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HYBUILD
Hybrid Energy Storage for Buildings

Project Title:

Innovative compact HYbrid electrical/thermal storage systems for low energy BUILDings

Project Acronym:

HYBUILD

Deliverable Report

Deliverable number:

D5.5

Deliverable title:

Full standardization proposals

Related task:	T5.4
Lead beneficiary:	UdL
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Publishable executive summary

The EU Horizon 2020-funded project HYBUILD, led by COMSA, will develop two innovative compact hybrid electrical/thermal storage systems for stand-alone and district-connected buildings.

Task 5.4 focuses on the standardization activities related to the technologies developed during the project. The task is composed of three sub-tasks, mutually linked, being: the identification and analysis of related existing standards, the collaboration with the relevant standardization Technical Committees, and the contribution to the on-going and future standardization developments from the results of the project. The first sub-task was addressed in Deliverable 5.4 by analysing existing standards for HYBUILD systems components.

In the present deliverable, D5.5, the remaining two subtasks are discussed and some proposals are provided for HYBUILD components standardization. The deliverable is divided in three main sections.

In the first section, the outcomes of an internal survey are reported. In the survey, HYBUILD partners were asked to reply to some questions related to their involvement in any relevant Standardization Technical Committees and/or in the definition/publication process of standards listed in deliverable D5.4. Moreover, they were inquired whether they think standardization scientific and/or technical novelties could be proposed thanks to HYBUILD experience.

The results of this survey helped in highlighting the HYBUILD components for which new standards or modifications of existing standards would be necessary or beneficial for their development. These include the electrical storage and DC system, the sorption storage and the Fresnel collectors. In the second section of the deliverable, standardization proposals for the abovementioned components are discussed.

An additional section is reported, which focuses on the updates of the EC survey, completed by the consortium and submitted to the Unit Valorisation policies and IPR of the European Commission, through the EUSurvey platform[1], on 15 June 2021.

Finally, the last section of the deliverable outlines the main conclusions. Indeed, it can be concluded that some standardization proposals can be derived based on HYBUILD results. Firstly, a very general standard for Safety of electrical equipment of machines (EN 60204) could be modified to also include higher voltage batteries. Secondly, a new standard could be realized starting from the EN 12309 including performance testing and measurement.

[1] https://ec.europa.eu/eusurvey/home/welcome/runner

Acronyms and Abbreviations

BIPV	Building Integrated Photo Voltaic
CEN	Committee of European Norms
CLC	Celenec
CONT	Continental
CSP	Concentrated Solar Power
DC	Direct Current
DHW	Domestic Hot Water
EC	European Commission
EN	European Norms
EU	European Union
HEX	Heat EXchanger
HP	Heat Pump
IEA	International Energy Agency
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MED	Mediterranean
NBK	Nobatek, Institut National pour la Transition Énergétique et Environnementale du bâtiment
NTUA	National Technical University of Athens
PCM	Phase Change Material
PV panel	Photo-Voltaic panel
R2M	Research to Market Solutions
RPW-HEX	Refrigerant-PCM-Water HEX (latent storage integrated in the refrigerant cycle of a compression heat pump)
STE	Solar Thermal Electric
STRESS	Sviluppo Tecnologie e Ricerca per l'Edilizia Sismicamente Sicura ed ecoSostenibile
UDL	Universidad de Lleida
WG	Working Group
WP	Work Package

1 Introduction

1.1 Aims and objectives

Task 5.4 aims at facilitating market penetration of the developed HYBUILD solutions. Moreover, it aims at providing starting information for other WPs, ensuring compatibility and interoperability with commercialized technologies through the identification of standards and regulations, while using the standardization system as a tool for dissemination of the project results and interaction with market stakeholders.

In order to fulfil the above objectives, Task 5.4 activities are developed under three subtasks: i) identification and analysis of related existing standards; ii) collaboration with relevant standardization Technical Committees, and iii) contribution to on-going and future standardization developments building upon project results.

In Deliverable D5.4, the first subtask was discussed, analysing existing standards related to relevant HYBUILD components, highlighted in Figure 1 and Figure 2 for the Mediterranean (MED) and the Continental (CONT) climates, respectively.

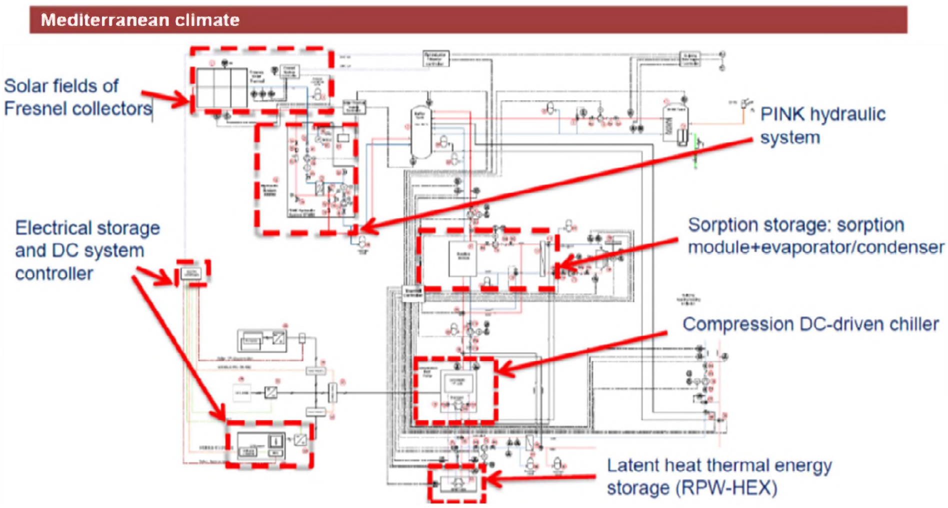


Figure 1. Components of MED HYBUILD system

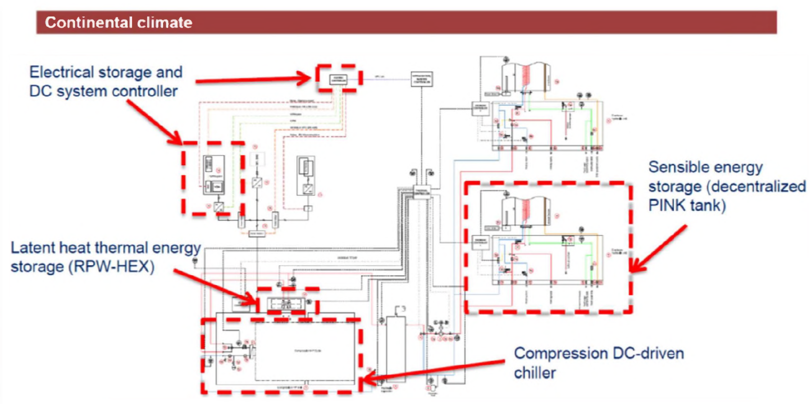


Figure 2. Components of CONT HYBUILD system

The focus of the present deliverable, D5.5, includes the second and the third subtasks. In the context of these subtasks, project partners were asked to report whether they collaborate with relevant standardization Technical Committees and whether they could highlight some technical novelties arising from HYBUILD experience to formulate standardization proposals.

1.2 Relations to other activities in the project

The work here presented is strictly connected to the activities described in Deliverable D5.4. More specifically, the existing standards analysed in the first subtask were used for formulating the internal standardization survey, which was the basis for the standardization proposals.

The proposed modifications to the standards are based on feedback from the various HYBUILD work packages. For example, for the sorption module, the WP3 "Hybrid storage sub-systems" dedicated to full-scale testing of technologies has enabled to develop a test method specific to this system. In particular, part of deliverable D3.3 is dedicated to this technology and its interconnection with the other components of the Mediterranean HYBUILD system.

The proposed changes to the standard for the Fresnel collector are based on feedback from the WP6 Demonstration and evaluation and the on-site installation of the system.

Standardization aspects are also crucial when it comes to market exploitation of the project outcomes, hence it relates to the work conducted in WP7 with the analysis of Key Exploitable Results.

1.3 Report structure

The report is structured as follows:

- In Section 2, the internal survey on standardization proposals is discussed, which was conducted to identify the components which, following the HYBUILD experience, might need a standardized procedure for their usability and exploitation.
- In Section 3, starting from the main outcomes of the internal survey, some proposals for standardization are given.
- In Section 4, some updates on the “EC survey on Standardization” submitted in July 2021 are given.
- In Section 5, the conclusions are discussed.

1.4 Contributions of partners

The results of “Standardization Proposals” activity have been reached thanks to the contribution of all HYBUILD partners, who were contacted to identify standardization proposals referred to the components of HYBUILD systems.

