



HORIZON
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Report on Options for Future European Joint Programme for the CSP Sector

Deliverable 3.3

WP 3:

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30 September 2022





DELIVERABLE FACTSHEET

Deliverable no.:	3.3
Title of Deliverable:	Report on Options for Future European Joint Programme for the CSP Sector
Responsible Partner:	METU
WP no. and title:	WP3 – R&I Impact maximization
Task no. and title:	Task 3.4: Evaluation of implementation
Version:	1
Version Date:	30 September 2022
Submission Date:	30 September 2022

Dissemination Level

X	PU = Public
	PP = Restricted to other programme participants (including the EC)
	RE = Restricted to a group specified by the consortium (including the EC)
	CO = Confidential, only for members of the consortium (including the EC)

This report should be cited as:

Baker, D., Demircan, M., Erden Topal, Y., Benitez, D. Heller, P., Zarza, E., Blanco, J., De Iuliis, S. (2022) "Report on Options for Future European Joint Programme for the CSP Sector". D3.3 of HORIZON-STE.



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DISCLAIMER

The project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 838514.

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Project information	
Project Number:	838514
Project title:	Implementation of the Initiative for Global Leadership in Solar Thermal Electricity' — 'HORIZON-STE'
Starting date:	01/04/2019
Duration:	42 months
Call identifier:	H2020-LC-SC3-2018-JA2

ABOUT THE PROJECT

HORIZON-STE is a Horizon 2020 funded project aiming at supporting the Implementation of the Initiative for Global Leadership in Solar Thermal Electricity (STE), also known as Concentrated Solar Power (CSP), which was launched by the European Commission and adopted within the Strategic Energy Technology Plan (SET Plan) of the European Commission.

Since more than a decade, Europe's Solar Thermal Electricity sector holds a worldwide technology leader until its further development abruptly hindered in Europe. To unlock this situation, the European Commission has launched a dedicated Initiative – Initiative for Global Leadership in Concentrated Solar Power focusing on 2 targets: a cost reduction target and an innovation target, in order to keep STE/CSP's global technology leadership and rebuild a home market in Europe.

Acting as competence centre of the Implementation Working Group within the Strategic Energy Technology Plan (SET Plan) of the European Commission, the overall goal of HORIZON-STE is to support the execution of the Implementation Plan regarding both STE/CSP Research and Innovation lines as well as First-Of-A-Kind projects that will help steer countries through political, legislative, and institutional shortcomings linked to various national policies concerning solar thermal electricity. Much of the focus centres on improving procurement of manageable RES and increased public funding for STE/CSP research.



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EXECUTIVE SUMMARY

The alignment of the Deliverable 3.3 (D3.3) content with the D3.3 descriptions in the Grant Agreement (GA) is demonstrated and the D3.3's objectives and target audiences are presented. The core of D3.3 is a description of the current context for a European Joint Programme for the Concentrating Solar Thermal (CST) Sector by summarizing the main European CST R&I funding schemes and activities and assessing their relevance to a European Joint CST Programme. While the primary purpose of the European Framework Programmes (FPs) is not as a Joint Funding Programme to align R&I funds from different national and regional scientific funding agencies, these FPs are expected to have a significant influence on the boundary conditions of any robust European Joint CST Programme. Although the European Energy Research Alliance-Joint Program-Concentrating Solar Power (EERA-JP-CSP) is not a funding scheme, it is the most complete and robust network of European research institutes with significant CST activities. Additionally, the EERA-JP-CSP members have collaborated on two European R&I projects (STAGE-STE and INSHIP) that blended European Commission (EC) FP funds with national and regional funds and therefore had a Joint Funding dimension. EU-SOLARIS is in the final stages of being constituted as a European Research Infrastructure Consortium (ERIC) with Cyprus, France, Germany, and Spain as founding members and Italy and Portugal as observers. EU-SOLARIS ERIC will integrate a large fraction of Europe's most significant CST Research Infrastructures under a single European umbrella and demonstrates the members' willingness and capacity to align national R&I investments and activities to achieve a common purpose. However, several countries commonly active in other joint CST R&I activities are not affiliated with EU-SOLARIS ERIC, including Greece, Israel, and Turkey. Historically ERANET was one of the main joint funding instruments for the CST Sector, including through the 1st (opened in 2019) and additional (opened in 2021) CSP ERANET Calls, and the outcomes, strengths and weaknesses of ERANET are described. ERANET is being replaced by the CET Partnership (CETPartnership) for Clean Energy Transition (CET) R&I in Horizon Europe. Since the 1st CETPartnership opened on 14 September 2022 after the D3.3 content had been finalized, details for this 2022 call are not presented, but an overview of the participating national and regional funding agencies, total budgets and targeted themes are presented. The main R&I needs identified by CST key stakeholders were presented in the CSP Implementation Plan (IP) for the Strategic Energy Technology-Plan (SET Plan), and these are briefly summarized as further inputs into a Joint CSP Programme. As the main input to the European CST workshop to be organized by CIEMAT in September 2022 as part of this project, the HORIZON-STE consortium recommends to realize a European Joint Programme for the CSP sector by building on the existing CETPartnership structures through three targeted actions:

1. Increasing harmonization of the EERA-JP-CSP, EU-SOLARIS ERIC, CETPartnership, and EU Framework Programs (FPs);



2. Strengthening collaboration with other European renewable energy sectors that would benefit from technology specific joint funding programmes;
3. Coordinating messages from all relevant key stakeholders to key decision makers on the value of and need for technology specific joint funding programmes.

ABBREVIATIONS

CET	Clean Energy Transition
CSP	Concentrating Solar Power, which is equivalent to Solar Thermal Electricity (STE)
CST	Concentrating Solar Thermal
EC	European Commission
EERA	European Energy Research Alliance
ERA	European Research Area
ESFRI	European Strategy Forum on Research Infrastructures
GA	Grant Agreement
H2020	Horizon 2020
IP	Implementation Plan
IWG	Implementation Working Group
JP	Joint Programme for EERA
RI	Research Infrastructure
R&I	Research and Innovation
RDI / RTDI	Research, (Technology) Development, and Innovation
SET Plan	EU Strategic Energy Technology Plan
STE	Solar Thermal Electricity, which is equivalent to Concentrating Solar Power (CSP)
TES	Thermal Energy Storage



1 SCOPE AND RELATION TO THE GRANT AGREEMENT

In the Grant Agreement (GA), Deliverable 3.3 (D3.3) is described by the title “Report on options for future European Joint Programme for the CSP sector,” where CSP is Concentrating Solar Power to generate electricity, which is also referred to as Solar Thermal Electricity (STE). The scope of D3.3 is further defined in the Task 3.4 (T3.4) description “The experience with the execution of first implementing projects will be considered and a strategy developed for transducing the IP into a longer-term activity after the end of this project, i.e., develop a concept for a European Joint Programme on CSP. To this extent, a European workshop will be organized by CIEMAT to discuss options to define a European Joint Programme on CSP. Deliverable D3.3 (Report on options for future European Joint Programme for the CSP sector) is directly connected with this activity.” Here the “first implementing projects” are those funded through the 1st CSP ERANET call and these experiences are described in Section 3.4. IP is the Implementation Plan to support the Initiative for Global Leadership in CSP, and this is described in Section 3.6. The European workshop to be organized by CIEMAT will occur in the last month of the project, September 2022, and D3.3 is framed to provide input to this workshop.

