



European Commission
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STAGE
STE 
EERA

STAGE-STE contribution to CSP Implementation Plan

*Latest joint efforts between Research and
Industry for strengthening European CSP
leadership*

*European Economic and Social Committee
Brussels, January 23rd, 2018*

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*Comité économique et social européen
European Economic and Social Committee*

STAGE-STE – WP2: Aims

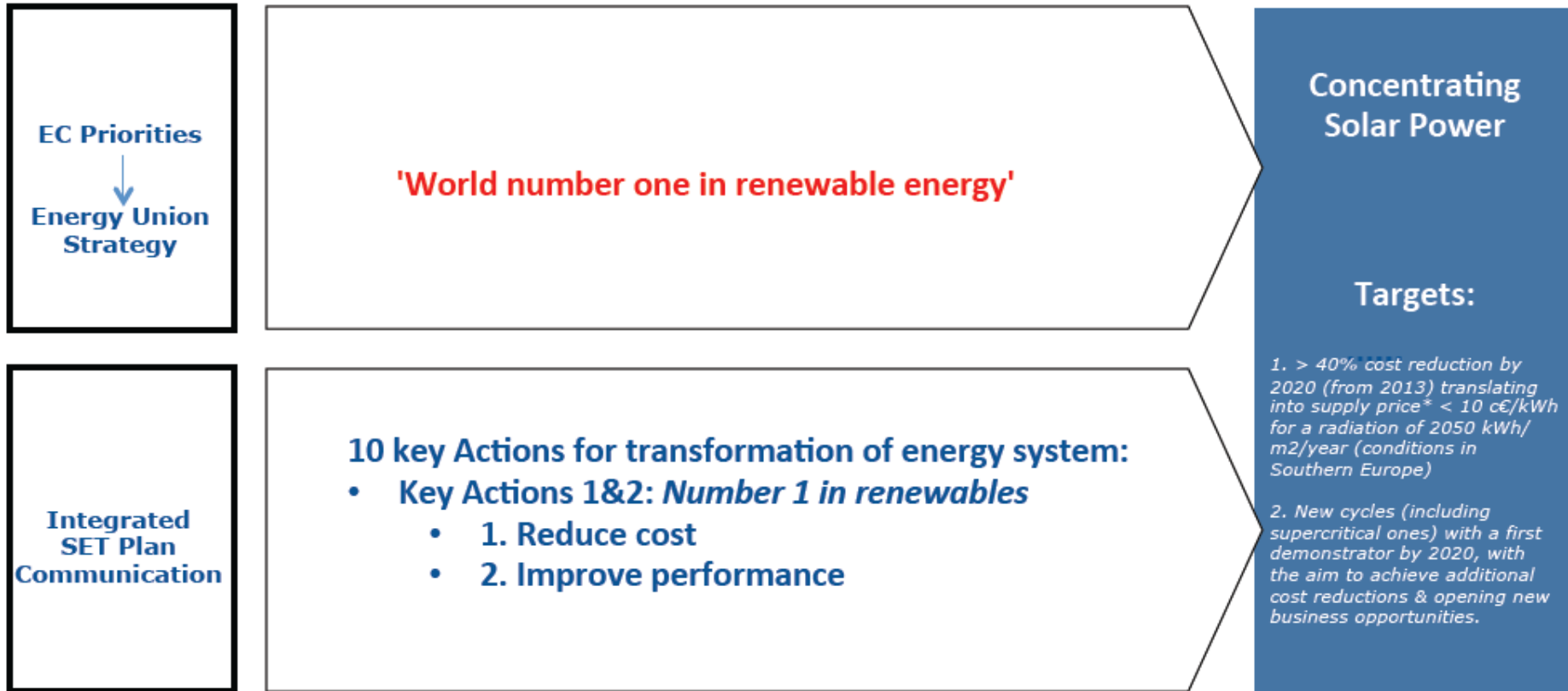


- STAGE-WP2 (**Integrating Activities to lay the foundations for long-lasting research cooperation**), was launched in February 2014.
- Led by the Cyprus Institute, the WP2 team worked to enhance relations between the Concentrating Solar Thermal (CST) research community and national research funding agencies, raising awareness on the importance of CST for the future energy mix in Europe and its neighbouring regions.
- A key objective of the WP2 was to encourage academics, industry and funding agencies in Member States to prepare a harmonised strategy for the implementation of the SET-Plan for Concentrated Solar Technologies,
- The expected result of WP2 actions was the development of coordinated funding programmes for CST research, enabling the EU to maintain its position as a global leader in the field.