Moreover, each partner involved in T5.4 has provided its contribution to the task. In particular, after the identification of the components which might need introduction of new or modification of existing standards, it was decided to assign to T5.4 partners the analysis of the HYBUILD partners contributions, taking into account their knowhow. Therefore, the following components assignment to partners has been defined:

- NBK studied the Fresnel collectors and Sorption storage and studied the proposals for standards of solar fields.
- R2M studied the Electric distribution in DC in microgrid and the Hybrid AC – DC systems in buildings. R2M also provided the outcomes of the updates of the "EC Survey".
- STRESS coordinated the task activities, structured the document and integrated and reviewed the partners contributions.
- NTUA reviewed the document

2 Internal survey on standardization proposal

In this section, information on the data requested by HYBUILD partners is discussed, firstly, by describing the survey process and, secondly, by discussing the survey outcomes.

2.1 Survey process description

Through the survey, all partners were asked to provide their potential contribution to the activities of Standardization Proposals. This is because it was clear that, to provide specific information and give valuable indications, the technical providers and partners involved in the development of single components and subsystems of the HYBUILD systems should be contacted.

In particular, the partners were asked to reply to three questions, reported in the Table 1. Starting from the list of Standards analysed in the first T5.4 subtask and reported in Deliverable D5.4, the partners were asked whether they are involved in any standardization Technical Committees and whether they had been involved in the development of any of the standards listed in D5.4 and whether they could suggest scientific and/or technical novelties to be proposed for standardization.

Table 1. Internal standardization survey

Question	*Answer*
Answer date	...
Involvement in any Technical Committee	...
Involvement in any of the standards listed	...
Scientific and/or technical novelties could be proposed for standardization	...

2.2 Survey outcomes

All the HYBUILD partners replied to the survey. Results of the survey are presented below.

Regarding the first and second questions, some partners replied that their organizations were, in some way, involved in some Technical Committees and in the definition/publication process of existing standards listed in D5.4. In particular:

- R2M is directly involved in IEA Task 15 (Enabling Framework for the Development of BIPV);
- NTUA participates in the Technical Committee responsible for the following standard: CEN/TC 57 - Central heating boilers;
- Fahrenheit was involved in the IEA-HPT Annex 43 “Fuel Driven Sorption Heat Pumps”;
- OCHSNER is involved in the Technical Committee 223 by Austrian Standards;
- EURAC is involved in CLC/TC 82 (Solar photovoltaic energy systems), specifically in the WG 01 - Wafers, cells and modules. Moreover, EURAC is also involved in EN IEC 61215 and EN IEC 61730;
- AIT is involved in the development of the following standards: ISO/TC 086; CEN/TC086; CEN/TC 182; CEN/TC 113; CEN/TC 044.

Therefore, regarding the first question, despite several partners being involved in many Technical Committees, only two of them (CEN/TC 182 and CEN/TC 113) are pertinent to the scientific and technical novelties of the project.

Regarding the last question, for some components, novelties could be proposed. In particular:

- ITAE/CNR suggested that Fresnel collector could be a topic to be proposed;
- CSEM pointed out that the standardization in the field of electric distribution in DC in microgrid or self-consumption community is ongoing, but not yet well defined, and that working more intensively on this aspect could be helpful;
- Fahrenheit pointed out that there are no effective standards regarding sorption storage systems. Nevertheless, some standards have been set-up for sorption heating and cooling systems;
- UCY highlighted the need to have more standards related to the hybrid AC – DC systems within buildings.

Therefore, it was decided to analyse possible standardization proposals for the following HYBUILD components:

- Electrical storage and DC system controller
- Sorption storage systems
- Solar fields of Fresnel collectors

2.3 One-to-one interviews with technical providers

In order to collect specific information and draw up some standardization proposals, one-to-one meetings were organized between T5.4 partners and the technical providers of the identified HYBUILD components.

3 Proposals for standardization

3.1 Electrical storage and DC system controller

In relation to this specific component, when looking at the current market landscape, only a few manufacturers are currently developing offers aligned with the innovation developed in HYBUILD.

The following three interesting initiatives of PV inverter with DC-coupled storage system capability were identified:

- **AI Boost** developed by the Chinese group **HUAWEI**: the product is presented as a residential smart PV solution which offers *"up to 30% more energy with optimizers; flexible investment & more usable energy via smart string ESS with energy optimizer; and 2x Power Battery Ready for more energy"*. A 5KTL inverter allows 5 kW full power AC output plus 5 kW full power battery charge. Figure 3 highlights extracts from the product technical factsheet, including its standard compliance information.

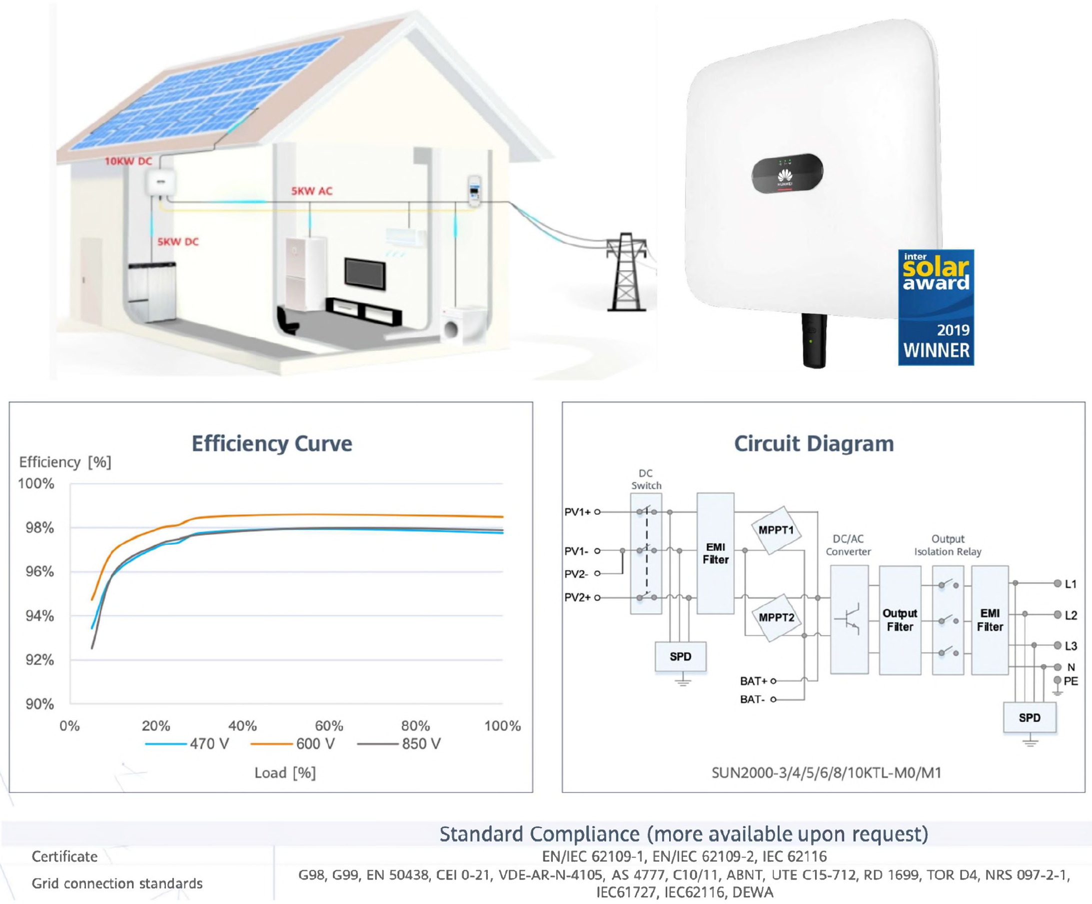
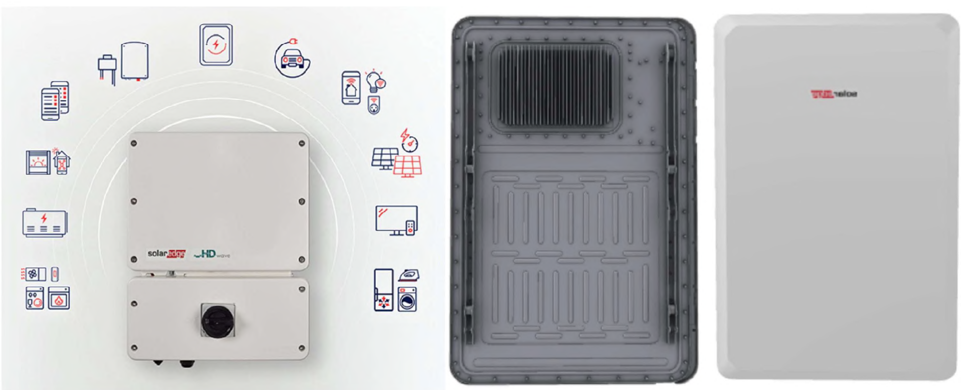


Figure 3. HUAWEI AI Boost & Smart Energy Controller | Market Factsheet | Technical sheet

- **SolarEdge Energy Hub** is presented as a single, next generation inverter platform with greater efficiency and flexibility, which offers more energy and larger installs with DC-coupling: the solution maximizes solar use year-round, and during an outage, with its DC-coupled technology – requiring only one power conversion, vs. three conversions with legacy AC-coupled technology. Figure 4 highlights extracts from the product technical factsheet, including its standard compliance information.