While the GA specifically targets a “European Joint Programme” as an output from D3.3, the consortium interprets the intent of the GA is to specifically target a “European Joint *Funding* Programme”, where this distinction becomes critical to the scope of D3.3 as follows:

European Joint Programme is defined herein as any activity involving multiple European actors, and this can include non-Funded activities such as EERA-JP-CSP discussed in Section 3.2.

European Joint Funding Programme is defined herein as a European activity funded by multiple funding agencies, with the classic example being the ERANET funding instrument discussed in Section 3.4.

The HORIZON-STE proposal was elaborated in 2018 with a focus on the CSP/STE sector. Since 2018 the sector has expanded to more explicitly include Solar Heat for Industrial Processes (SHIP) and the production of renewable fuels (e.g., H₂). Looking to the future, the sector sees large market opportunities for all of electricity production, SHIP, and renewable fuels. Therefore, the sector has repositioned itself as the more inclusive Concentrating Solar Thermal (CST) sector that encompasses all 3 end uses. Within this Deliverable, both the acronyms CST and CSP are used, with CST typically being used in a more forward-looking context and CSP being used in a more historical context. Furthermore, D3.3 targets a “Joint Programme on *CST* Sector” and not “... *CSP* Sector”, but the Deliverable title remains “... *CSP* Sector” to be consistent with the GA.



2 OBJECTIVES AND TARGET AUDIENCE

The scope and presentation of D3.3 reflect D3.3's Objectives and Target Audiences within the context of D3.3 being a public deliverable. The objectives of the deliverable are:

- Obj. 1: Define a concept for European Joint CST Programming that appropriately supports the energy transition through stable R&I funding.
- Obj. 2: Demonstrate effective use of EC Investments in HORIZON STE
- Obj. 3: Raise awareness of and support for
 - 3.a. HORIZON STE Project
 - 3.b. CST
 - 3.c. European Investments in Research
- Obj. 4: Accumulate, share and archive information, knowledge, and experiences.

The targeted audiences are the HORIZON STE Consortium, Key ERA CST R&I Stakeholders, the European Commission (EC), National Funding Agencies, European Energy Research Area (EERA), Global CST R&I Community, and the General Public. In Figure 1 the objectives and target audiences are listed in order of importance, and the importance of each objective to the target audience is defined. For example, the achieving the objective *3a. Raise awareness of and support for the HORIZON-STE project* is *Most Important* for the target audience *Key ERA CST R&I Stakeholders* but not relevant for the target audience *HORIZON-STE Consortium*.



Importance of Objective to Target Audience	
Most Important	+++
Very Important	++
Important	+
Not Relevant	

Objectives (In order of importance)	Target Audience (In order of importance)						
	HORIZON-STE Consortium	Key ERA CST R&I Stakeholders	EC	National Funding Agencies	Communities		
					EERA	Global CST R&I	Gen. Public
1. Define a concept for European Joint CST Programming that appropriately supports the energy transition through stable R&I funding.	+++	+++	+++	+++	++	+	+
2. Demonstrate effective use of EC investments in HORIZON-STE.	+++	+++	+++	++	++	++	++
3. Raise awareness of and support for							
3a. HORIZON-STE project		+++	+++	+++	+++	++	+++
3b. CST		+	+++	+++	+++	++	+++
3c. European Union Investments in Research		+++	+++	+++	+	++	+++
4. Accumulate, share, and archive information, knowledge, and experiences.	+++	+++	+++	+++	++	++	+

Figure 1: Ranking and mapping of objectives and target audiences for D3.3.

3 CONTEXT FOR A EUROPEAN JOINT PROGRAMME FOR THE CSP SECTOR

In this section European CST Research and Innovation (R&I) activities are summarized with an emphasis on providing the necessary context to make this report accessible to a wide audience and to highlight the potential to leverage these activities, networks, and lessons-learned in the development and execution of a European Joint Funding Programme for the CSP sector.

3.1 European Framework Programmes

Historically the largest and most important funding source for transnational European Research, Technology Development, and Innovation (RTDI) has been the European Framework Programmes (FPs). The 1st Framework Programme (FP1) ran from 1984 to 1987 with a budget of €3.8B. More recently, the FP8 Programme, termed Horizon 2020, ran from 2014 to 2020 with a total budget of €50.5B. The FP9 Programme, termed Horizon Europe, will run from 2021 to 2027 with a total budget of €95.5B. These FP Programmes fund a diverse set of calls with many targeting CSP RTDI activities specifically. Within Horizon Europe, the most appropriate place for CSP related calls is under the Climate,



Energy and Mobility cluster under Pillar II Global Challenges & European Industrial Competitiveness. Representative RTDI budgets for Horizon Europe projects range from approximately €3M for lower Technology Readiness Level1 (TRL) Research and Innovation Actions (RIAs) to approximately €20M for higher TRL Innovation Actions (IAs). The FPs also fund Coordinating and Support Actions (CSA) with sample consortium budgets of approximately €1M for the present H2020 HORIZON-STE project and €0.6M for the follow-up Horizon Europe CST4ALL project.

These FPs are not Joint Funding Programmes since their underlying funding strategy is based on the European Commission (EC) as a single funding source rather than aligning funds from multiple national and regional funding agencies to seek solutions to transnational challenges. However, the FPs are an important source for transnational European CST RTDI funds that may impact the objectives, scope and functioning of a European Joint Programme for the CST Sector. For example, in some cases, FP funds are used to catalyse and support Joint Programmes, such as through the FP7 STAGE-STE project described in Section 3.2.3 and the H2020 INSHIP project described in Section 3.2.4.

3.2 EERA-JP-CSP

The EERA-JP-CSP is the Joint Programme (JP) on Concentrating Solar Power (CSP) in the European Energy Research Alliance (EERA). EERA-JP-CSP is the most comprehensive CSP research network in Europe and is potentially an appropriate institution to leverage when developing and executing a European Joint Funding Programme for the CST Sector. As D3.3 is a public deliverable targeting a global audience, first a broad overview of EERA is provided for readers unfamiliar with EERA, such as those outside the European Research Area (ERA). Next EERA-JP-CSP is described in more detail. Finally, brief overviews of the two main European FP research projects resulting from EERA-JP-CSP (STAGE-STE and INSHIP / SHIP ECRIA) are given to facilitate the adaptation of relevant lessons-learned to a European Joint Funding Programme for the CST Sector.

3.2.1 Overview of EERA²

EERA is the main energy research community in Europe and consists of approximately 250 associations, industries, research organisations, and universities from 30 countries. EERA's mission is to catalyse European energy research with the objectives defined in the EU's Strategic Energy Technology Plan (SET Plan) and its clean energy transition strategy for a climate-neutral continent by 2050. EERA consists of the following 18 JPs that facilitate collaboration among EERA members working on the same topic.

