EUA-EPUE
European Platform of Universities in Energy Research & Education

23 November 2015

Response to SET-Plan consultation:
Initiative for Global Leadership in Concentrated Solar Power/Solar Thermal Electricity

Introduction

This "Input Paper" is a response of the European Platform of Universities in Energy Research & Education (EUA-EPUE) to the invitation of the European Commission to contribute to the consultative process on the European Strategic Energy Technology Plan (SET Plan).

EUA-EPUE responds to the consultation from the perspective of the universities' role in society. Universities constitute a significant part of the research capacity in Europe. At the same time, they educate the highly skilled work force of our societies. It therefore seems important to mobilise the capacity of Europe's universities to contribute to successful implementation of the SET Plan.

In this light, EUA-EPUE wants to emphasise that the long-term goal of technological leadership should not only focus on high-TRL, close-to-market technologies. It also requires **sustainable support for next generation technologies made available through fundamental research, including "use-inspired basic research"**.[1] Similarly, the goal demands the **development of a highly skilled workforce** capable to sustain innovation and technological leadership in the long run. The availability of highly skilled professionals is bound to be a limiting factor for how well Europe can position itself in the global energy market.

According to the OECD, "Countries should step up their investment in long-term R&D to develop frontier technologies that will reshape industry, healthcare and communications and provide urgently needed solutions to global challenges like climate change."[2] Both the IEA and the IPCC also state a clear need for a paradigm shift in renewable energy, which also calls for supporting research that has a longer time horizon to the market, but is use-oriented towards renewable energy.

The UNI-SET project's survey of activities at universities show that many universities, in particular the technology universities engage with industry and research institutes in applied research for technology development. Integration of education with innovation oriented applied research is a very effective way of disseminating new research knowledge, and converting it into industrial innovation. Experience shows that disruptive innovations often come from young innovators, we see that the world's innovation hotspots are fuelled by talented students. It seems that Europe is not as effective as the US in exploiting the innovation potential of young graduates.

We consider therefore that setting up the SET Plan projects with ensured integration of innovative research with education, including industrial partners, will provide a high pay-off towards achieving the energy system transition that is the objective of the SET plan.

In the SET-Plan process, universities have contributed to the SET-Plan Education & Training and the SET-Plan Integrated Roadmap initiatives. EUA-EPUE is now taking forward this commitment with the UNI-SET project, an FP7 Coordination & Support Action aiming to mobilise the university sector in the SET-Plan process and the Energy Union (http://www.uni-set.eu/).

[1] A term coined by Donald Stokes in "Pasteur's Quadrant – Basic Science and Technological Innovation", Brookings Institution Press, 1997

[2] See OECD "Governments must step up R&D in frontier technology", press release available at http://www.oecd.org/newsroom/governments-must-step-up-rd-in-frontier-technology.htm, full report "OECD Science, Technology and Industry Scoreboard 2015" is available at http://www.oecd.org/science/oecd-science-technology-and-industry-scoreboard-20725345.htm (links accessed 16/11/2015).

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RESPONSE

Proposed targets in CSP/STE

For the main expected outcome: To make specific recommendations on the priorities/targets proposed in the issues paper(s)

- Do you agree with the targets set in the issue paper?
- Do you think that the level of ambition is correct?
- Are there any standing issue(s) in the way to reaching the proposed targets/priorities?

It may be useful to understand the broader context in which these targets/priorities need to be achieved. If possible, we suggest that the following is addressed as well:

- *What are your specific recommendations on prioritising R&I activities on these issues (and building where appropriate on relevant existing initiatives)?*
- *Who are the best placed actors to implement the targets/priorities (Industry, EU, Member States, regions, groups of countries/organisations/etc.),?*

- The Issues Paper No.3 recognizes the potential of CSP/STE to contribute to the transformation of the European energy system thanks to its flexibility of dispatch, which can facilitate the integration of variable renewable electricity generators (wind, PV). In this specific point, however, the paper does not mention that the flexibility of dispatch of CSP/STE plants can be provided not only by built-in thermal energy storage, but also through hybridization with other thermal energy source, a renewable (biomass) or fossil fuel. Hybridization has the potential to bring down the cost of CSP/STE electricity while still providing significant environmental benefits, thus offering a viable path for the gradual transformation of the European electricity system.
- CSP/STE plants are already playing a significant role in Spain, where the electricity generated by the existing plants have reached monthly contributions up to 4% of the total electricity generation. At the same time, the experience gained in these projects is allowing the European CSP/STE industry to compete with advantage in international markets, with significant cost reductions –up to 20% in the South African market between the last two rounds- that demonstrate the potential of the technology to achieve competitive electricity costs.
- The complexity of CSP/STE systems makes it advisable to engage the different stakeholders – universities, research centres, industry…- in innovative, collaborative projects and initiatives that reinforce cooperation, help technology development and increase visibility and confidence of the industry and society in this technology. The success of these projects will depend, among other factors, of the availability of adequate and agile schemas that combine and align national and European funding sources.

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Proposed targets in CSP/STE solar energy

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

- The short-term target of achieving a cost reduction > 40% by 2020, that would result in PPA prices below 10 c€/kWh in Southern European regions seems reasonably ambitious. This goal can possibly be achieved by a combination of optimization of available technologies and the introduction of new technological advances.
- The definition of key demonstration projects to be developed in the Southern European regions could be a feasible and effective way to promote cooperation and to demonstrate the higher level TRL advances in the R&D activities. These projects would help to keep the European industry at the lead of the technology.

Proposed targets in CSP/STE solar energy

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 longer-term target proposed in the Issues Paper is surprisingly focused on supercritical cycles, a very specific technology –not specifically solar- whose potential still needs to be demonstrated. While recognizing that the use of more efficient power cycles is one of the key factors to take advantage of the full potential of CSP/STE systems and to achieve additional cost reductions, we suggest to leave it more open by removing the specific mention to supercritical cycles.
- The Issues paper correctly identifies in its introduction the value of flexibility of dispatch provided by CSP/STE systems thanks to their ability to integrate Thermal Energy Storage (TES) systems. The use of new power cycles will very likely require the development of new TES solutions that can be efficiently integrated in the future configurations, as well as new heat transfer fluids (HTF) that can operate at the required temperatures in a stable and safe way. We would propose to state this explicitly in the formulation of the long-term targets.
- In the same manner, it is very likely that some significant breakthroughs in the medium and long terms will be linked to the identification and/or development of new materials and their successful application to different components or subsystems, from receivers to the power block itself. We would propose to state this explicitly in the formulation of the long-term targets.
- The optimization of the O&M in CSP/STE plants has a central role in the achievement of the short- and long- term targets. In this respect, attention should be paid to the development of systems that contribute to a more reliable, efficient and flexible performance of the plants, like the improvement of DNI *nowcasting* systems and its integration into advanced control systems.
- The European CSP/STE industry is competing worldwide with great success, but an increased competition from other regions (USA; China, etc.) is to be expected in the near future. Preserving the current leadership position requires the formulation of clear and ambitious long-term targets

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in terms of cost (see, for example, the SunShot initiative of the US Department of Energy). It would be desirable to establish a long-term cost objective for CSP/STE electricity in different scenarios in terms of solar resource.

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