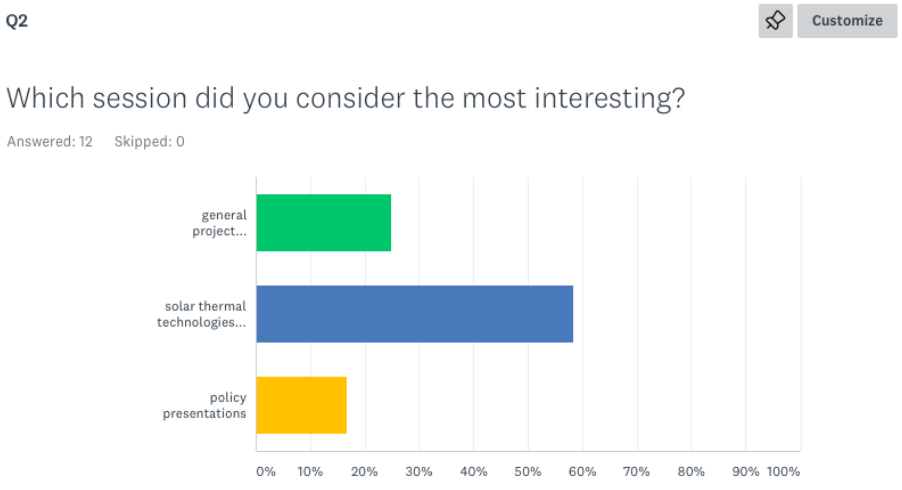

Figure 10 most interesting session

Then we asked if the attendees we satisfied within the content of workshop, and all the participants respond positively (see Figure 11)

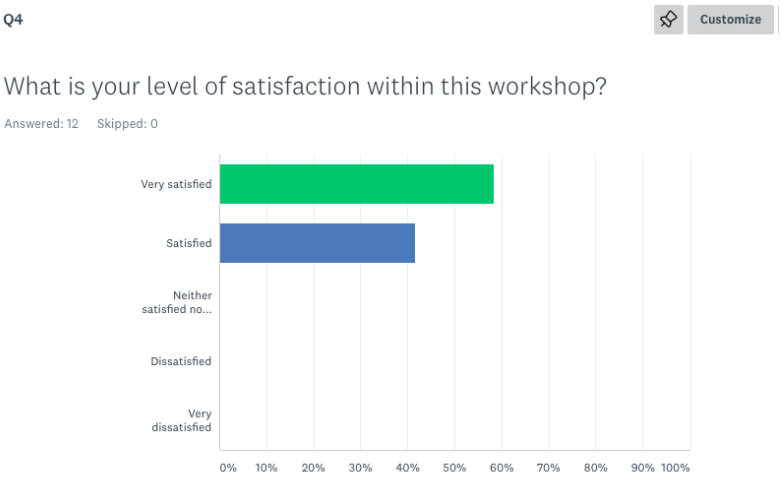

Figure 11 general level of satisfaction refered to the workshop

Attendees respond positively also to possible future participation in other similar activities (i.e. next stakeholders workshop dedicated to heat pumps). Data displayed in Figure 12.

