

# CSP Implementation Plan

*EERA JP-CSP  
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# CSP/STE IMPLEMENTATION PLAN (June 2016 – September 2017)

## Launching event: STAGE-STE Madrid Workshop (20th April 2016)

## TWGs definition and TWG on CSP/STE composition:

- Governments/Funding Agencies from: Spain, Portugal, France, Germany, Italy, Cyprus and Turkey (+Belgium). Leadership: Spain (MINECO)
- European Solar Thermal Electricity Association (ESTELA) representing more than 100 entities
- JP-CSP, representing 29 organizations
- European Association of Gas and Steam Turbines Manufacturers (EUTurbines), representing 6 entities

## CSP/STE Implementation Plan finally based on 3 pillars:

- First-of-a-kind (FOAK) commercial projects (1 to 3 plants)
- R&I Activities (12 defined), to provide FOAK projects eventual innovations
- ~~Political Declaration (on CSP technologies support)~~
- EU-SOLARIS (added in the very last moment)

## CSP/STE Implementation Plan formal approval:

- Endorsed by the SET Plan Steering Group on 27.09.2017 and published in SETIS

# CSP/STE IMPLEMENTATION PLAN (June 2016 – September 2017)

## List of R&D proposed activities ranked according defined relevance:

List of R&D proposal ranked according its defined relevance	Estimated budget (M€)
1) Proposal 5: Improved Central Receiver Molten Salt technology	20 – 22
2) Proposal 3: Parabolic Trough with Silicon Oil ( <i>LC-CS3-RES-13-2018</i> )	6 - 8
3) Proposal 6: Next Generation of Central Receiver power plants	20 - 25
4) Proposal 1: Advanced Linear Fresnel technology	25 - 30
5) Proposal 2: Parabolic Trough with Molten Salt ( <i>LC-CS3-RES-13-2018</i> )	10 - 14
6) Proposal 4: Open Volumetric Air Receiver	5 - 6
7) Proposal 8: Multi-Tower Beam Down System	7 – 8
8) Proposal 9: Advanced TES ( <i>LC-CS3-RES-17-2019</i> )	8 – 10
9) Proposal 10: Supercritical Steam turbine	20 - 25
10) Proposal 11: Improved flexibility in CSP applications	4 - 5
11) Proposal 12: High Temp Brayton Sc. CO <sub>2</sub>	25 - 30
12) Proposal 7: Pressurized Air Receiver with Storage	4 – 6
<b>TOTALS</b>	<b>154 - 189</b>

# CSP/STE IMPLEMENTATION PLAN (September 2017 - .....

## Tentative mapping of Activities sharing (national level):

- From the very beginning it was clear that **the required amount of money to execute all 12 proposals/activities was impossible to be achieved.**
- In order to help the continuation of the process an additional step was envisaged and decided to be addressed from the R&D community (July 2017 – Madrid).
- **Definition of the interest of different involved countries** → from National Financing Organizations to identify the activities of top interest (up to 4), if possible, with additional prioritization (still without formal financial commitment).
- In some countries, the definition of such interest required the previous check with relevant related industries their eventual collaboration in projects development.
- Feedback received from: Spain, Portugal, Germany, France, Italy, Cyprus, Turkey and Belgium (Wallonie), which joined the process in Sept. 2017.
- **Each country would finance only national organizations providing 50% of total cost as a general accepted rule. Remaining 50% should come from industrial contribution and in-kind in the case of R&D organizations.**
- From this info → proposal of Activities Mapping → Final selection of projects to be executed and financial commitment (by NFO) → Definition of procedure to the implementation/execution (public competitive calls required).

# CSP/STE IMPLEMENTATION PLAN (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
<del>Act. 7: Pressurized Air Receiver with Storage</del>			
Act. 8: Multi-Tower Beam Down System	3	8	4
Act. 9: Advanced TES <i>(LC-CS3-RES-17-2019)</i>	5	10	5
<del>Act. 10: Supercritical Steam Turbine</del>			
<del>Act. 11: Improved flexibility in CSP applications</del>			
<del>Act. 12: High Temp Brayton Sc. CO<sub>2</sub></del>			
<b>TOTALS</b>		<b>120</b>	<b>60</b>

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 1: ADVANCED LINEAR FRESNEL TECHNOLOGY

