

Preface: SolarPACES 2024, 30th International Conference on Concentrating Solar Power, Thermal, and Chemical Energy Systems

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Renewable energy technologies are a key element in the journey towards sustainable and secure energy systems. They not only help us neutralize our carbon footprint, but also enable us to harness energy sources that are abundant and more evenly distributed globally.

In 2023, the participants in COP 28 committed to triple the installed capacity of renewable power by 2030. Also, the International Energy Agency reports that the annual renewable capacity additions marked a step change in 2023 and are expected to steadily increase over the next years. This huge expansion will be led by market-mature technologies like solar PV and on-shore wind, which are expected to make up each year for nearly 95 % of the renewable electricity capacity additions, until 2030.

However, as the penetration of renewables approaches 100%, the availability of clean technologies that allow dispatchable production will no longer be an option, but a necessary element for our energy systems to be not only sustainable, but also flexible and resilient. Also, it has now become very clear that full electrification of our energy uses will not be possible in the short term. The “hard-to-abate” sectors, like energy intensive industries and heavy transport, will require alternative approaches to be decarbonized. Today, industry makes up for roughly 30 % of the total world’s energy consumption and industrial processes require 70 % of their energy input as low-, medium- and, mostly, high-temperature heat. Fulfilling this energy demand in a sustainable way is a challenge that will require the use of multiple energy technologies and vectors. This includes hydrogen and other renewable fuels, but also technologies that can directly produce renewable heat.

Concentrating solar thermal (CST) technologies possess all the key features to address these challenges. They can be used to produce (or co-produce) high-temperature heat, electricity, hydrogen and other renewable fuels. They can rely on commercially proven long-duration thermal energy storage solutions, which are not based on critical materials and allow flexible and, potentially, round-the-clock operation. Furthermore, they can support the penetration of non-programmable renewables by providing flexibility and ancillary services to the grid.

Several challenges still hinder the deployment of CST technologies. Improving the cost-efficiency is among the first priorities. Research and innovation can partly contribute to this aim, but ensuring a stable pipeline of commercial projects is crucial. In turn, in many markets, today this requires well-designed and stable support policies.

From October 7th to 11th, 2024, more than 520 experts and delegates from 41 countries gathered at the *Auditorium della Tecnica* in Rome (Italy), to attend the 30th edition of the SolarPACES Conference. With 42 years of activity since its inauguration in 1982, the conference has become the world's reference event for the CST community, which now every year provides an excellent forum for research, industry and policy makers to connect, exchange ideas, build networks, showcase cutting edge innovations, and lay the groundwork for new projects.

The Conference boasted a very rich technical program with 4 plenary sessions including 8 keynote presentations and a roundtable discussion, 40 technical sessions with more than 220 talks, 244 posters and a technical visit to ENEA Casaccia Research Center, which hosts the most relevant CST-related research infrastructures in Italy. The participants were greeted during the opening session by the Italian Minister of Environment and Energy Security Gilberto Pichetto Fratin, who pointed out how CST is among the key energy technologies identified by the European Union to achieve its ambitious climate goal of carbon neutrality by 2050 and, accordingly, is expected to contribute to the Italian energy mix in the near future as reported in the National Energy and Climate Plan.

This volume collects the 177 full papers submitted for the Conference Proceedings. The papers cover all the 16 conference topics that address a wide and exhaustive range of current issues in the field of CST technologies, from the assessment of solar resource, to the deployment of commercial projects. Almost half of the papers focus on one of three key topics, namely "*Analysis and Simulation of CSP and Hybridized Systems*", "*Thermal Energy Storage Materials, Media, and Systems*", and "*Solar Industrial Process Heat and Thermal Desalination*". This clearly reflects the main trajectories that the CST community has been following in recent years towards the future of the technology.

The following papers mark another step to improve the technological and economic performance of CST technologies and foster their further deployment. To the authors of these papers, to those who helped in the organization of the Conference, and to all the participants goes my deepest gratitude.

References

- [1] <https://www.solarpaces-conference.org/>