STAGE-STE – WP2 - actions

- In 2014, in each of the participating countries (Spain, Italy, Germany, France, Portugal, Switzerland, UK and Cyprus), **National Working Groups** were set up, composed of representatives from academia, industry and funding agencies.
- Each National Working Group produced a **National Concept Note** on implementing the CSP provisions of the SET plan in their country.
- On 20th **April 2016**, the working groups came together in an European workshop in Madrid, to develop a **common European Strategy for CSP**, under the auspices of the Spanish Government (MINECO).
- This was also the first meeting of the Temporary Working Group (TWG) for SET Plan CSP implementation, led by the Spanish Government (MINECO).

STAGE-STE & CSP TWG IP



When SET-Plan TWGs were launched, CSP sector was in an optimum position as activities previously defined at STAGE-STE (WP2) perfectly matched (NWG already created and active / Madrid workshop 20.04.2016)

CSP TWG IP (May 2016 - June 2017)



STAGE-STE organizations have actively contributed to provide the TWG the needed inputs on R&D activities, linked to the achievement of SET-PLAN defined targets to STE/CSP technology

RESEARCH CENTERS (17)

- CIEMAT (Spain)
- UNIV. OF EVORA (Portugal)
- DLR (Germany)
- ENEA (Italy)
- FRAUNHOFER (Germany)
- CNRS (France)
- IMDEA (Spain)
- CEA (France)
- METU (Turkey)
- Cyl (Cyprus)
- TECNALIA (Spain)
- CENER (Spain)
- IK4-TEKNIKER (Spain)
- FBK (Italy)
- UNIV. DI FIRENZE (Italy)
- LNEG (Portugal)

INDUSTRIES (20)

- ESTELA (Belgique)
- EU-TURBINES (Belgique)
- SENER (Spain)
- ABENGOA (Spain)
- ARCHIMEDE SOLAR ENERGY (Italy)
- ACS-COBRA (Spain)
- SUNCNIM (France)
- ENI (Italy)
- RIOGLASS (Belgique)
- ALMECO (Italy)
- EMPRESARIOS AGRUPADOS (Spain)
- KRAFTANLAGEN (Germany)
- SCHLAICH BERGERMANN PARTNER - SBP SONNE (Germany)
- TSK DEVELOPER (Germany)
- TSK-FLAGSOL (Germany)
- MAGALDI (Italy)
- ACCIONA (Spain)
- INNOGY (Germany)
- SQM (Chile)
- ACWAPOWER (Saudi Arabia)

CSP TWG IP (May 2016 - June 2017)



List of proposed R&I activities, ranked according its defined relevance:

| List of R&D proposal ranked according its defined relevance | Estimated budget (M€) |
|--|-----------------------|
| 1) Activity 5: Improved Central Receiver Molten Salt technology | 20 – 22 |
| 2) Activity 3: Parabolic Trough with Silicon Oil (<i>LC-CS3-RES-13-2018</i>) | 15 - 20 |
| 3) Activity 6: Next Generation of Central Receiver power plants | 20 - 25 |
| 4) Activity 1: Advanced Linear Fresnel technology | 8 - 10 |
| 5) Activity 2: Parabolic Trough with Molten Salt (<i>LC-CS3-RES-13-2018</i>) | 10 - 14 |
| 6) Activity 4: Open Volumetric Air Receiver | 8 - 10 |
| 7) Activity 8: Multi-Tower Beam Down System | 8 – 10 |
| 8) Activity 9: Advanced TES (<i>LC-CS3-RES-17-2019</i>) | 12 – 15 |
| 9) Activity 10: Supercritical Steam Cycle 600° | 8 - 10 |
| 10) Activity 11: Flex Steam Turbine | 8 - 10 |
| 11) Activity 12: High Temp Brayton Sc. CO ₂ | 25 - 30 |
| 12) Activity 7: Pressurized Air Receiver with Storage | 12 - 15 |
| TOTALS | 154 - 191 |

CSP TWG IP (September 2017 - ...)