STANDARD COMPLIANCE	
Safety	UL1741, UL1741 SA, UL1741 PCS, UL1699B, UL1998, UL9540, CSA 22.2
Grid Connection Standards	IEEE1547, Rule 21, Rule 14H
Emissions	FCC part 15 class B

Figure 4. SolarEdge Energy Hub | Market factsheet | Technical sheet

- The modular **TRUMPF TruConvert** product family: combined with Ampt string optimizers, it offers a cost-effective, energy-efficient, flexible solution for DC-coupled solar energy storage systems. TruConvert product family is optimized for low voltage battery applications; Ampt string optimizers are designed to maximize the production and value of PV installations. The combined solution uses a higher, fixed DC-link voltage to achieve the ideal power electronics solution for PV-coupled storage systems. Taking typical efficiency values for the components of both approaches, the DC-coupled solution has a significantly higher round-trip efficiency when charging the battery with PV energy since two of the AC conversion stages are eliminated. When feeding the PV energy directly into the grid, the AC-coupled solution has a slightly higher efficiency by avoiding the extra MPPT; however, this advantage is offset by the DC-coupled system's increase in PV utilization over the complete operation range. Figure 5 shows this scenario for a 48 V battery realized as a DC-coupled solution using the TruConvert family and Ampt string optimizers. Instead of using two 75 kW DC/AC inverters, the TruConvert solution uses only one 25 kW inverter and five 10 kW string optimizers. This lowers the overall costs and increases roundtrip energy storage efficiency.

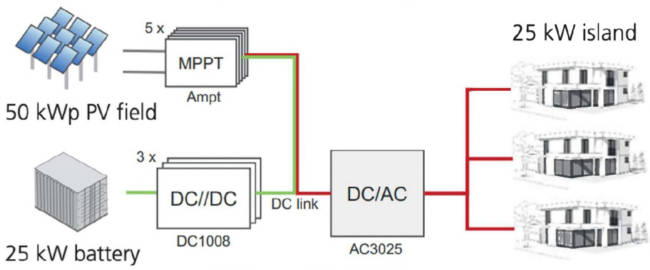


Figure 5. TruConvert system for a 25 kW island application | TRUMPF Hüttinger White Paper 05/2019

In HYBUILD, the Electrical storage controller and DC bus sub-system that is part of both the Mediterranean and Continental HYBUILD systems developed by CSEM consists of a plug-and-play DC microgrid with storage system integrated into a 19" electric rack, called Main rack in the following. The Electrical storage and DC system controller is meant to interconnect an external AC distribution grid with the DC-supplied heat pump (HP) and photovoltaic (PV) installation of HYBUILD around a shared DC bus with the use of suitable converters. Its general topology is depicted in Figure 6. The nominal voltage of the DC bus is 550 Vdc and is unearthed (IT system).

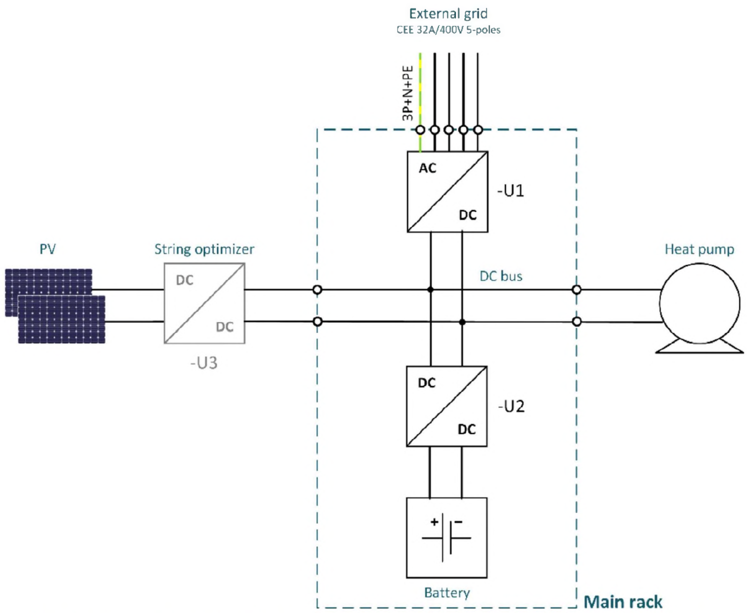


Figure 6. General system architecture and definition of the boundary of the Main rack

The different components are connected to the DC bus in the following way:

- The 3-phase AC distribution grid is connected to the DC bus by means of the bidirectional AC/DC converter *U1*.
- The HP is directly connected to the DC bus.
- The embedded battery system is connected to the DC bus by means of the bidirectional DC/DC converter *U2*.
- The PV installation is connected to the DC bus by means of the DC/DC string optimizer *U3*.

Both *U1* and *U2* are included in the electric demonstrator's main rack, while converter *U3* is installed close to the PV system. Note that the converter *U3* is not provided by CSEM.

In addition to the components mentioned, protection, supervision and control devices are also included in the demonstrator to guarantee its stable and safe operation. A complete user manual has been designed by CSEM and further presents the overall system and its technical characteristics.

During the project, the developed Electrical storage and DC system controller sub-system went through a control and test performed by Electrosuisse according to **IEC/EN 60204-1 Safety of machinery – Electrical equipment of machines, 03.08.2018**. The control and test reports, as well as the subsequent declaration of conformity are presented in Figure 7.

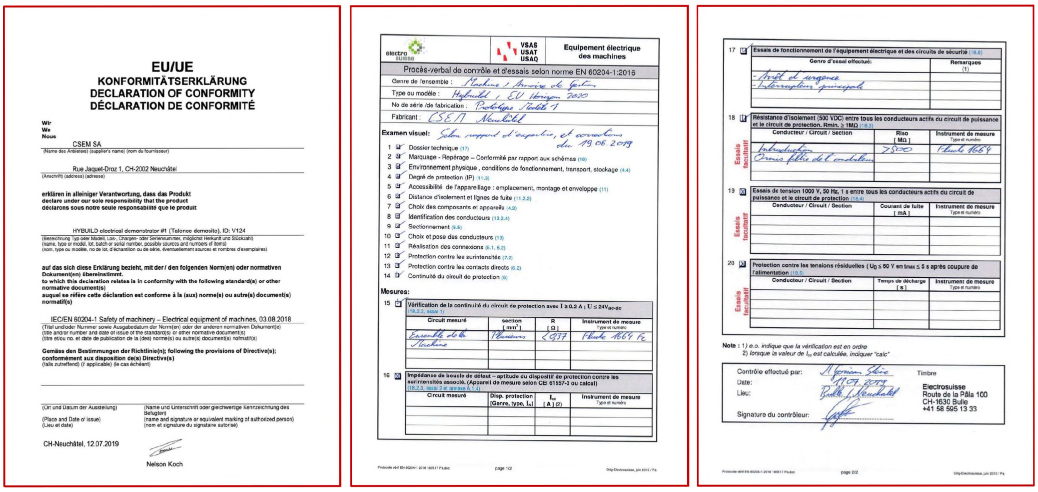


Figure 7. Control, tests report and declaration of conformity according to IEC/EN 60204-1

For such DC-coupled storage systems, there is always a trade-off observed between using a lower voltage, which leads to higher safety, versus using a higher voltage, which leads to higher efficiency.

When looking at the growing market of static batteries for the residential market, HYBUILD thinks that it now makes sense to go more and more in the direction of high voltage batteries (around 400 V), since the technology becomes increasingly reliable. This will result in the need to develop new standards, or extend existing standards around safety of these elements, which would also be beneficial for raising awareness of installers and end-users around them and promote their acceptance and marketability.

It can be noted that the standard against which the Electrical storage and DC system controller was tested (IEC/EN 60204-1) is a rather general one, as it does not address the voltage of systems. **This issue of a standard voltage level is a major factor, which can potentially lead to significantly grow the market of DC-appliances when properly standardized.**

Finally, still in relation to safety, when developing the HYBUILD system presented in this chapter, it was decided to opt for a floating bus, which means that none of the pole of DC bus are connected to the ground. Instead, ground insulation monitoring was used, and this might be one way to go for a safe architecture (i.e. on how to detect potential pole to ground faults). Further testing is however required to confirm that this can be a promising way.