1. AMPEA: Advanced Materials and Processes for Energy Applications
2. Bioenergy
3. CCS: Carbon Capture and Storage
4. CSP: Concentrated Solar Power

¹ https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

² <https://www.eera-set.eu/>



5. Digitalisation for Energy (Transversal JP)
6. e3s: Economic, Environmental and Social Impacts of the Energy Transition
7. Energy Efficiency in Industrial Processes
8. Energy Storage
9. Energy Systems Integration
10. Fuel Cells & Hydrogen
11. Geothermal
12. Hydropower
13. Nuclear Materials
14. Ocean Energy
15. Photovoltaic Solar Energy
16. Smart Cities
17. Smart Grids
18. Wind Energy

The EERA programme provides a framework that can facilitate the identification and adaptation of Joint Research Programming and lessons-learned from other JPs to the JP-CSP.

3.2.2 Description of EERA-JP-CSP³

The objective of EERA-JP-CSP is to integrate and coordinate the scientific collaboration among the leading European research institutions in CSP to contribute to the achievement of the targets initially set by the "Solar Thermal Electricity-European Industrial Initiative" (STE-EII) and subsequently by the SET-Plan, including:

1. Supporting the CSP/STE industry, to achieve significant cost reductions and to increase commercial deployment worldwide through the integration of national and European roadmaps;
2. Clustering of European R&D activities on CSP/STE to develop exploitable breakthrough technologies with a specific focus on Thermal Energy Storage (TES);
3. Defining a limited and clear priority of scientific and technological targets /challenges in each current CSP/STE technology defined by the EERA-JP-CSP's Sub-Programmes (SPs);
4. Increasing the integration of CSP/STE into the energy system through cost-effective solutions;
5. Addressing all previous challenges in the context of aligned European and Member States R&I priorities, investments, and activities.

EERA-JP-CSP currently consists of 15 full participants and 11 associated participants from the following 11 countries: Cyprus, France, Germany, Greece, Italy, Netherlands, Portugal, Spain, Switzerland, Turkey, and UK. Thus, EERA-JP-CSP includes participants from the countries that are most likely to participate in a European Joint Programme for the CST Sector and therefore these participants can facilitate developing and activating a CST Joint Programme.

³ <https://www.eera-csp.eu/>



For the 2018-2021 period, these 26 participants committed 145.40 person-years/year to joint work on the following 6 Sub-Programmes (SPs):

SP1 Line-Focusing CSP Systems

SP2 Point-Focusing CSP Systems

SP3 Thermal Energy Storage

SP4 Materials for CSP

SP5 Solar Driven Thermochemical Processes

SP6 Solar Heat for Industrial Processes and Applications

STAGE-STE (2014-2018) and INSHIP (2017-2020) are two completed European FP projects on CST that were strongly coupled to EERA-JP-CSP and are discussed in more detail in the following sections. In terms of a European Joint Funding Programme for the CST Sector, these two projects are significant as they are examples of how EU FP funds have been used to catalyse, align, and leverage national funds to support transnational European CST research.

3.2.3 STAGE-STE

STAGE-STE is the *Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy* project funded under the European FP7 Programme (Grant 609837) from 1 Feb. 2014 to 31 Jan. 2018. From the CORDIS website⁴,

... This Integrated Research Programme (IRP) engages all major European research institutes, with relevant and recognized activities on STE and related technologies, in an integrated research structure to successfully accomplish the following general objectives: a) Convert the consortium into a reference institution for concentrating solar energy research in Europe, creating a new entity with effective governance structure; b) Enhance the cooperation between EU research institutions participating in the IRP to create EU added value; c) Synchronize the different national research programs to avoid duplication and to achieve better and faster results; d) Accelerate the transfer of knowledge to industry in order to maintain and strengthen the existing European industrial leadership in STE; and e) Expand joint activities among research centres by offering researchers and industry a comprehensive portfolio of research capabilities, bringing added value to innovation and industry-driven tech.

The total project budget for STAGE-STE was €21,134,658 with an EU contribution of €9,997,207 and in-kind contributions of €11,137,451, and thus the project used EU funds to catalyse, align and leverage national and regional funds.

⁴ <https://cordis.europa.eu/project/id/609837>



3.2.4 INSHIP and the Resulting ECRIA on SHIP

INSHIP is the *Integrating National Research Agenda on Solar Heat for Industrial Processes* project funded under the European H2020 Programme (Grant 731287) from 1 Jan. 2017 to 31 Dec. 2020. From the CORDIS website⁵,

... INSHIP aims at the definition of a [European Common Research and Innovation Agenda (ECRIA)] engaging major European research institutes with recognized activities on [Solar Heat for Industrial Processes (SHIP)], into an integrated structure that could successfully achieve the coordination objectives of: more effective and intense cooperation between EU research institutions; alignment of different SHIP related national research and funding programs, avoiding overlaps and duplications and identifying gaps; acceleration of knowledge transfer to the European industry, to be the reference organization to promote and coordinate the international cooperation in SHIP research from and to Europe, while developing coordinated R&D TRLs 2-5 activities with the ambition of progressing SHIP beyond the state-of-the-art through: an easier integration of low and medium temperature technologies suiting the operation, durability and reliability requirements of industrial end users; expanding the range of SHIP applications to the EI sector through the development of suitable process embedded solar concentrating technologies, overcoming the present barrier of applications only in the low and medium temperature ranges; increasing the synergies within industrial parks, through centralized heat distribution networks and exploiting the potential synergies of these networks with district heating and with the electricity grid.

SP6 *Solar Heat for Industrial Processes and Applications* in EERA-JP-CSP was created to support INSHIP and reflects the evolution of the CSP sector from primarily focusing on Solar Thermal Electricity (STE) to encompass the rapidly emerging field SHIP with a specific emphasis on supporting the energy transition for industry including in hard-to-abate industries. The EU contribution to INSHIP was €2,498,661 and in-kind contribution commitments in the Grant Agreement totalled €3,489,940. Thus, relative to STAGE-STE, the EU contribution was reduced significantly and the ratio of in-kind to EU contributions increased significantly, which is consistent with the European Commission's increasing emphasis on using EU funds to catalyse, align, and leverage national funds and supports the need to create a new Joint Funding Programme to sustain and grow the European CST Sector.

3.2.5 Gaps and opportunities for EERA-JP-CSP

At the 8th EERA-JP-CSP General Assembly Meeting on 21 Jan. 2020, it was noted that STAGE-STE and INSHIP projects provided a strong framework to support pan-European collaboration on CST, and with the conclusion of INSHIP on Dec. 31, 2020 and without a similar follow-up activity there was a risk of reduced pan-European collaboration on CST. Specifically, 46% of participants at this meeting indicated that their main reason to participate in EERA-JP-CSP was to achieve greater financing and participate in more

⁵ <https://cordis.europa.eu/project/id/731287>



projects, and 52% of participants expected their contribution to EERA-JP-CSP would be significantly reduced if there was no externally financed activity similar to STAGE-STE or INSHIP in the future. Therefore, any business model for the long-term sustainability of the EERA-JP-CSP should appropriately reflect:

1. It will likely be difficult to sustain the level of coordinated activities achieved during the STAGE-STE and INSHIP projects without any external funding and/or collecting membership fees like other JPs;
2. The strategic advice EERA provides to the EC is very important, and EERA-JP-CSP should aim to continue to provide this strategic advice even in the absence of funding;
3. Maintaining a strong EERA-JP-CSP is expected to continue to benefit the European CST community in the future, and therefore it is important to keep this network alive, even in the absence of funding.