Tentative mapping of Activities sharing (national level):

| R&D Activities with more than one country interested | Number of countries interested | Total budget (M€) | Contrib. requested (M€) |
|--|--------------------------------|-------------------|-------------------------|
| Act. 1: Advanced Linear Fresnel technology | 3 | 30 | 15 |
| Act. 2: P. Trough with Molten Salt <i>(LC-CS3-RES-13-2018)</i> | 3 | 11,5 | 5,75 |
| Act. 3: Parab. Trough with Silicon Oil <i>(LC-CS3-RES-13-18)</i> | 3 | 8 | 4 |
| Act. 4: Open Volumetric Air Receiver | 4 | 5,5 | 2,75 |
| Act. 5: Improved Central Receiver Molten Salt technology | 5 | 22 | 11 |
| Act. 6: Next Generation of Central Receiver power plants | 5 | 25 | 12,5 |
| Act. 7: Pressurized Air Receiver with Storage | | | |
| Act. 8: Multi-Tower Beam Down System | 3 | 8 | 4 |
| Act. 9: Advanced TES <i>(LC-CS3-RES-17-2019)</i> | 5 | 10 | 5 |
| Act. 10: Supercritical Steam Turbine | | | |
| Act. 11: Improved flexibility in CSP applications | | | |
| Act. 12: High Temp Brayton Sc. CO₂ | | | |
| TOTALS | | 120 | 60 |

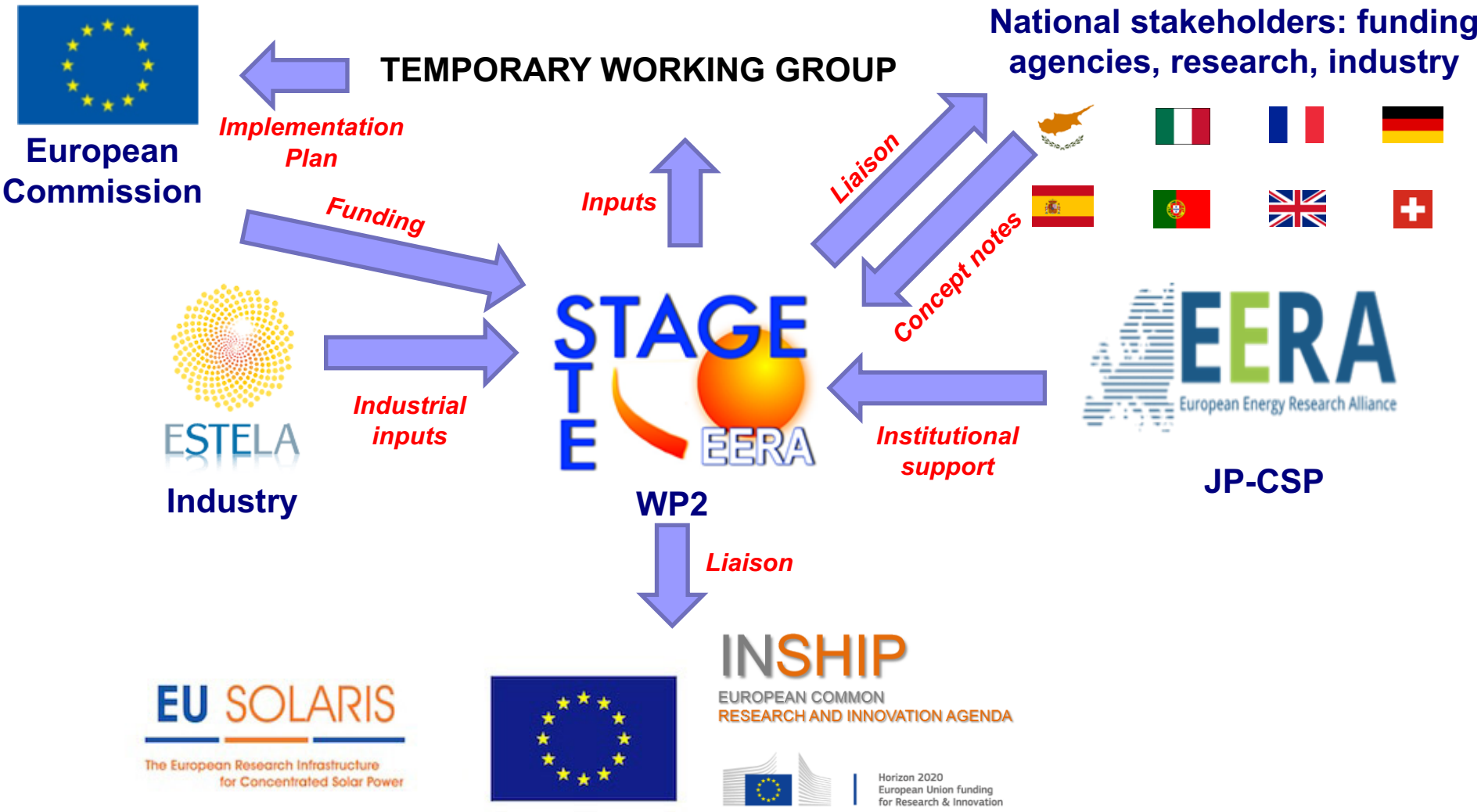
CSP TWG IP (September 2017 - ...)