3.2 Sorption storage

In the present subsection, a method for characterising solar regenerative solid sorption cooling systems is proposed. This document links the closest existing standard (NF EN 12309) and the HYBUILD feedback. The proposed method sets the basis for future regulation of solid sorption cooling systems. Given the state of the art of this technology, this subsection focuses on the characterisation methods that could be applied to it.

The physical phenomenon of solid sorption (**Ad**sorption) is based on a family of materials capable of absorbing, among other things, water vapor, a phenomenon that gives off heat. The water absorbed in this way can be stored for a long period of time until the material is heated up, thus releasing the adsorbed water. This feature is used in some systems to cool a refrigerant from an external heat source. This external heat source heats a heat transfer fluid which activates the desorption of compartment 1 (Figure 8). It then allows the refrigerant to vaporise and separate from the adsorbent before entering the classic condenser/expander/evaporator cycle and adsorbing in compartment 2. Gradually, the first compartment drains of refrigerant during the second fills up. Then the process is reversed and so on.

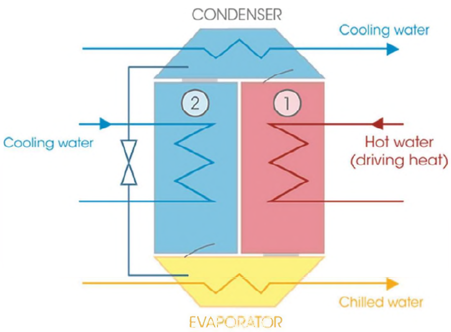


Figure 8. Schematic diagram of a solid sorption cooling system

The heat source for the desorption of the absorbers can come from waste heat from industrial processes, geothermal sources or, as for the HYBUILD case, from solar collectors.

In HYBUILD, the adsorption chiller is connected to a vapor compression heat pump in cascade mode, where the adsorption chiller is the topping component and the compression heat pump is the bottoming component. The cold water coming out of the evaporator of the adsorption chiller cools down the condenser of the vapor compression heat pump. With this operation, the condensing temperature of the vapor compression heat pump is reduced compared to the ambient temperature. This reduces the pressure difference between the evaporator (7) and the condenser (6), thus limiting the energy consumption to drive the compressor (8). In this way, cold is produced with high electrical efficiency and can either be delivered directly to the user or stored in a separate tank to provide energy on demand.

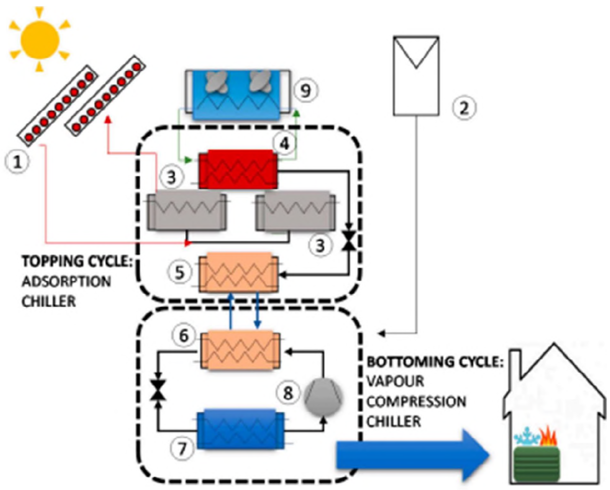


Figure 9. The hybrid system proposed: (1) solar thermal collector field. (2) photovoltaic panels. (3) absorbers of the absorption chiller. (4) absorption chiller condenser. (5) absorption chiller evaporator. (6) vapor compression chiller condenser. (7) vapor compression chiller evaporator. (8) compressor. (9) dry cooler for heat rejection to the ambient.

3.2.1 Similar Technology on the Market

Solid sorption refrigeration is a relatively new technology used in industrial cooling applications. Currently, its main use is in industrial cooling. However, there are a few manufacturers offering cooling systems based on this physical principle for building applications, some of them still active and some others recently disappeared from the market. Among them, the following can be mentioned:

- **Invensor** with its model **LTC 10 plus** (not on the market anymore since April 2021)

Main characteristics

Length: 1,100 mm
Height: 1,370 mm
Width: 750 mm
Weight: 440 kg

Hot water temperature: 45 / 100 °C
Chilled water temperature: 10 / 25 °C
Max. operating pressure: 4 bar
Re-cooling water temperature: 20 / 37 °C

COP_{TH}: up to 0.75
Cooling capacity: up to 14.0 kW

- **Fahrenheit** with the product **Zeo M10**

Main characteristics

Length: 1,550 mm
Height: 1,465 mm
Width: 875 mm
Weight: 440 kg

Hot water temperature: 75 / 95 °c
Chilled water temperature: 8 / 23 °c
Max. operating pressure: 2 bar
Re-cooling water temperature: 27 /45 °c

COP_{TH}: up to 0.5
Cooling capacity: up to 20.0 kW

As these solutions do not represent a large sales volume, the normative environment is not yet adapted to this technology. After discussions with Fahrenheit, they have confirmed that they are basing their design and sizing on the NF EN 12309 standard "Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW".

3.2.2 Proposition of new standard for characterization of solar adsorption chillers based on existing standard NF EN 12309

In the present section, a new standard for the characterization of solar adsorption chillers is proposed. The standard is based on existing standard NF EN12309 which concerns gas-fired sorption chillers and valorises knowledge derived during the HYBUILD project, and specifically the testing and performance assessment activities of the adsorption chiller.

As previously stated, the standard NF EN 12309 applies to gas fired sorption chillers. However, the HYBUILD system does not have a gas burner as driving source. Furthermore, even though the standard partly deals with cooling generation, it is mainly focused on heat generation. It is necessary to understand the points of divergence and to propose an adaptation of this standard to solar regenerative adsorption refrigeration machine technologies. Given the current state of the technology, it seems appropriate to propose adaptations regarding performance testing and measurement.

The NF EN 12309 standard is divided into 8 distinct parts. Those concerning performance measurements are parts 1, 3, and 4. Part 7, which deals with "specific provisions for hybrid appliances", does not fall within the scope of this document. In the following, specific modifications/updates proposals of NF EN 12309 to address solar adsorption refrigeration are discussed.

3.2.2.1 Part 1: Terms and definitions:

As mentioned above, the system developed within HYBUILD project does not use gas. All gas-related issues can be removed.

The paragraph "3.1.37 sorption" can be completed by explaining the crucial adsorption phenomena in the considered system. The following definition is proposed:

"Absorber: Compartment containing the adsorbent material allowing the absorption of the fluid in gaseous form from the evaporator, and the desorption of the fluid to the condenser".

It could be interesting to add the definition of:

- Thermal COP (Coefficient of performance) as the ratio between the cooling energy supplied and the thermal energy consumed.

- Electrical COP (Coefficient of performance) as the ratio between the cooling energy supplied and the electrical energy consumed.

3.2.2.2 Part 3: Test conditions

Compared to a gas sorption system operating with two water systems, the adsorption module operating with three distinct water systems has:

- The high-temperature water heat exchanger from the solar field for desorption.
- The medium-temperature water heat exchanger to cool the adsorber and the condenser during the adsorption and condensation phases.
- The low-temperature water heat exchanger, which provides heat to the chiller evaporator.

The third one can be either connected directly to the adsorption chiller, in case of stand-alone operation, or to the vapor compression heat pump, in case of hybrid cascading operation.

Thus, the table of test conditions must be modified to accommodate this particularity. Based on HYBUILD's experience of the range of temperature variations observed, the following table is proposed:

	Temperature of the fluid in the heat exchange loop with the Fresnel system (1)	Temperature of the fluid in the heat exchange loop with the absorber (2)	Temperature of the fluid in the heat exchange loop with the evaporator (3)	Water temperature at the system outlet (4)
	Inlet temperature °C	Inlet temperature °C	Inlet temperature °C	Inlet temperature °C
Nominal variation range	[75-90]	[30-50]	[10-25]	Near 5

(1) Based on the particular case of a Fresnel collector, the temperature variation would be adapted if another technology were to be used. This strongly depends on the operating conditions of the system and the adsorbent material employed. If the example of Invensor's technology is taken, the temperature can go down to 45 °C.
(2) Deliverable D4.3 states that the inlet temperature to the desorption heat exchanger has a significant impact on the final performance of the system. Special attention should be paid to this parameter.
(3) This fluid temperature in the exchange loop with the evaporator is not controlled, it results from the total cooling demand.
(4) The range of variation of the water temperature at the system outlet will depend on how the cold produced is consumed.

The flow rates used to circulate the fluids in the different heat exchangers depend on the size of the chiller and the connections.

3.2.2.3 Part 4: Test methods

Basic principles

In order to take into account the numerous parameters influencing the behaviour of the system, it seems appropriate to propose a test matrix. This would allow the performance of the system to be evaluated in favourable, nominal, and part-load conditions.

In order not to duplicate the tests, only the nominal flow rate is taken into account for each heat exchanger.