Thus, the European Joint Funding Programme for the CST Sector could be structured to respond to these gaps and opportunities.

3.3 EU-SOLARIS ERIC

In this section, a brief introduction to the European Strategy Forum on Research Infrastructures (ESFRI) is given for context followed by a description of EU-SOLARIS as an ESFRI Landmark and its significance for a European Joint Funding Programme for the CST Sector. ESFRI⁶ is a strategic instrument to strengthen Europe's scientific integration and international outreach by offering competitive and open access to high-quality Research Infrastructures (RIs) with an aim to attract the best researchers globally. ESFRI was established in 2002, and periodically publishes its *Roadmap* summarizing the ongoing projects to construct and develop the next generation of pan-European RIs that become ESFRI Landmarks upon entering operation. The last Roadmap was published in 2021⁷.

EU-SOLARIS is the *European Solar Research Infrastructure for Concentrated Solar Thermal*. EU-SOLARIS was included as a Project in the 2010 ESFRI Roadmap⁸ specifically focused on Energy, Food and Biology. The Preparatory Phase of EU-SOLARIS was funded through the EU FP7 project *The European Solar Research Infrastructure for Concentrated Solar Power*⁹ (Grant 312833) from 1 Nov. 2012 to 31 Oct. 2016. This EU-SOLARIS FP7 project contained 15 partners from 7 EU countries (Cyprus, France, Germany, Greece, Italy, Portugal, and Spain) and 2 Associated countries (Israel and Turkey). The Transition/Implementation Phase ran from 2017 to 2021 and was funded through in-kind contributions from interested countries and their national scientific nodes; i.e., the Transition/Implementation Phase did not receive any direct EU financial support, which

⁶ <https://www.esfri.eu/>

⁷ <https://www.esfri.eu/esfri-roadmap-2021>

⁸ https://www.esfri.eu/sites/default/files/esfri-strategy_report_and_roadmap_2010.pdf

⁹ <https://cordis.europa.eu/article/id/166097-european-excellence-in-solar-thermal-energy>



suggests that the relevant countries and scientific nodes making these in-kind contributions expected the benefits from EU-SOLARIS membership to be sufficiently large to justify these In-Kind costs. EU-SOLARIS is being legally constituted as a European Research Infrastructure Consortium (ERIC). EU-SOLARIS’s status as an ERIC will be formally recognized by ESFRI in October 2022, at which point EU-SOLARIS ERIC will become an ESFRI Landmark.

The operation of ERICs is funded in part through membership fees paid by the member countries, and membership requires the alignment of each member country’s scientific, financial, and regulatory/political support with the structure of the relevant ERIC. In the case of EU-SOLARIS ERIC, founding member countries are required to commit to paying €20,000/yr for 4 years and designate a single scientific national node to represent the country scientifically in EU-SOLARIS. Furthermore, as the headquarters, Spain’s Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas-Plataforma Solar de Almería (CIEMAT-PSA) committed to paying €115,000/yr for 4 years in membership fees and in-kind contributions. On 28 Apr. 2021 EU-SOLARIS passed the Review Hearing to be constituted as an ERIC with commitments from CIEMAT-PSA to be the headquarters and Cyprus, France, and Germany as member states represented through the scientific nodes Cyprus Institute (Cyl), Centre national de la recherche scientifique (CNRS), and German Aerospace Center (DLR). Subsequently, Portugal represented by The University of Evora (UEvora) and with support from Portugal’s National Laboratory of Energy and Geology (LNEG) indicated its intention to be an Observer. In August 2022 ENEA announced that Italy is seeking at least Observer status. The evolution of the countries and institutions involved in EU-SOLARIS is as follows in Figure 2.

	EU Countries & Institutions							Associated Countries &	
	Cyprus	France	Germany	Greece	Italy	Portugal	Spain	Israel	Turkey
	Cyl	CNRS	DLR	APTL-CERTH CRES	ENEA	LNEG U.Evora	CIEMAT-PSA* CTAER	WEIZMAN	METU Selcuk U.
Preparatory Phase (EU FP7 Project)	+	+	+	+	+	+	+	+	+
Started Implementation Phase in 2017	+	+	+	+	+	+	+	+	+
Strong interest in joining EU-SOLARIS in Fall 2020	+	+	+	+	+	+	+	+	+
Intends to be affiliated with EU-SOLARIS as of 30 Aug. 2022: M = Full Member; O = Observer	M	M	M	-	O**	O	M	-	-

* EU-SOLARIS Headquarters

** Italy recently started the process to become at least an Observer

Figure 2: The evolution of the countries and institutions involved in EU-SOLARIS



This table illustrates that, as of 30 Aug. 2022, many countries and institutions who were involved in the EU-SOLARIS Preparatory and Implementation Phases have not secured the necessary political commitment to become an EU-SOLARIS ERIC Founding Member or Observer. EU-SOLARIS is continuing to work with these countries and institutions to enable them to become a Member, or at least an Observer, of EU-SOLARIS ERIC.

With respect to a European Joint Funding Programme for the CSP Sector, EU-SOLARIS represents both lessons learned and an opportunity. In terms of lesson-learned, only 4 / 8 (50%) of the countries that started the Implementation Phase in 2017 currently intend to join EU-SOLARIS as a Member, and 2 countries intend to become an Observer, which highlights the challenges in aligning national scientific, financial, and regulatory/political support across multiple countries within ERA. As a short case study to illustrate this point, after Germany and Spain, Turkey has been one of the largest and most reliable contributors to ERANET calls targeting CST. Therefore, Turkey has demonstrated scientific and financial commitment to participating in pan-European CST R&I activities. Furthermore, in the Fall 2020 Turkey secured the necessary scientific and financial support to join EU-SOLARIS ERIC as a founding member, which at the time was the first and only ERIC Turkey expressed interested in joining as a full member. However, over the Spring 2021 it became increasingly clear that Turkey did not have the national regulations required to enable it to join any ERIC, including EU-SOLARIS. Turkey regulatory situation may in part be due to Turkey being an Associated Country rather than an EU member state, and therefore its national regulations are often not fully harmonized with EU regulations. While key scientific and regulatory people in Turkey continue to actively lobby for national reforms to enable Turkey to join ERICs, to date there has been a lack of political will within Turkey to craft these regulations. As an opportunity, the EU-SOLARIS Implementation Phase network, defined as all of the countries and their associated funding agencies and scientific nodes that participated in the Implementation Phase regardless of whether they are currently committed to being affiliated with EU-SOLARIS ERIC, encompasses the key funding agencies and scientific institutions in many of the countries most likely to participate in a European Joint Funding Programme for the CST Sector, and therefore these networks and lessons-learned can be exploited to facilitate the creation of a European Joint Funding Programme for the CST Sector. A final strength of EU-SOLARIS ERIC is its stability due to its indefinite lifetime.