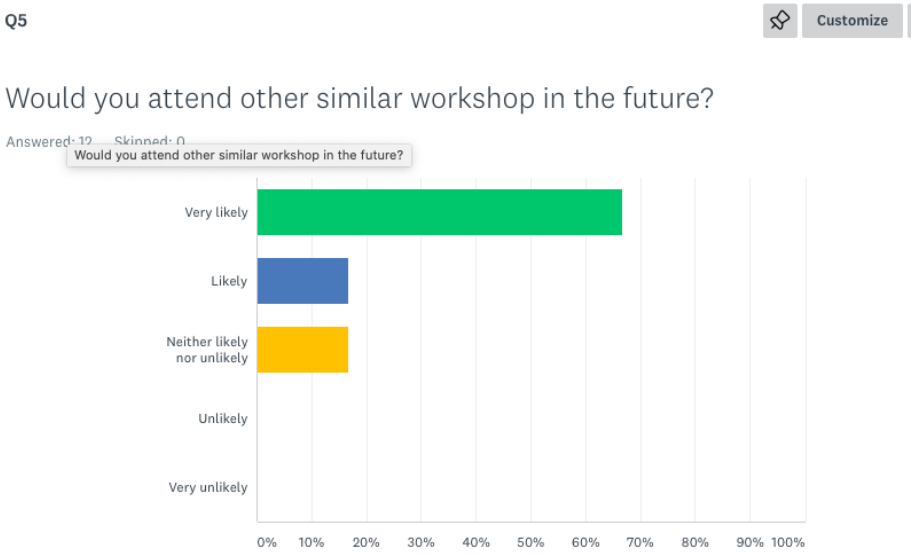

Figure 12 data referred to future possible participation

Considering the overall data form the survey, we considered the first stakeholders workshop as a success, for the number of people who registered and attended the event, for the fruitful discussions engaged within the panel and for the positive feedback received in the survey.

All this information will be taken in consideration for the organisation of the 2nd stakeholders' workshop, which will be dedicated to the Heat Pump technologies deployed in the SunHorizon workshop.

3.2.3.2 Contacts

After the workshop, CEA was directly contacted by David Bouguignon from ALOEN association, leader of the INTERREG EU project **SUNPEOPLE**. https://www.channelmanche.com/fr/projets/projets/sunpeople/

Micro-Project: Demonstration and testing of a cost-competitive, sustainable residential and commercial heat energy service, based on heat pump and solar technologies

In the FCE Programme area, heat represents half of the energy consumed, two-thirds of which is consumed by the residential and commercial sectors, with more than 80% of space heating or domestic hot water being produced using non-renewable and/or carbon-emitting energy sources (mostly natural gas).

The SunPeople project aims to increase the development and uptake of a decarbonised heat energy service in the residential and commercial sectors, which represent roughly one third of the carbon emissions of the area. It is also aimed at stimulating innovation in SMEs by involving them in the project, both as partners and stakeholders, across the entire supply chain.

The project's objective is to demonstrate and test on 15 sites, in Plymouth and Lorient, a cost-competitive, sustainable heat energy service based on heat pump and solar technologies. This service will enable to reduce carbon emissions on these sites an estimated 62.8 (respectively 1,255) tons of carbon over a one-year contracting period corresponding to the project (respectively over a conventional 20-year period corresponding to system lifetime).

This contact is then an opportunity for both SunHorizon and Sun people projects to exchange reciprocally knowledge and experiences from on-site demonstration of systems coupling solar technology with heat pumps.

3.2.3.3 Press release

On the 17th of September 2020, an article about the SunHorizon technologies and testing in the 8 demo sites has been published in BATIRAMA journal, from the solar stakeholder workshop contents. https://www.batirama.com/article/34529-pompes-a-chaleur-et-solaire-comment-associer-efficacement-ces-deux-technologies.html

It relates in French the key SunHorizon messages and current simulation results before starting the on-site deployment.

4 Stakeholder engagement in 2022 perspective

For the next two years of the project, the stakeholders' engagement will be continuously strongly enhanced, thanks to project partners, to present project's results and received insights to be implemented in the last part of the project activities. A second stakeholders' workshop will be organized in the last year of the project, focused on the heat pump sector, but also to have the chance to present preliminary project results on demonstration activities.

Moreover, a questionnaire survey and survey campaign will be prepared and circulated among all the stakeholders engaged and promoted via social media, to collect relevant insights on innovative H&C solutions for buildings.

The outcomes of all these initiatives will be included in D8.7

A. References

Chèze, D., Cuneo, A., Macciò, C., Porta, M., Dino, G., Gabaldón, A., 2020. FOUR INNOVATIVE SOLAR COUPLED HEAT PUMP SOLUTIONS FOR BUILDING HEATING AND COOLING, in: ISES Conference Proceedings. Presented at the Eurosun 2020 - 13th International Conference on Solar Energy for Buildings and Industry, ISES, virtual conference Athenes, p. 12.

Hadorn, J.-C., 2018. IEA SHC || Task 60 || Application of PVT Collectors [WWW Document]. URL https://task60.iea-shc.org/ (accessed 9.21.20).

Wagener, P., 2019. ANNEX 55 Comfort and Climate Box – Speeding up market development for integrating heat pumps and storage packages. [WWW Document]. HPT Annex 55 / ECES Annex 34. URL https://heatpumpingtechnologies.org/annex55/ (accessed 9.21.20).