	Temperature of the fluid in the desorption heat exchanger loop (in case of high temperature solar collectors, e.g., Fresnel)	Temperature of the fluid in the adsorber/condenser heat exchanger loop	temperature of the fluid in the evaporator heat exchanger loop.	Delta of temperature of the Water at the system outlet
	Inlet temperature °C	Inlet temperature °C	Inlet temperature °C	Delta temperature °C

Unfavourable case	75	50	Not controlled	5
Nominal case	83	35	Not controlled	5
Favourable case	90	28	Not controlled	5

To be representative, the tests evaluation should be carried out considering at least three full cycles.

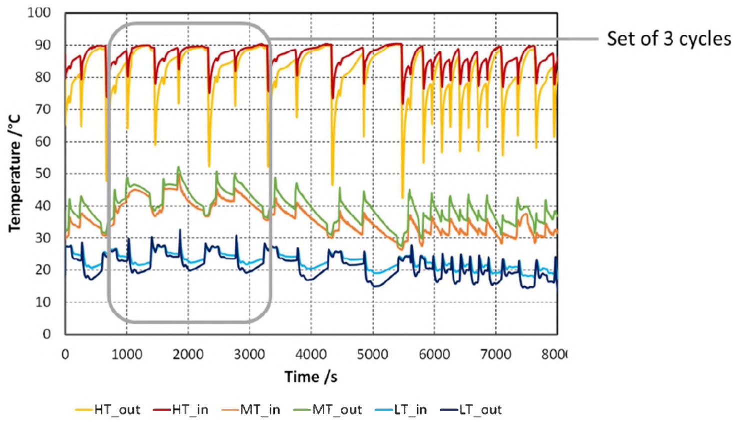


Figure 10. Testing of the sorption module for a reference day condition.

The following parameters can then be calculated:

$$Q_c = \frac{\sum_{j=1}^{n}(Vmj\ .\delta j. Cpj\ .\Delta tj)}{n}$$

j is the scan number;

n is the number of scans of the data collection period;

Q_c is the measured cooling capacity, in [kW];

Vmj is the volume flow rate of the heat transfer medium at the considered scan, in [m^3/s];

δj is the density of the heat transfer medium at flow meter temperature at the considered scan, in [kg/m^3];

Cpj is the specific heat of the heat transfer fluid at constant pressure at the average temperature of the heat transfer fluid at the sweep under consideration, in [kJ/(kg K)];

Δtj is the difference between inlet and outlet temperatures of the heat transfer medium at the considered scan, in [K].

$$Q_{Ec} = Q_c + c_{pump}$$

Q_{Ec} is the effective cooling capacity, in [kW];

Q_c c is the measured cooling capacity, in [kW];

c_{pump} is the power correction due to the pump(s) circulating the heat transfer fluid in the heat exchanger, in [kW].

$$PE = \frac{\sum_{j=1}^{n}(PTj)}{n} + c_{pump} + c_{out}$$

j is the scan number;

n is the number of scans of the data collection period;

PE is the effective electrical power input, in [kW];

PTj is measured (total) electrical power input at the considered scan, in [kW];

c_{pump} is the capacity correction due to the pump(s) responsible for circulating the heat transfer medium through the heat exchanger in [kW];

c_{out} is the correction of the electrical power consumption of the pump(s) that circulate the heat transfer fluids in the different heat exchangers, in [kW].

$$AEF_c = \frac{Q_{EC}}{PE}$$

AEF_c is the cooling energy factor, in [kW/kW];

PE is the effective electrical power input, in [kW];

Q_{Ec} is the effective cooling capacity, in [kW].

Test equipment

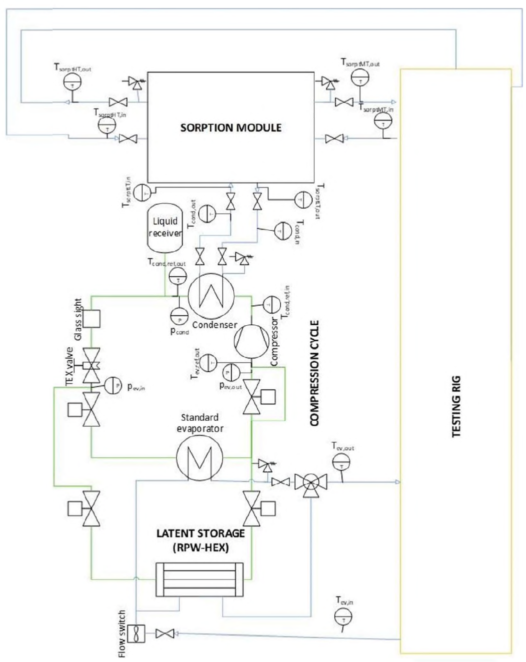


Figure 11. P&ID of Mediterranean subsystems integrated in the lab – from Deliverable 3.3

The test facility that was carried out as part of the HYBUILD project is significantly different from the facility that is conventionally used for testing gas fired sorption chillers. For solar adsorption cooling systems, it is proposed to use infrastructure similar to that of HYBUILD.

In particular, the test-rig used in HYBUILD was set-up in the premises of CNR-ITAE. In the test-rig, the adsorption chiller is connected with the following water networks:

- Hot water network simulating the fluid from the solar field
- Intermediate temperature water network simulating the fluid cooling the absorber
- Cold water network simulating cooling supply

Specifically, regarding the sorption chiller module, the following installation was used:

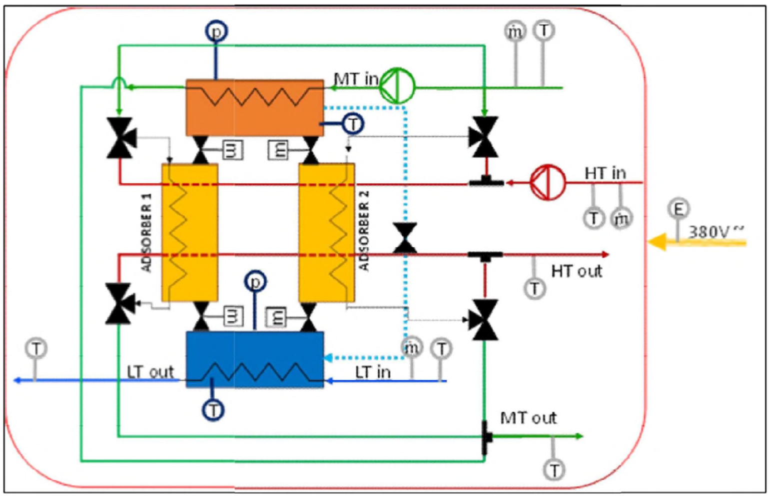


Figure 12. Schematic view of the sorption system

In order to ensure the accuracy of measurements, it is proposed to use the table of uncertainties proposed by EN 12309-4:

Measured parameter	Unit	Measurement uncertainty
Water or glycol water		
Inlet/outlet temperature	°C	± 0,15 K
Temperature difference	K	± 0,21 K
Flow rate	m^3/s or kg/s	± 1 %
Concentration of the heat transfer fluid	%	± 2 %
Power consumption		
Electric power	kW	± 2 %
Time		
Time	s	± 0.2 s up to 1 h ± 0.1 % over 1 hour

Test procedure

After starting the testing rig and ensuring that the temperatures and flow rates are within the set point, data acquisition commences by starting the operation of the adsorption chiller and then the compression chiller. Once the system is running, a minimum of three adsorption working cycles must be recorded to consider the test valid. Particular attention must be paid to the non-drifting of the influencing parameters, such as the inlet temperatures of the fluids or their respective flow rates.

The procedure described must be carried out for each case in the test matrix.

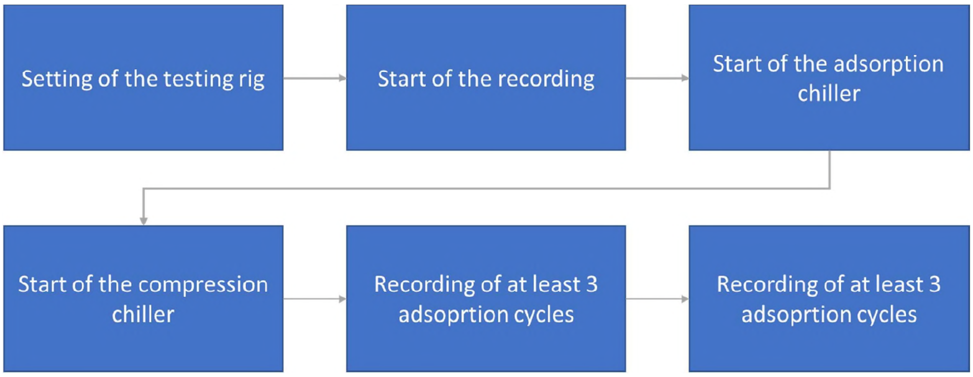


Figure 13. Testing procedure

This test procedure is the result of feedback from the HYBUILD project but also from the HYCOOL project in which Fahrenheit is involved.