3.4 CSP ERANET

ERANET is a joint European research funding scheme in which each institution in a project is funded by its national or regional funding agency. ERANET calls typically require that each proposed project include institutions from at least 3 different participating countries, thus enforcing the transnational and co-fund nature of the instrument. The aim of ERANET is to substantially increase the share of funding that individual countries dedicate to joint European R&I projects. The public HORIZON-STE Deliverable 1.4 (D1.4) *Report on options for financing instruments and schemes* provides an overview of the ERANET scheme including the challenges in aligning the national and regional funding



instruments that are used to support ERANET projects, including challenges due to very different eligible costs, time schedules, and budgets. For brevity this information is not repeated herein and interested readers are referred to D1.4¹⁰. The EU Horizon 2020 (H2020) funding programme exploited the ERANET joint funding instrument through calls where the bulk of the funds to support the research was intended to come from national and regional funding agencies, and the EC was to provide funds to facilitate executing the call and as “top-up” funds, which is consistent with the EU’s desire to increasingly use EC capacities to catalyse, align, and exploit national R&I funding. These “top-up” funds were intended to correct problems in previous ERANET calls lacking EC co-funding where budgets from some funding agencies were consumed before others, and as a result, for some proposals funding for some but not all partners existed. As part of the transition from the Horizon 2020 to the Horizon Europe funding programme, the ERANET joint funding scheme is being replaced by the Clean Energy Transition Partnership (CETPartnership) described in Section 3.5.

The H2020 co-fund mechanism was used to support two CSP ERANET calls where the EC funded the H2020 CSP ERANET¹¹ project to develop and execute the call and H2020 HORIZON-STE project (i.e., the present project) to provide industrial and scientific support for the call.

The 1st CSP ERANET call opened on 7 October 2019, with a total budget of €13M, with €9 M from national funds and €4M from EC funds with call details provided at¹². Six proposals were funded and the results in terms of number of projects and participating institutions per country are given in Table 1 (where the same institution participating in two projects is counted as 2 institutions).

Table 1: 1st CSP ERANET Call Results- Participating Institutions and Countries

	Germany	Greece	Israel	Italy	Portugal	Spain	Switzerland	Turkey
Projects	4	2	3	1	1	5	1	2
Institutions	10	4	3	1	1	15	1	4

As shown in the table above, all countries funding the call had at least one project, and therefore institution, funded. This 1st CSP ERANET call is a significant reference point for a European Joint Funding Programme for the CST Sector as the CSP ERANET call blended national funds and EC funds in an approximately 2:1 ratio.

The CSP ERANET Additional Call 2021 was launched on 1st of October 2021 with a total budget of €6.05M. The 7 funding agencies participating in the 1st and this Additional Call are shown in the green rows below, while the 5 funding agencies that participated in the 1st Call but not the Additional Call are shown in the grey cells (Table 2). Note Italy decided

¹⁰ http://www.horizon-ste.eu/Docs/Deliverables/HORIZON-STE_D1.4_Final.pdf

¹¹ <https://cordis.europa.eu/project/id/838311>

¹² https://csp-eranet.eu/sites/default/files/templates/csp_eranet_d21_1st_call_guidelines_v0.4_update_20200414.pdf



to focus its resources on the CETPartnership (Section 3.5) rather than participate in the CSP ERANET Additional Call.

Table 2: Funding agencies and Countries/ Regions participating in the CSP ERANET Calls. Green rows indicate funding agencies that participated in both calls; Grey rows indicate funding agencies that only participated in the 1st call.

Country / Region	Funding Agency
Germany	PtJ: Projektträger Jülich PtJ
Germany / NRW	ETN: Projektträger ETN
Greece	GSRI: General Secretariat for Research and Innovation
Italy	MIUR: Ministero dell'Istruzione dell'Università e della Ricerca
Israel	MOE-IL: Ministry of Energy of Israel
Spain	AEI: Agencia Estatal de Investigación
Spain	CDTI: Centro para el Desarrollo Tecnológico Industrial
Spain	Junta de Extremadura – Consejería de Economía e Infraestructuras
Switzerland	SFOE: Swiss Federal Office of Energy
Turkey	TÜBİTAK: The Scientific and Technological Research Council of Turkey
Portugal	DGEG: Direção-Geral de Energia e Geologia

Seven pre-proposals were submitted to the Additional Call with 33 applicants representing all 7 funding agencies. Additionally, 3 Associated partners from Germany and Portugal have participated covering their own funds in their projects. Ultimately 4 full proposals were accepted in July 2022 that will be supported by funding agencies in Germany, Spain, and Turkey. The total costs of the accepted projects are €5.5M and the total requested funding is €4.1M. Two outcomes highlight challenges facing the ERANET funding scheme. First, the total requested funding is ~68% of the available budget, and thus all of the available budget was not used. Second and in contrast to the 1st Call, not all funding agencies participating in this Additional Call were represented in a successful proposal, which is consistent with not all of the available budget being consumed. Further details on the Additional Call are available from the June 2022 CSP ERANET Newsletter¹³.

¹³ https://csp-eranet.eu/sites/default/files/publications/csp-eranet-newsletter-jun2022_2.pdf



3.5 Clean Energy Transition Partnership (CETPartnership)

The CETPartnership replaces the ERANET scheme (Section 3.4) for HORIZON-EUROPE and is a

... multilateral and strategic partnership of national and regional research, development and innovation (RDI) programmes in European Member States and Associated Countries aiming to boost and accelerate the energy transition and to support the implementation of the European Strategic Energy Technology Plan (SET Plan).¹⁴

The evolution from ERANET to CETPartnership reflects the evolution in European priorities and strategies to accelerate the clean energy transition by supporting R&I in clean energy technologies. Understanding the CETPartnership can provide important context when formulating a European Joint Funding Programme for the CST Sector. The aim of CETPartnership is to enable Europe's clean energy transition and support Europe's goal to be the first climate-neutral continent by 2050. Additionally, the CETPartnership intends to blend national and regional RDI funding from Europe with funding partners from outside Europe to leverage global capacities and integrate European stakeholders and solutions into global value chains.

The CETPartnership is based on a Strategic Research and Innovation Agenda (SRIA)¹⁵ with the first version (v1.0) being published in November 2020. In this SRIA, the CETPartnership is explicitly coupled to the European Partnerships and RDI Initiatives in the graphic below (Figure 3) and to the following Programmes and financial tools: InvestEU; Innovation Fund; Connecting Europe Fund (CEF); ERDF Cohesion Funds.

