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ISSUES PAPER No.3

Initiative for Global Leadership in Concentrated Solar Power (CSP) / Solar Thermal Electricity (STE)

Purpose of this document

This document¹ is intended to progress the implementation of the actions contained in the SET-Plan Communication² and specifically the actions concerned with the priority "Number 1 in renewable energy". It is part of a series of Issues Papers jointly prepared by the services of the European Commission and discussed with the representatives of EU member states and countries part of the SET Plan, working together in the SET Plan Steering Group.

The Issues Papers propose to stakeholders strategic targets in different areas of the energy sector. The input from, and positions of, stakeholders for each area will be used to come to an agreement on targets in a dedicated meeting of the SET Plan Steering Group with a representation of key stakeholders.

Stakeholders are invited to take position on the proposed targets in accordance with the guidelines set out in the paper ***The SET Plan actions: implementation process and expected outcomes*** and submit their positions to SET-PLAN-SECRETARIAT@ec.europa.eu by 20 November 2015 at the latest. All relevant documents and material are available on the SETIS website <https://setis.ec.europa.eu/>.

¹ This document is a working document of the European Commission services for consultation and does not prejudice the final form of any future decisions by the Commission.

² Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation" (C(2015)6317)

Introduction – Concentrated Solar Power/Solar Thermal Electricity (CSP/STE)

CSP/STE can make a significant contribution to the transformation of the European energy system by providing an important share of renewable electricity on demand (i.e. flexibility of dispatch) thanks to the incorporation of in-built storage in CSP/STE plants – which avoids additional grid integration costs. Moreover, by providing flexibility for grid services, CSP/STE can facilitate the integration of variable output renewables such as PV or wind into electricity systems, thereby contributing to the reliability of the transmission grid. Moreover, CSP/STE will significantly help meet the energy needs of other parts of the world – both creating a potentially very important export sector for the EU industry which can support jobs and growth, and supporting the development agenda after the Paris Climate Change Conference. According to the International Energy Agency (IAE) forecasts, CSP/STE has a huge potential in the long term, ranging from the 357 TWh in the World Energy Outlook (edition 2014) central scenario by 2040 up to 4 350 TWh by 2050 according to the hi-Ren scenario (Energy Technology Perspectives 2014), meaning CSP/STE will account for 11% of the electricity generated worldwide and 4% in Europe. In any case, it represents a significant market potential that justifies the efforts to maintain the competitive advantage of the EU in this domain. The potential for deployment in Europe would be higher in an Energy Union scenario in which CSP/STE-generated power can be supplied in significant volumes from Southern Europe to other parts of the continent – provided the necessary inter-connections are in place.

Why taking action now on CSP/STE?

The EU industry is global leader in CSP/STE, with EU entities involved in all projects developed so far worldwide. However, countries such as the United States (SunShot Initiative) or China are investing heavily to reduce the technology gap and besides their own markets they are targeting the same potentially huge markets in the MENA region, India, South America or South Africa. In order to maintain this global leadership, the EU industry needs to stay ahead with more advanced, competitive technologies. Moreover, innovation needs to happen in Europe, since in order to maintain the confidence of the international investors abroad, advanced technologies need to be demonstrated and commercialized in Europe first.

Targets

Building on the Integrated Roadmap of the SET Plan, public (EC and Member States/Regions) and private investment must focus on targeted R&I actions to achieve the following goals in terms of performance and cost-reductions:

Proposed targets in Concentrated Solar Power/Solar Thermal Electricity (CSP/STE)

1. Short-term: > 40% cost reduction by 2020 (from 2013) translating into
 - **Supply price* < 10 c€/kWh** for a radiation of 2050 kWh/m²/year (conditions in Southern Europe) significantly narrowing the gap in terms of cost with gas combined-cycles
2. Longer-term: develop the next generation of CSP/STE technology
 - **New, supercritical cycles with a first demonstrator by 2020**, which will bring additional cost reductions besides opening new business opportunities linked to the achievement of higher temperatures at the receiver.

* The supply price is meant to be the targeted price within Power Purchase Agreements (PPA) with a duration of 25 years

The achievement of the targets will be not only the result of technological advance, but also of non-technological factors such as economies of scale (i.e. resulting from an increase in installed capacity), risk-finance for 1st-of-kind commercial-scale projects (to compensate for the costs of the initially higher commercial risk), the ability to take full advantage of the European "Single Market", regulation, standardization, skills, etc. In this context, international cooperation in energy research can also bring substantial benefits, including in terms of new CSP/STE cycles. Such non-technological issues will have to be specifically examined at the subsequent stage of defining how to achieve the agreed targets.

[Annex: Relevant actions of the 'Towards an Integrated Roadmap' document of the SET Plan](#)

Concrete targeted R&I actions for the long, medium and short term for CSP/STE development in general are proposed in the Annex 2 of the 'Towards an Integrated Roadmap' document³. Action 1 and 4 from the Advanced Research Programme, Action 1 and 4 of the Industrial Research and Demonstration Programme and Action 1 of the Innovative and Market-uptake Programme seem to be the most relevant ones for realising the targets defined in the Issues Paper.

A. Proposed targeted R&I actions

Advanced Research Programme

Action 1 (see Integrated Roadmap): Development of more efficient CSP/STE components

Scope: To develop technologies in order to reduce the costs of solar components and to identify the heat transfer fluids (HTF) that allow for advanced system designs with higher conversion efficiency.

Deliverables: actions on new optical solutions, receivers and/or HTF.

Action 4 (see Integrated Roadmap): Improvement of Storage Systems

Scope: The potential to store thermal energy and use it to follow the demand is one of the most important advantages of CSP/STE compared to other renewables. Enhancing this feature at the lowest possible cost is essential to enable a high penetration of renewable energy in the electricity system.

Deliverables: actions on new storage concepts & design, and storage optimization.

Industrial Research and Demonstration Programme

Action 1 (see Integrated Roadmap): Development of more efficient CSP/STE components

Scope: To make the solar components cheaper and to find new fluids which increase the working temperature and allow for advanced system designs with higher conversion efficiency.

Deliverables: actions on concentrators, receivers, HTF and/or sub-components.

Action 4 (see Integrated Roadmap): Improvement of Storage Systems

Scope: More efforts are needed by European Industry to improve the competitiveness of the storage systems.

Deliverables: actions on storage design and storage operation optimization

B. Framework conditions – policy measures

Innovative and Market-uptake Programme

Action 1 (see Integrated Roadmap): establish framework conditions to keep innovation in Europe

Scope: The growing international competitive environment requires the timely achievement of cost-reductions for EU CSP/STE plant projects. The highest cost reduction potential arises from the implementation of advanced CSP/STE technologies. However, investors and owners around the world are hesitant to invest in non-commercialized technologies. In order to create confidence advanced technologies

³ https://setis.ec.europa.eu/system/files/Towards%20an%20Integrated%20Roadmap_0.pdf

need to be demonstrated and commercialized first in Europe. In this context, the possibilities of the cooperation mechanisms foreseen in the Renewable Energy Directive (RED) are particularly important.

Deliverables: Identifying and addressing all non-technological barriers which are an obstacle to the implementation of the cooperation mechanisms of the RED.