3.3 Solar fields of Fresnel collectors

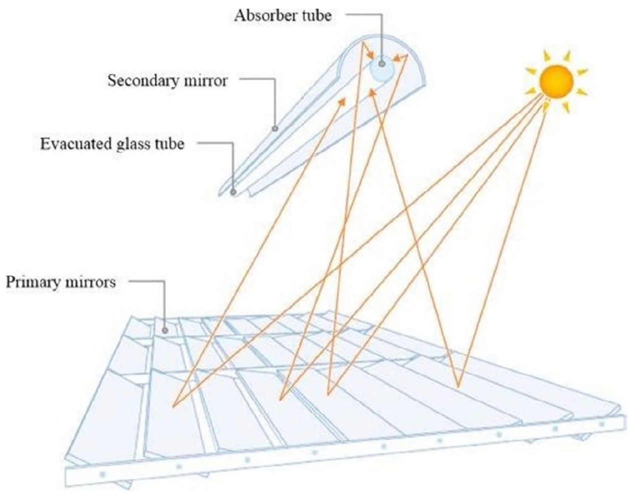


Figure 14. Schematic diagram of a Fresnel collector

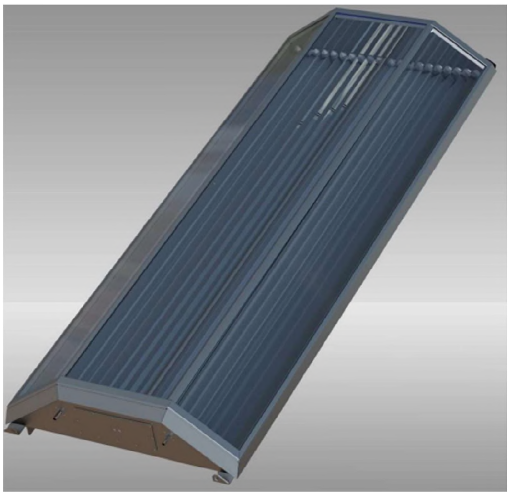
The Fresnel solar system is a concentrated solar technology. The sun's rays are reflected by the primary mirrors to the secondary mirror. The primary mirrors are rectangular in shape and can be adjusted to follow the trajectory of the sun during the day. The secondary mirror is usually semi-cylindrical in shape and redirects the solar flux to the absorber. The design of the absorber can vary: it is often a tube, but sometimes several tubes or even a flat surface can be used. A heat transfer fluid (oil, glycol water, steam) flows through the absorber to collect and store thermal energy.

3.3.1 Similar Technology on the Market

Concentrator technology is mainly used in the industrial environment, to produce steam for the process or converted into electricity via a turbine. This use requires large installations which are then installed on the ground.

Nevertheless, there are some manufacturers who offer Fresnel concentrators adapted to the building industry, used for the production of heat or cold. The following examples include:

Chromasun - The Chromasun Micro-Concentrator (MCT)



For one module

Length: 3390 mm
Width: 1230 mm
Height: 316 mm
Weight: 100 kg

Maximum output temperature: 200°C
Maximum operating pressure: 40 bar

Thermal power: 2.2 kWt (DNI of 1,000 W/m²)
Thermal power: 1.9 kWt (DNI of 850 W/m²)

LF 11 - Industrial Solar

This system is not strictly speaking used for buildings, but is adaptable to industrial roofs.

For one module

Length: 4060 mm
Width: 7500 mm
Height: 4500 mm
Weight: 798 kg

Maximum output temperature: 400°C
Maximum operating pressure: 30 bar

Thermal power: 13.82 kW (DNI of 900 W/m²)

3.3.2 Analysis of existing standards and proposals for improvement

Since the delivery of Deliverable 5.4, a draft version of BS IEC 62862-5-2 has been published. This standard is to be formalised in July 2022. The document has been collected and here a first analysis with suggestions for improvement is provided.

The "BS IEC 62862-5-2: Solar thermal electric plants - Part 5-2. Systems and components. General requirements and test methods for large-size linear Fresnel collectors" incorporates many of the tests specified in ISO 9806 with regard to measuring the performance of the installation.

However, this standard takes into account some particularity of a Fresnel collector.

- Tracker

To ensure a good performance throughout the day, Fresnel systems are equipped with trackers to orientate the mirrors and thus follow the path of the sun. The BS IEC 62862-5-2 provides a method for checking that the tracker is working correctly.

- Cleanliness

The performance of the system can be greatly impacted by the dirt or dust accumulated on the primary or secondary mirrors. The outdoor performance test method is therefore modified to take this parameter into account: a "global cleanliness" factor is introduced. The purpose of this factor is to correct the displayed performance value to take account of any dirt/dust deposit during the test.

In the context of the use of this technology in an inaccessible environment (e.g. building roofs), it could be interesting to include a section about the proper maintenance of the system and the installation requirements.

- Mirror shape

Due to external stresses, the flatness of the mirror and its deformation are phenomena that can greatly affect the performance of the system, in the case the incident rays do not focus on the secondary mirror. The standard proposes to refer to the Spanish standard UNE 206016:2018 Chapter 5. This chapter describes a method for measuring the geometry of the reflecting surface.

It is proposed to extend the set of tests put forward by this standard to the mirror of Fresnel concentrators. In particular, chapters 6 and 7 propose to study the effects of ageing on the reflection performance, which seems relevant for the use of this technology on roofs, exposed to external weather conditions.

- Structure

The standard describes the common components of the Fresnel system including the materials used for the structure. Manufacturers are required to specify technical information such as weight per m^2, maximum wind load, etc.

For use on the building, it is important to carry out a thorough study of the impact of the system on the building's structure. For example, the effects of wind loads must be taken into account. A reference to the method of determining the wind load as specified in Eurocode 1 - Part 1-4 could be included in this standard.

Similarly, it must be ensured that the occurrence of any leaks is not detrimental to the watertightness of the building, particularly when oils are used as a heat transfer fluid.

In general, it seems important that the body responsible for the standardisation of building energy systems and the body responsible for the standardisation of the structure of the building are brought together.

4 Updates on the "EC survey on Standardisation"

Annex 1 of this deliverable presents the **"Code of Practice for Researchers on Standardisation"** EUSurvey that was completed by the consortium and submitted on 15 June 2021. During the preparation of this deliverable, past answers were reviewed by the technology providers who participated in the bilateral interviews. The following updates were suggested:

Question 5.5: What were the main initial reasons for addressing standardisation in your project? Multiple indication is possible.

'*Standardisation was a requirement from the market*': it was suggested by CSEM to tick this option since standardisation would be indeed a requirement for the HYBUILD system and/or its components if we move to the market.

Question 5.8: Were there any risks you encountered in relation to standardisation related activities?

Instead of the past answer "No specific risk", it would be more appropriate here to indicate that we did not get up to that point in HYBUILD (i.e. it would have been required to go further identify potential risks).

Question 6.8: Please indicate whether any of the following wider impacts on innovation are likely as a result of your project making direct use of one or more existing standards. Please indicate all that apply?

For the proposed option '*Higher confidence level of consumers*', we should select '*In the medium to longer term*'.

The other answers were considered still appropriate.

5 Conclusions

This work has permitted to identify some standardisation recommendations in relation to selected individual components of the HYBUILD overall system. These include standardization related to the voltage of electric storage systems that is relevant with the Electric storage and controller and the characterization of solar adsorption chillers, which is directly related to the solar adsorption cooling system of HYBUILD. To go further, it would be necessary to engage with the members of the Technical Committees that are developing the specific standards.

In addition, as already suggested in the previous deliverable D5.4, it might also be useful to discuss with standardisation organisations on the relevance of establishing a new Technical Committee dedicated to hybrid storage solutions such as the ones developed in HYBUILD and its sister projects.

Annex 1 - Code of Practice for Researchers on Standardisation

Please see the "HYBUILD-Standardisation-Survey-Contribution" pdf file attached to this deliverable.

Contribution ID: f556acd1-3b1e-4875-a74a-10f2a49eb125
Date: 15/06/2021 09:44:38

Code of Practice for Researchers on Standardisation

Fields marked with * are mandatory.