¹⁴ <https://cetpartnership.eu/>

¹⁵ https://eranet-smartenergysystems.eu/global/images/cms/CETP/CETP_SRIA_v1.0_endorsed.pdf

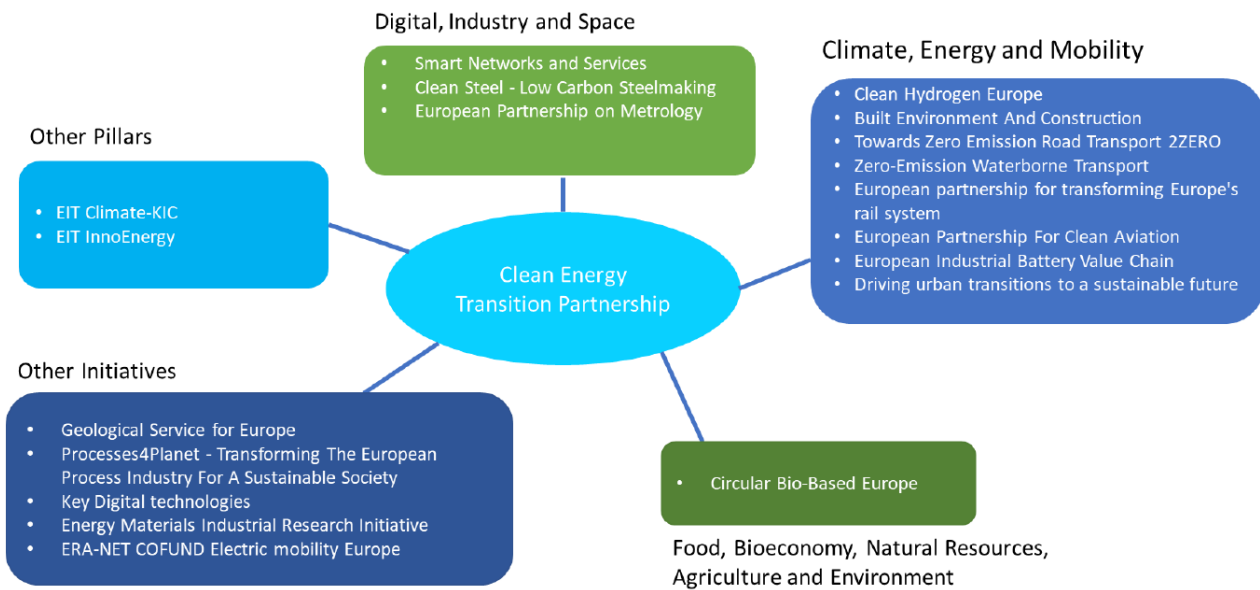


Figure 3: The Structure of Clean Energy Transition Partnership

The *SET Plan Stakeholder Groups Dialogues Summary Paper* provided input to the CETPartnership SRIA v1.0. In this summary paper, CSP's Expected Impacts are defined as reduced Levelized Cost of Electricity (LCOE) to become more competitive with other renewables (i.e., wind and PV) and to develop hybrid solutions with other technologies. Specific targeted impacts to achieve these Expected Impacts as presented in this 2020 summary paper are as follows, with updated values¹⁶ from 2021 being presented in Section 3.6 *CSP IP for SET-Plan*.

1. LCOE reduction of CSP technology to €0.09/kWh in Southern Europe locations (DNI approximately 2050 kWh/m²/year), without any additional constraints by 2025, targeting €0.08/kWh by 2030, providing competitive dispatchable solar power (e. g., at night).
2. Feasibility of novel material approaches for Thermal Energy Storage (TES) demonstrated via validation in lab or demonstration in relevant environment including liquid, solid, Phase Change Material (PCM), and Thermo-Chemical Storage (TCS) media.
3. Cheaper TES enabling at least 10% of heat consumed in industrial processes in Europe to be delivered through concentrated solar technologies by 2030.
4. Thermal energy cost ≤ €0.03/kWh for small scale applications with temperatures less than 400°C and ≤ €0.02/kWh for large scale applications and temperatures >600°C.

¹⁶ Since the objective of this Deliverable is to define Options for a Future European Joint Programme for the CST Sector and not to define specific targeted impacts for CSP, no attempt is made to reconcile the different specific targeted impacts presented in different documents, as they are sufficiently consistent for the objectives of this Deliverable.



- Demonstration of H₂ solar thermal production viability at a cost of €3 €/kg_{H₂} by 2030.

CST key stakeholders identified 20 challenges to achieving these Expected Impacts that are grouped under four broad *CSP Challenges*. Furthermore, in the CETPartnership SRIA v1.0, eight *CETPartnership Challenges* are identified, and the 4 *CSP Challenges* are mapped onto these 8 *CETPartnership Challenges* as shown below in Figure 4, where uppercase X indicates that the *CSP challenge* is of key relevance to the *CETPartnership Challenge*, while lowercase x indicates that the *CSP challenge* is of higher or normal relevance to the *CETPartnership Challenge*.

Four CSP Challenges	Eight CETPartnership Challenges							
	1. Optimised integrated European net-zero emissions Energy System;	2. Enhanced zero emission Power Technologies;	3. Enabling Climate Neutrality with Storage Technologies, Renewable Fuels and CCU/CCS;	4. Efficient zero emission Heating and Cooling Solutions;	5. Integrated Regional Energy Systems;	6. Integrated Industrial Energy Systems;	7. Integration in the built Environment;	8. Cross-cutting Dimensions.
1. Central Receiver and Line-Focusing power plants with lower LCOE		X						
2. Reliable and cost-effective medium and high-temperature thermal storage systems.			X			X		
3. Turbo-machinery developed for specific conditions of solar thermal power plants.		X						
4. Reliable and cost-effective solar fuels production.			X		x	X		

Figure 4: Map of CETPartnership Challenges and CSP Challenges

The same exercise is completed in the CETPartnership SRIA v1.0 for 9 other technologies: 1. PV; 2. Offshore Wind; 3. Onshore Wind; 4. Deep Geothermal Energy; 5. Bioenergy; 6. Carbon Capture, Utilization, and Storage (CCUS); 7. Ocean Energy; 8. Hydropower; and 9. Solar thermal heating and cooling. In terms of CSP's positioning against these other technologies, only CSP and Solar Thermal Heating & Cooling are of key relevance (i.e., "X") to the CETPartnership Challenge 6. *Integrated Industrial Energy Systems*, while 6 technologies are of higher or normal relevance, "x", to this Challenge 6. Additionally, only CSP, bioenergy, and CCUS are of key relevance to the CETPartnership Challenge 3. *Enabling Climate Neutrality with Storage Technologies, Renewable Fuels and CCU/CCS* and no technologies are of higher or normal relevance. In contrast, 6 technologies, including CSP, are of key relevance to CETPartnership Challenge 2. *Enhanced zero emission Power Technologies*. Finally, 3 non-CSP technologies are of key relevance to CETPartnership Challenge 5. *Integrated Regional Energy Systems*, while CSP is only of



higher or normal relevance. Thus, CSP can potentially provide unique added value to addressing CETPartnership Challenges 3 and 6, which is consistent with / reflects the CST community's self-assessed competitive advantage being commercially proven and economically competitive TES technologies, and potentially large but almost completely undeveloped market opportunities for SHIP in the near term, and for solar fuels in the medium to longer term.