Total estimated budget: <b>30 M€</b>		Tentative proposal of needed contribution from NFO s: <b>15 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Portugal	Very High	≈ 37%	≈ 5,5 M€	Regional Funds (CCDRA). Contributions from national CSP companies In-kind contribution from research organizations
France	Very High	≈ 37%	≈ 5,5 M€	European Regional Development Funds (already used) Investment for the Future (already used) National Agency for Research (ANR) National Agency for the Environment and Energy Management (ADEME)
Italy	High	≈ 27%	≈ 4,0 M€	Regional funds; National funds. Contributions from national companies In-kind contribution from research organizations. EU-funded projects. Industrial funding as follow up of Industrial project, SOLARGRID-ENEA (National founded research) proposal submitted in November 2017, Local (Regional) fund

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 2: PARABOLIC TROUGH WITH MOLTEN SALT

Total estimated budget: <b>11,5 M€</b>		Tentative proposal of needed contribution from NFOs: <b>5,75 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Portugal	Very High	≈ 33%	≈ 1,9 M€	Regional Funds (CCDRA). Contributions from national CSP companies In-kind contribution from research organizations
Germany	Very High	≈ 33%	≈ 1,9 M€	Energy Research Framework Programme: Topic High Temperature Solar Thermal Technologies (annual budget of about 10 Mio€/a: applicable to German industry or research partners) at a level of 35-50% cost sharing. Helmholtz Program on Renewables; Topic Concentrating Solar Power: Research on advance heat transfer fluids 1.5 Mio€/a funding is linked to research in DLR. Up to 3 M€ national total funding additionally available (to whole German participation)
Italy	Very High	≈ 33%	≈ 1,9 M€	Regional funds; National funds. Contributions from national companies In-kind contribution from research organizations. EU-funded projects. Industrial funding

***Suitable to be financed by LC-CS3-RES-13-2018 (in competition with the Activity #3)***

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 3: PARABOLIC TROUGH WITH SILICON OIL

Total estimated budget: <b>8 M€</b>		Tentative proposal of needed contribution from NFOs: <b>4 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Spain	Medium	≈ 20%	≈ 0,8 M€	Support from CDTI to technological development and industrial innovation Support/grants from MEIC to research activities Contributions from national CSP companies In-kind contribution from research organizations
Germany	Very High	≈ 50%	≈ 2,0 M€	Energy Research Framework Programme: Topic High Temperature Solar Thermal Technologies (annual budget of about 10 Mio€/a: applicable to German industry or research partners) at a level of 35-50% cost sharing Helmholtz Program on Renewables; Topic Concentrating Solar Power: Research on advance heat transfer fluids 1.5 Mio€/a funding is linked to research in DLR. Up to 3 M€ national total funding additionally available (to whole German participation)
Italy	High	≈ 30%	≈1,2 M€	FBK funding to develop project Bricker, ASE Are considering that technology important for future application is going to invest on it

***Suitable to be financed by LC-CS3-RES-13-2018 (in competition with the Activity #2)***



# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 4: OPEN VOLUMETRIC AIR RECEIVER

Total estimated budget: <b>5,5 M€</b>		Tentative proposal of needed contribution from NFOs: <b>2,75 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Turkey	Medium	≈ 15%	≈ 0,4 M€	TÜBİTAK International Industrial R&D Projects Grant Programme. Scientific and Technological Research Projects Funding Program. Research & Technology Development and Innovation Program
Belgium	High	≈ 30%	≈ 0,8 M€	3,4 M€ potentially available to participate in just one project (either no 4, 5 or 6)
Italy	Medium	≈ 15%	≈ 0,4 M€	Funding: FBK on this activity related to novel technologies.
Germany	Very High	≈ 40%	≈ 1,15 M€	Energy Research Framework Programme: Topic High Temperature Solar Thermal Technologies (annual budget of about 10 Mio€/a: applicable to German industry or research partners) at a level of 35-50% cost sharing. Helmholtz Program on Renewables; Topic Concentrating Solar Power: Research on advance heat transfer fluids 1.5 Mio€/a funding is linked to research in DLR. Up to 3 M€ national total funding additionally available (to whole German participation)