1 Introduction

Dear Project beneficiary,

As part of the implementation of the Communication on 'A new ERA for Research and Innovation' DG Research and Innovation (DG R&I) is developing Guiding Principles for knowledge valorisation as set out by Action 7 of the Communication. A set of codes of practice have been proposed in order to implement these Guiding Principles. One of these codes of practice will be a Code of Practice for researchers on standardisation. This code will be co-created with relevant stakeholders to ensure its usefulness, relevance and create ownership. As part of this exercise, DG R&I is launching a comprehensive on-line survey to collect and understand the experiences and views of beneficiaries on the role of standardisation in valorising R&I results.
By investigating the nature and the extent to which Horizon 2020 projects have made use of standards or have proposed or contributed to the development of new standards as part of their activities, the survey will provide important input to the code of practice on standardisation.
Following the analyses of project data of Horizon 2020, your project has been selected as relevant for standardisation as means of valorisation of R&I results. In order to facilitate the design of the code, DG R&I would appreciate if you could contribute to this work by responding the survey questionnaire. If your project is ongoing, please respond to the survey in relation to your expectations for the project as a whole. Bearing in mind the specificities of some questions you may deem it necessary to involve project partners.
Responses should be completed before 31 May 2021.

Your answers will be saved automatically as you enter them. All individual responses will be treated as confidential and will not be reported in an attributable format without your permission.

2 About your organisation and consortium

* 2.1 Please indicate the number of your project.

768824

* 2.2 What type of organisation is the project coordinated by?

- University
- Research and Technology Organisation

- [x] Company other than SME
- [ ] SME
- [ ] National standardisation body (NSB) or standard development organisation (SDO)
- [ ] Other

* 2.4 What kind of organisations is the consortium composed of? Multiple indication is possible.

- [x] University
- [x] Research and Technology Organisation
- [x] Company other than SME
- [x] SME
- [ ] National standardisation body (NSB) or standard development organisation (SDO)
- [ ] Other

* 2.6 In which countries are the consortium members of your project located? Multiple indication is possible.

- [x] Austria
- [ ] Belgium
- [ ] Bulgaria
- [ ] Croatia
- [x] Republic of Cyprus
- [x] Czech Republic
- [ ] Denmark
- [ ] Estonia
- [ ] Finland
- [x] France
- [x] Germany
- [x] Greece
- [ ] Hungary
- [ ] Ireland
- [x] Italy
- [ ] Latvia
- [ ] Lithuania
- [ ] Luxembourg
- [ ] Malta
- [ ] Netherlands
- [ ] Poland
- [ ] Portugal
- [ ] Romania
- [ ] Slovakia
- [ ] Slovenia
- [x] Spain
- [ ] Sweden
- [ ] Associated country
- [ ] Other

3 About your project

* 3.1 Under which thematic section of Horizon 2020 has your project been funded?

- [ ] Marie Sklodowska-Curie Actions
- [ ] Research infrastructures
- [ ] Leadership in Enabling Industrial Technologies
- [ ] Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing and Biotechnology
- [ ] Information and Communication Technologies
- [ ] Access to Risk Finance
- [ ] Innovation in SMEs
- [ ] Health, Demographic Change and Wellbeing
- [ ] Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy
- [x] Secure, Clean and Efficient Energy
- [ ] Smart, Green and Integrated Transport
- [ ] Climate Action, Environment, Resource Efficiency and Raw Materials
- [ ] Europe in a changing world – Inclusive, innovative and reflective societies
- [ ] Secure societies
- [ ] Spreading Excellence and Widening Participation
- [ ] Enhanced European Innovation Council Pilot (FET, SME Instrument, Pathfinder, Accelerator)
- [ ] Euratom
- [ ] Science with and for Society

* 3.2 In which domain has your project been running?

- [ ] Agriculture and forestry
- [ ] Bio-based industries, biodiveristy
- [ ] Key Enabling technologies
- [ ] Raw materials

- ○ Biotechnology
- ◉ Construction Energy
- ○ Circular economy
- ○ Food, fisheries and healthy diet
- ○ Health
- ○ ICT including digital transformation
- ○ Security
- ○ Space
- ○ Transport
- ○ Water resources
- ○ Water, air and soil quality
- ○ Other

* 3.4 Under what type of action has your project been funded?

- ◉ Research and Innovation action
- ○ Innovation Action
- ○ Coordination and support action
- ○ Marie Skłodowska-Curie action
- ○ European Research Council (ERC)
- ○ ERA-NET Cofund
- ○ Pre-commercial Procurement (PCP)
- ○ Public Procurement of Innovative Solutions (PPI)
- ○ SME instrument, EIC pilot

3.5 Which level of readiness describes your technology at the start and at the end of your project?

	At the start	At the end
TRL 1 – basic principles observed	☐	☐
TRL 2 – technology concept formulated	☐	☐
TRL 3 – experimental proof of concept	☐	☐
TRL 4 – technology validated in lab	☑	☐
TRL 5 – technology validated in relevant environment	☐	☐
TRL 6 – technology demonstrated in relevant environment	☐	☑
TRL 7 – system prototype demonstration in operational environment	☐	☐
TRL 8 – system complete and qualified	☐	☐
TRL 9 – actual system proven in operational environment	☐	☐

* 3.6 Has your project delivered new services and/or products on the market during the project or beyond the end date?

- ◉ Yes
- ○ No

3.7 If yes, which ones:

Expected delivery of 10 Exploitable results, including the HYBUILD Mediterranean and Continental Systems and subsystems. Some of these will be uploaded on the EC Horizon Results portal. At the time of completing this questionnaire, two ERs are already available on the portal : PCM (Phase Change Material) thermal storage module for HVAC applications (https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/29719;keyword=hybuild) and Innovative adsorber: Adsorption Heat exchanger with high surface area (https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/29049;resultId=29049;keyword=hybuild)

4 About the collaboration with standards development organisations

A National Standardization Body (NSB) is a one stop shop for all stakeholders and is the main focal point of access to the concerted standardisation system. Besides the NSB Standard Developing Organisations (SDOs) focus on developing, publishing, or disseminating technical standards using a consensus-based standards development process. SDOs are any official organisation that can provide the infrastructure for developing standards in compliance with the same procedures the NSB uses. A Technical Committee (TC) is a group responsible for the development and drafting of standards which are then ratified by European Standards Organisations.

4.1 Has your project liaised with standards developing organisation (SDO), national standardisation body (NSB) or technical committee (TC)?

	Yes	No
* SDO	○	●
* NSB	○	●
* TC	●	○

4.2 If yes, which ones?

The project has delivered a report entitled "existing standards and standardization landscape": this report aims at collecting the existing standards related to the HYBUILD systems developed for both Mediterranean and Continental climates. The two systems are structured into sub-systems and specific components. The collection of the standards is aimed at defining the state-of-the-art on the norms regulating the identified components, and at understanding whether there are shortcomings to be integrated with new standards.
In this context, project partners have been looking at the work being conducted by several TCs (e.g.: ISO/TC 180 Solar Energy; CEN/TC 228 "Heating systems and water based cooling systems in buildings"; CLC/TC 21X "Secondary cells and batteries", mirror committee of the IEC TC21/SC21A; etc.), and in some cases they have been in touch with them to clarify some questions.
The report is currently under review by the EC and will be then uploaded as a public report on the HYBUILD project website (http://www.hybuild.eu/publications/deliverables/)

4.3 At what stage did you liaise wizh SDOs, NSBs or TCs? What did you expect from the collaboration?

See answer at question 4.2. In addition, another deliverable entitled "Full standardization proposals" is scheduled to be released before the end of the project. This deliverable will report on the following activities :
• conducting an internal work to identify which HYBUILD consortium partners are already connected with relevant standardization organisations and technical committees;
• engaging discussions with relevant technical committees to understand whether an ad- hoc certification or standard would be relevant / required considering the complexity of the HYBUILD hybrid storage solution.

* 4.4 Have there been a SDO, SNB or TA directly involved in the conortium?

- ○ Yes
- ● No

4.5 How did you choose cooperation with the SDO, NSB or TCs?

Based on the proposed HYBUILD Systems Components an analysis of the existing Standards and related TCs has been perfomed.

4.6 How did the SDO, NSB or TC contribute to the methodology of the work package relevant for standardisation?

Different scientific and technical novelties were selected within the project as possible contributions for future standards and the pertinent Technical Committees were identified. No specific contact with those TC has been taken yet, the activity is still ongoing.

* 4.7 Did the implication of the SDO or NSB impact technological choices in any way?

- ○ Yes
- ● No

* 4.9 Have you been in collaboration with SDOs or NSBs outside the project?

- ○ Yes
- ● No

* 4.11 To what extent was the external standardisation entity involved in the project?

- ● Not involved
- ○ Very little involved
- ○ Little involved
- ○ Somewhat involved
- ○ Highly involved

4.13 Have you had any contact with CEN-CENELEC or ETSI?

	Yes	No
* CEN-CENELEC	○	●
* ETSI	○	●

5 About addressing standardisation in your project

* 5.1 How important do you consider standardisation in your project?

- ○ Of no importance
- ○ Of little importance
- ● Of some importance
- ○ Of major importance

* 5.2 In your project standardisation activities have been addressed:

- ○ In a dedicated work-package
- ● In a dedicated task
- ○ As a transversal issue in different work packages
- ○ As a transversal issue in different tasks
- ○ Other (e.g. by setting-up an Advisory Group)

* 5.3 Did the consortium members advocate for the incorporation of standardisation activities in the project?