Focusing on the structure of the CETPartnership calls, the CETPartnership intends to implement annual joint calls from 2022 to 2027. The 2022 and 2023 calls will have a €210M budget funded by 50 national and regional RTDI programme owners and managers from 30 countries including one non-European country (Canada)¹⁷. The 2022 CETPartnership Call¹⁸ will have a total budget of €125M. For the 2022 call, the 8 CETPartnership Challenges identified above were transformed into the following 7 Transition Initiative (TRIs) covering enabling technologies, system integration, and cross-cutting dimensions:

- TRI1 Integrated Net-zero-emissions Energy System
- TRI2 Enhanced zero emission Power Technologies
- TRI3 Enabling Climate Neutrality with Storage Technologies, Renewable Fuels and CCU/CCS
- TRI4 Efficient zero emission Heating and Cooling Solutions
- TRI5 Integrated Regional Energy Systems
- TRI6 Integrated Industrial Energy Systems
- TRI7 Integration in the Built Environment

Among these 7 TRIs only the CETPartnership Challenge 8 *Cross-cutting Dimensions* is not explicitly addressed. Each TRI will have 1-2 modules in the call yielding 11 modules total for the call. Crossing these TRIs with the mapping of the Four CSP Challenges onto the Eight CETPartnership Challenges above, the modules that seem most relevant to CSP are 2, 3 and 6, and to a lesser extent 5:

- | | |
|------------------------|---|
| Call Module 2.1 (TRI2) | Advancing RE technologies for power production through cost reduction |
| Call Module 2.2 (TRI2) | Breakthrough R&D to increase RE power technologies efficiency |
| Call Module 3.2 (TRI3) | Enabling Climate Neutrality with hydrogen and renewable fuels |
| Call Module 5 (TRI5) | Integrated Regional Energy Systems for a Resilient, Secure, and Renewable Energy Supply |

¹⁷ <https://cetpartnership.eu/cetpartnership-joint-call-2022-infoday-online>

¹⁸ http://www.ricercainternazionale.miur.it/media/36873/cetp_ic2022_callpromotion.pdf



Call Module 6 (TRI6) Industrial energy systems

Note Modules 2.1 and 2.2 specifically focuses on wind, ocean, marine and solar energy technologies, where “solar energy” implicitly suggests both CSP and PV technologies. Based on the discussions above, CSP may have competitive advantage over other technologies for Modules 3.2 and 6. However, based on current information in these modules, no budget is specifically reserved for R&I for any specific technology, including CSP. Thus, while this 2022 CETPartnership Call will be open to the CST Sector, it will not specifically target the CST Sector.

The 2022 CETPartnership call will be two-stage, the first stage opened on 14 September 2022, and will close on 23 November 2022. Each consortium must have at least 3 partners representing 3 different participating countries, and at least two of these countries must be Member States or Associated Countries. The complete list of funding agencies contributing to the call and their associated budget is available at the link given in footnote¹⁹. The following is a list of funding agencies from countries that are assessed as being most important to a European Joint Funding Programme for the CST Sector based on being a member in EERA-JP-CSP, INSHIP, and/or being Mediterranean (Table 3).

Table 3: The list of CETPartnership Funding Agencies most important to a European Joint Funding Programme for the CST Sector

Country	Funding Agency	Abbrev.	Amount €
Austria	Austrian Research Promotion Agency	FFG	3 900 000
Cyprus	Research and Innovation Foundation	RIF	3 000 000
France	Agence Nationale de la Recherche	ANR	3 000 000
France	Agence de la transition écologique	ADEME	1 500 000
Germany	Forschungszentrum Jülich GmbH (BMWK)	FZJ/PtJ	17 000 000
Germany	Forschungszentrum Jülich GmbH (MWIDE)	FZJ/PtJ	1 428 571
Greece	General Secretariat for Research and Technology	GSRT	500 000
Israel	Ministry of National Infrastructure, Energy and Water Resources	IMNIEWR	600 000
Italy	Ministry of Economic Development	MISE	16 000 000
Italy	Ministry of university and Research	MUR	2 400 000
Malta	Malta Council for Science and Technology	MCST	500 000

¹⁹ http://www.ricercainternazionale.miur.it/media/36873/cetp_ic2022_callpromotion.pdf



Portugal	Fundação para a Ciência e a Tecnologia	FCT	500 000
Spain	Agencia Estatal de Investigación	AEI	2 000 000
Spain	The Centre for the Development of Industrial Technology	CDTI	1 500 000
Spain	Departamento de Desarrollo Económico, Sostenibilidad y Medio Ambiente. Eusko Jauriaritza-Gobierno Vasco	EUSKADI	1 000 000
Spain	Ente Vasco de la Energía	EVE	1 000 000
Spain	Fundación para el fomento en Asturias de la Investigación Científica Aplicada y la Tecnología	FICYT	300 000
Spain	Regional Development Agency of Cantabria	SODERCAN	150 000
Switzerland	Federal Department of the Environment, Transport, Energy and Communications	DETECSFOE	10 000 000
Switzerland	Swiss National Science Foundation	SNSF	550 000
Turkey	The Scientific and Technological Research Council of Turkey	TUBITAK	2 000 000

At this still very early stage in the life of CETPartnership, the following ideas are considered particularly relevant for a European Joint Funding Programme for the CST Sector. As a large success, the CETPartnership has aligned a significant amount of R&I funds from a large number of national and regional funding agencies to seek solutions to common CET challenges. Additionally, the explicit coupling of the CETPartnership to other partnerships, initiatives, and Programmes has the potential to harmonize and leverage funds from a large number of sources to make more efficient use of limited R&I funds. As an opportunity, CST technologies can potentially effectively compete against most other technologies identified in the CETPartnership SRIA v1.0 in the areas of storage, renewable fuels, and industrial process heat. Finally, the main countries contributing to the 2022 CETPartnership Call include the four countries that are committed to being Founding Members of EU-SOLARIS ERIC (Cyprus, France, Germany, and Spain) and the four countries with scientific partners in HORIZON-STE (Germany, Italy, Spain, and Turkey), which demonstrates that these countries have demonstrated capacities and interest for Joint CST Programmes. As challenges, based on available information the calls are not expected to be technology specific and therefore the budgets will not narrowly target solutions from the European CST sector; i.e., the calls are not expected to target challenges and opportunities unique to the European CST sector. Additionally, there is a large disparity in the funds available from different countries. For example, Germany's budget is 37x that of Malta and 4x that of France, and these differences can only partially be attributed to differences in GDP and similar macro-economic indicators; e.g., Germany's GDP is ~271x that of Malta and ~1.5x that of France. When taken within the



context of ERANET budgets, a logical conclusion is that some countries (e.g., Germany) will likely be more willing to make large invests in a European Joint Funding Programme for the CST Sector than other countries for reasons that may include differences in GDP, and expected returns on investments in joint programmes. Finally, although the details for the 2022 CETPartnership Call were not available when this D3.3 content was finalized, it is expected that there will be differences in funding conditions between funding agencies, and that these differences will also create challenges to building consortia and executing projects as they did for the ERANET Calls.