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 5: IMPROVED CENTRAL RECEIVER MOLTEN SALT TECHNOLOGY

Total estimated budget: <b>22 M€</b>		Tentative proposal of needed contribution from NFO: <b>11 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Spain	Very high	≈ 27%	≈ 3 M€	Support from CDTI to technological development and industrial innovation. Support/grants from MEIC to research activities. Contributions from national CSP companies. In-kind contribution from research organizations
Germany	Very High	≈ 27%	≈ 3 M€	Energy Research Framework Programme: Topic High Temperature Solar Thermal Technologies (annual budget of about 10 Mio€/a: applicable to German industry or research partners) at a level of 35-50% cost sharing. Helmholtz Program on Renewables; Topic Concentrating Solar Power: Research on advance heat transfer fluids 1.5 Mio€/a funding is linked to research in DLR. Up to 3 M€ national total funding additionally available (to whole German participation)
Cyprus	High	≈ 9%	≈ 1 M€	Possible grants from Research Promotion Foundation under the RESTART calls and other structural funds.
Turkey	High	≈ 18%	≈ 2 M€	3.5 M€ Euro potentially available. TÜBİTAK International Industrial R&D Projects Grant Programme. Scientific and Technological Research Projects Funding Program. Research & Technology Development and Innovation Program
Belgium	High	≈ 18%	≈ 2 M€	3,4 M€ potentially available to participate in just one project (either no 4, 5 or 6). Support from Wallonia, General Directorate for Economy, Employment and Research. Support from cluster MECATECH. Contributions from national CSP companies. In-kind contribution from research organizations

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 6: NEXT GENERATION OF CENTRAL RECEIVER POWER PLANTS

Total estimated budget: <b>25 M€</b>		Tentative proposal of needed contribution from NFOs: <b>12,5 M€</b>		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Spain	Very High	≈ 30%	≈ 3,75 M€	Support from CDTI to technological development and industrial innovation. Support/grants from MEIC to research activities. Contributions from national CSP companies. In-kind contribution from research organizations
France	High	≈ 20%	≈ 2,5 M€	European Regional Development Funds. Investment for the Future. National Agency for Research (ANR). National Agency for the Environment and Energy Management (ADEME)
Cyprus	High	≈ 10%	≈ 1,25 M€	Support from CDTI to technological development and industrial innovation. Support/grants from MEIC to research activities. Contributions from national CSP companies. In-kind contribution from research organizations
Turkey	High	≈ 20%	≈ 2,5 M€	2.5 M€ Euro potentially available. TÜBİTAK International Industrial R&D Projects Grant Programme. Scientific and Technological Research Projects Funding Program. R&D Funding Research & Technology Development and Innovation Program
Belgium	High	≈ 20%	≈ 2,5 M€	3,4 M€ potentially available to participate in just one project (either no 4, 5 or 6) Support from Wallonia, General Directorate for Economy, Employment and Research. Support from cluster MECATECH. Contributions from national CSP companies. In-kind contribution from research organizations

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 8: MULTI-TOWER BEAM DOWN SYSTEM

Total estimated budget: 8 M€		Tentative proposal of needed contribution from NFOs: 4 M€		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Portugal	Medium	≈ 30%	≈ 1,2 M€	In-kind contribution from research organizations
Italy	High	≈ 60%	≈ 2,4 M€	The activity is a part of SOLARGRID-ENEA (National founded research) proposal submitted in November 2017, Follow up of National POR&PON, Regional founded project, SOLARGRID-MAGALDI Regional funds; National funds; Contributions from national companies; In-kind contribution from research organizations; EU-funded projects.
Cyprus	Medium	≈ 10%	≈ 0,4 M€	Possible grants from Research Promotion Foundation under the RESTART calls and other structural funds.

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

## Activity no. 9: ADVANCED THERMAL ENERGY STORAGE (TES)

Total estimated budget: 10 M€		Tentative proposal of needed contribution from NFOs: 5 M€		
Country	Industrial interest	Tentative national contribution (%)	Tentative needed contribution (M€)	Comments (about financing possibilities)
Spain	High	≈ 20%	≈ 1,0 M€	Support from CDTI to technological development and industrial innovation. Support/grants from MEIC to research activities. Contributions from national CSP companies. In-kind contribution from research organizations
France	Very High	≈ 30%	≈ 1,5 M€	Investment for the Future. National Agency for Research (ANR). National Agency for the Environment and Energy Management (ADEME)
Portugal	High	≈ 10%	≈ 0,5 M€	Regional Funds (CCDRA). Contributions from national CSP companies In-kind contribution from research organizations
Turkey	High	≈ 20%	≈ 1,0 M€	3 - 3.5 M€ Euro potentially available TÜBİTAK International Industrial R&D Projects Grant Programme. Research & Technology Development and Innovation Program
Italy	High	≈ 20%	≈ 1,0 M€	Regional + Private contribution + follow-up of EU REPLICATE SCC1 Project, (WG) PROG.EU. H2020 IN-POWER GA 720749, (WG) PROG.EU. H2020 RESLAG GA 642067, (WG) PROG.EU. H2020 ORC-PLUS GA 657690. Regional funds; National funds; Contributions from national companies; In-kind contribution from research organizations; EU-funded projects.

# CSP/STE IMPLEMENTATION PLAN (proposed Mapping of Activities)

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

## Next steps:

- 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).

# CSP Implementation Plan

## End of Presentation

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