- ○ Not at all
- ○ Little bit
- ● Somewhat
- ○ Strongly

* 5.4 Were any of the consortium members against implementing standardisation activities?

- ● Not at all
- ○ Little bit
- ○ Somewhat
- ○ Strongly

5.5 What were the main initial reasons for addressing standardisation in your project? Multiple indication is possible.

- [ ] Standardisation was a requirement from the market.
- [ ] It was a requirement from the legislation
- [ ] It was a requirement from your organisation
- [ ] It was a key requirement of the call for projects
- [x] It was seen as critical to conduct the research activities during the projects (e.g. for agreeing on terminology or methodology)
- [x] It was seen as critical to ensure the success of the project's exploitation and/or market strategy
- [ ] Other

5.7 When have the standardisation activities been mainly implemented in your project?

- ○ At the beginning of the project
- ● Throughout the project
- ○ During the final phase of the project
- ○ Other:

5.8 Were there any risks you encountered in relation to standardisation related acitivites?

No specific risk

5.10 Have the results of the standardisation activities in your project been followed by any specific action after the end of the project?

- ( ) Yes
- (x) No

5.12 Have the standardisation activities in your project led to specific deliverables?

- (x) Yes
- ( ) No

5.13 If yes, what is the nature of these deliverables?

- [ ] Common terminology
- [ ] Harmonised research methodology
- [ ] Recommendations and/or requirements for new or revised standards
- [ ] One of the standardisation tools proposed by the CEN CENELEC
- [ ] Workshop Agreements (CWAs)
- [ ] Technical Specifications
- [ ] Standard Operating Procedure
- [x] A Technical Report
- [ ] Development of a new standard
- [ ] Proficiency Test
- [ ] Reference data
- [ ] Reference material
- [ ] Certification
- [ ] Accreditation
- [ ] Interlaboratory comparisons
- [ ] Other. Please specify:

5.15 Which standard was addressed by your project?

See earlier answer at question 4.2

5.16 What were the overall costs related to standardisation activities?

Standardisation activities are included in a dedicated task of the HYBUILD work plan, within a work package which also includes LCA, LCC ans Social-LCA activities. The overall effort to cover all activities has been estimated at 66PMs along the whole project duration.

5.17 Have you encountered specific difficulties or barriers in conducting standardisation activities during the project?

- ( ) Yes
- (x) No

5.19 Have there been any disadvantages of the standardisation process that negatively impacted the project?

- Yes
- (selected) No

5.20 Are technologies that are proposed in standard development exercises also patented or have patents been applied for?

- (selected) Yes
- No

6 About exisiting standards

* 6.1 Has your project involved a review or assessment of existing standards to understand if any would have been useful for your project?

- (selected) Yes
- No
- I don't know

* 6.2 Have you identified and made direct use of one or more existing standards as part of the project?

- (selected) Yes
- No
- No opinion

6.3 If yes, what?

> From the analysis carried out so far, it can be concluded that there are some HYBUILD components which are fully standardised (e.g. the heat pumps) and others that need a deep development (e.g. latent and sorption heat storage).

6.4 Please briefly explain how the project made use of these existing standards:

> We are making sure that existing standards are followed for what concerns HYBUILD components being already fully-standardised, in relation to the the installation at the HYBUILD demo sites (http://www.hybuild.eu /pilot-sites/)

6.5 Please indicate how important the use of these standards have been for the success of your project.

- Of no importance
- Of little importance
- (selected) Of some importance
- Of major importance

6.6 To what extent has using existing standards within your project led to the following categories of benefit:

	Not at all	To a small extent	To a medium extent	To a large extent

Improved understanding of current state of the art	○	○	●	○
Improved technical knowledge within the consortium	○	○	●	○
Improved efficiency of the project activities	○	○	●	○
Improved quality of outputs from the project	○	○	●	○
Other	○	○	○	○

6.8 Please indicate whether any of the following wider impacts on innovation are likely as a result of your project making direct use of one or more existing standards. Please indicate all that apply:

	In the short-term	In the medium to longer term
Improved design of products, services or processes	●	○
Faster or easier market access (incl. European or international)	○	●
Improved capacity to respond to EU regulation	●	○
Improved interoperability of products, services or processes	●	○
Improved access to public procurement	○	●
Higher confidence level of consumers	○	○
Enabling the display of a mark of product or process quality	●	○
Wider use of recognised methodologies, processes or terminology	●	○
Other	○	○

7 About new or revised standards

* 7.1 Has your project directly involved or led to a specific recommendation or proposal for the development of new or revised standards or was aimed at supporting the development or revision of a standard already under development?

- ● Yes
- ○ No
- ○ I don't know

7.2 Was it an intention from the outset to propose or support new or revised standards as part of the project?

- Yes, definitely
- (selected) Yes, possibly
- No
- Not sure

7.3 Using the following scale, please indicate how important the proposal of standards has been for your project:

- Of no importance
- Of little importance
- (selected) Of some importance
- Of major importance

7.4 Please provide details of the new standards or revisions that were proposed (i.e. title and a brief description of scope):

> Different scientific and technical novelties were selected within the project as possible contributions for future standards:
> •Fresnel collector
> •Electric distribution in DC in microgrid or self-consumption community
> •Sorption storage systems
> •Hybrid AC–DC systems in buildings
> No proposal was delivered yet.

7.5 Please briefly explain how your project has shared or disseminated its standard proposal (i.e. how have your ideas been shared, presented or submitted to appropriate people and organisations):

> The standard proposals are being discussed internally.

7.6 Please briefly explain what has happened as a result of the standard proposal (i.e. has work to develop a standard been initiated?):

> The work to develop a standard has not been initiated yet.

7.7 Has your project also directly contributed to the subsequent development of the proposed standard?

- Yes
- No
- (selected) Not applicable
- I don't know

7.8 Has the standard you proposed or supported the development of been finalised and / or published?

- Yes – in development
- Yes - published
- (selected) No

○ I don't know

7.9 If yes, please provide further details:

○ The name of the standardisation organisation
○ The name of the technical body involved
○ The reference and title of the published standards

7.10 Please indicate the main benefits of standardisation for the valorisation of the project results once the proposed standard is developed and put to use:

	In the short term	In the medium term	In the long term
Improved codification of research results	●	○	○
Improved dissemination of research results	●	○	○
Opportunity to network / access complementary expertise	●	○	○
Other	○	○	○

7.12 Please indicate the main benefits of standardisation for market uptake once the proposed standard is developed and put to use:

	In the short term	In the medium term	In the long term
Improved design of products, services or processes	○	●	○
Easier or faster market access (incl. European or international)	○	●	○
Improved capacity to respond to EU regulation	○	●	○
Improved interoperability of products, services or processes	○	●	○
Improved access to public procurement	○	●	○
Higher confidence level of consumers	○	●	○
Enabling the display of a mark of product or process quality	○	●	○
Wider use of recognised methodologies, processes, or terminology	○	●	○
Other	○	○	○

8 Best practices

We are planning to proceed with a deep analysis of a number of projects that have led to the development of a European standard or workshop agreement. These projects will then be used by the Commission to highlight and explain these benefits to the wider research community.

* 8.1 Do you think that your project would be an interesting and useful example for a best practice case in terms of valorisation of R&I results through existing, revised or new standards?

- [ ] Yes
- [x] No

* 8.2 Would you consider using, proposing or developing standards as part of future research projects?

- [x] Yes
- [ ] No

* 8.3 Would you be interested in clustering with other projects funded by the Framework Programme to work on the same standard?

- [ ] Yes
- [x] No

8.4 Please explain your answer further:

* 8.5 In another R&I project would you address standardisation in another way?

- [ ] Yes
- [x] No

8.6 If yes, how?

* 8.7 Would you start the standardisation process at another stage if you were again a grantee of a public R&I programme?

- [ ] Yes
- [x] No

8.8 Please explain:

8.9 Do you have any suggestions for how the links between research, innovation and standardisation could be strengthened?

* 8.10 Would you be willing to assist us in describing best practice cases using your project as an example (through provision of project documentation and a telephone interview)?

- [ ] Yes
- [x] No

8.11 If yes, please provide your current contact details (name, e-mail, phone number):

8.12 Please include any other comments not covered by the previous questions:

We thank you for completing this questionnaire. Please submit your answers by pressing the button below.

8.13 Free Text Question

8.14 Have you considered collaboration with the International Organisations for Standardisation (ISO), the International Electrotechnical Commission (IEC) or the International Telecommunication Union (ITU)?

	Yes	No
* ISO	○	●
* IEC	○	●
* ITU	○	●
* Other	○	●

Contact

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