| | Spain | Portugal | France | Italy | Germany | Cyprus | Turkey | Belgium | TOTAL (M€) |
|---|-------|----------|--------|-------|---------|--------|--------|---------|------------|
| Act. 1: Advanced Linear Fresnel tech. | | 5,50 | 5,50 | 4,00 | | | | | 15,00 |
| Act. 2: P. Trough with Molten Salt | | 1,90 | | 1,90 | 1,90 | | | | 5,70 |
| Act. 3: P. Trough with Silicon Oil | 0,80 | | | 1,20 | 2,00 | | | | 4,00 |
| Act. 4: Open Volumetric Air Receiver | | | | 0,40 | 1,15 | | 0,40 | 0,80 | 2,75 |
| Act. 5: Improved Central Receiver Molten Salt tech. | 3,00 | | | | 3,00 | 1,00 | 2,00 | 2,00 | 11,00 |
| Act. 6: Next Generation of Central Receiver plants | 3,75 | | 2,50 | | | 1,25 | 2,50 | 2,50 | 12,50 |
| Act. 7: Pressurized Air Receiver | | | | | | | | | |
| Act. 8: Multi-Tower Beam Down | | 1,20 | | 2,40 | | 0,40 | | | 4,00 |
| Act. 9: Advanced TES | 1,00 | 0,50 | 1,50 | 1,00 | | | 1,00 | | 5,00 |
| Act. 10: Supercritical Steam Turbine | | | | | | | | | |
| Act. 11: Improved flexibility in CSP | | | | | | | | | |
| Act. 12: High Temp Brayton Sc. CO ₂ | | | | | | | | | |
| | 8,55 | 9,10 | 9,50 | 10,90 | 8,05 | 2,65 | 5,90 | 5,30 | 59,95 |

Next steps proposed:

- Final selection of projects to be executed (by NFOs)
- Financial commitment (by NFOs)
- Definition of procedure/tool to the implementation/execution of defined activities (public competitive calls required).

STAGE-STE WP2 – Summary



STAGE-STE WP2 Impact



- **Greater cohesion in the CSP/STE sector**, effective communication and stronger links between R&D centers and industry, between national stakeholders and the EU level (TWG), and among relevant projects (STAGE, EU-SOLARIS, INSHIP etc.)
- Increased the number of **relevant R&D organizations in Europe** that actively contribute to the advancement of CSP/STE technology, and the number of countries actively involved in the field.
- Identification of core capabilities and competences of involved R&D partners advancing a natural **process of clustering and specialization**.
- Creation of an **efficient collaborative group** at the European level in CSP/STE research, with a broad vision and visibility, actively supporting the coordination & integration of National and European research efforts/objectives.
- Creation of a wide network with **strong links with industries and international actors** to promote synergetic international cooperation and create market opportunities for EU industry.
- Achievement and successful launching of **ECRIA initiatives**.

To conclude...

STAGE-STE, and in particular WP2, was the nexus through which information and proposals were exchanged between the Research Community (STAGE and EERA JP-CSP members), National Authorities, Funding Agencies, EERA, the Industry, the Commission, Research Institutes and other European Projects, as well as the Temporary Working Group, leading to the successful drafting of the SET Plan CSP Implementation Plan.