3.6 CSP IP for SET Plan

The CSP-STE implementation Working Group (IWG) was established in 2016 as a temporary implementation group to bring together stakeholders, the European Commission (EC), and SET Plan countries to discuss an initiative to strengthen the globally leading position of the European CSP industry²⁰. This IWG produced the Implementation Plan (IP) for CSP²¹ for the SET-Plan with a specific focus on Solar Thermal Electricity. In 2021 the CSP IP's proposed strategic targets and areas of activities were updated to reflect the advances and changes in the CST field. In addition to updates to the STE targets and activities, targets and activities were added for Solar Heat for Industrial Processes (SHIP) and Solar Fuels reflecting the increasing importance of these fields at European and global levels. Specifically, the targeted cost figures currently considered, hence non-binding, for the update of the CSP IP are as follows:

1. Cost reduction of electricity provided during periods with low wind, PV or hydropower infeed, to prices below €0.08 /kWh in Southern Europe locations by 2025, targeting €0.065kWh by 2030, considering 2050 kWh/m²/year as reference conditions and no constraints regarding the size/type of the plant and Power Purchase Agreements (PPA) with a duration of at least 20 years.
2. Development of new generation of CSP/STE technology to achieve at least 3 points of increase in the overall power plant efficiency (reference value 39.4 percent²²) by 2025.
3. At least one First of a Kind (FOAK) CSP/STE plant integrated in the energy system by 2025, demonstrating either the cost reduction or the efficiency increase.
4. Thermal energy cost for industrial process heat applications below €0.03/kWh (T < 400 °C, small scale applications) and below €0.02/kWh (T > 600 °C, large scale applications), by 2025.
5. Demonstration of 24/7 economically viable solar thermal baseload production of hydrogen and other solar fuels by 2030.

Note Targets 1, 4 and 5 are parallel (but not identical) to the CETPartnership Targets 1, 4 and 5, respectively. The Proposed Areas for IP Activity are:

1. Line-focus solar power plant technology.

²⁰ https://setis.ec.europa.eu/implementing-actions/csp-ste-implementation-working-group_en

²¹ https://setis.ec.europa.eu/system/files/2021-04/set_plan_-_csp_initiative_implementation_plan.pdf

²² Official efficiency of 50 MW parabolic trough plant in Spain with Siemens turbine SST-700-RH



2. Central Receiver power plant technology.
3. Reliable and cost-effective medium and high-temperature thermal storage systems.
4. Turbo-machinery developed for specific conditions of solar thermal power plants.
5. Medium- and high-temperature systems for industrial solar heat applications.
6. High temperature solar fuels.
7. Cross-cutting issues.

With the exception of activity 5, these 6 activities are consistent with the 4 areas identified in the CETPartnership SRIA v1.0 where R&I is needed. Thus, broadly the 2021 updates to the CSP IP for the SET Plan are consistent with the Specific Targeted Impacts and SRIA for the CETPartnership, which suggests that the European CST community has largely agreed on these targets and needed activities, and together these can provide starting inputs for the objectives of a European Joint Funding Programme for the CST Sector.

4 CONCLUSIONS AND RECOMMENDATIONS

A European Joint Programme for the CST Sector can offer transnational benefits by strengthening and leveraging CST's unique ability to deliver cost-effective dispatchable clean energy through its integration with Thermal Energy Storage (TES) technologies, provide Solar Heat for Industrial Processes (SHIP), and produce renewable fuels (e.g., H₂). These transnational benefits include the ability of CST to facilitate the clean energy transition through its integration with TES to complement variable renewable energy technologies (e.g., PV and wind), and through its application to the hard-to-decarbonize industrial and transportation sectors. Additionally, CST can strengthen Europe's energy security by reducing dependence on imported natural gas and oil for the industrial and transportation sectors.

Realistically, any European Joint Funding Programme for the CST Sector will likely have to be built on existing structures, as developing unique structures for an effective European Joint Funding Programme for the CST Sector is not thought to be reasonable or viable. The European Clean Energy RTDI landscape is increasingly emphasizing activities that lead to systemic and horizontal solutions over technology specific solutions resulting from "silo" research activities. This emphasis is reflected in the broad positioning of Horizon Europe and appears to be reflected in the 2022 CETPartnership Call, and this emphasis will be a further barrier to realizing any new European Joint Funding Programme that is specifically tuned to the CST Sector. Another problem concerning the CETPartnership are the very different rules imposed by the funding agencies contributing, thus complicating the internal management and synchronization of activities in the R&D projects funded. This problem already became evident with ERANET projects since the very beginning.

Based on the outcomes from Section 3 *Context for a European Joint Programme for the CSP Sector*, currently there is no existing instrument or structure that can support a



European Joint Funding Programme that fully fulfils the needs of the European CST sector. To realize such a programme, three actions are recommended.

First, it is recommended to further harmonize the EERA-JP-CSP, EU-SOLARIS ERIC, CETPartnership, and EU Framework Programs (FPs) within the following context. While EERA-JP-CSP is not a funding instrument, it is the most complete network of key CST research actors in ERA, and therefore is in a unique position to represent the interests of the European CST research sector and to harmonize European CST R&I activities. The strengths of EU-SOLARIS ERIC are that the member states have demonstrated a commitment to aligning national CST research infrastructures and R&I investments to pursue solutions to common challenges, and EU-SOLARIS ERIC contains most of Europe's most significant CST Research Infrastructure facilities. However, currently only Cyprus, France, Germany, and Spain have committed to be members of EU-SOLARIS ERIC with Portugal and Italy as observers, and key states such as Greece, Israel, Switzerland, and Turkey that historically have contributed to European co-fund schemes (e.g., CSP ERANET) are currently not affiliated with EU-SOLARIS ERIC. Thus, the footprint of EU-SOLARIS ERIC does not currently fully include all key countries and scientific funding agencies in ERA. The CETPartnership is an established Joint Funding Programme that includes the key countries and scientific funding institutions for CST within Europe and the resulting calls are expected to target solutions that CST can produce. However, and in contrast to the ERANET calls such as CSP ERANET, the CETPartnership calls are not expected to specifically target or reserve budget for CST technologies, and therefore the CETPartnership is currently not a European Joint Funding Programme with calls that can specifically target the CST Sector. Finally, to make effective use of a diverse set of European R&I funds, any European Joint Programme for the CST Sector would need to complement the European FPs, and ideally the European FP would provide structure and support for a European Joint CST Programme as it did through the FP7 STAGE-STE project and the H2020 INSHIP and HORIZON-STE projects.

Second, outreach should be performed to the other European renewable energy sectors that would benefit from technology specific joint funding programmes. A natural platform for this outreach is the Horizon Europe *CST4ALL* project that starts on 01 Oct. 2022. *CST4ALL* aims to build-on HORIZON-STE successes with a specific emphasis on identifying and collaborating with other renewable energy sectors on common challenges. Thus, *CST4ALL* provides a natural platform to seek common ground with other renewable energy sectors on the need for technology specific European Joint Funding Programmes, and to coordinate efforts to raise awareness of and support for technology specific European Joint Funding Programmes among key decision makers.

Third, key decision makers need to be convinced of the value of adapting the existing CETPartnership structures to create technology specific European Joint Funding Programmes, including for the CST Sector. Here the increased harmonization among all European key stakeholders that would benefit from technology specific joint funding programmes will increase their ability to effectively communicate to key decision makers



HORIZON
STE

Implementation of the
Initiative for Global Leadership in
Solar Thermal Electricity

the unique value that technology specific joint funding programmes would bring to Europe's clean energy transition.