SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2025 HIGHLIGHTS

Task 72 - strong SHC solar photoreactor network

TASK 72 NETWORK FORMATION

Kicking off in November 2024, the formation of a strong solar photoreactor network within Task 72 was a major highlight of the 1st year. In 3 expert meetings, 48 experts from 12 countries have gathered physically and online to exchange project results, discuss future development priorities and raise further public awareness on solar photo reactors. An active expert list has been released at the Task 72 website: https://task72.iea-shc.org/participants.

The expert meetings were held in plenary mode, across the 3 Subtask themes: photoactive materials, solar photo reactor designs and system integration. In each Subtask expert presentations were included from national and internation projects. So far a list of over 48 recently closed and ongoing projects has been gathered around the kick-off phase, which will updated in the year 2026. The projects span across the development of new photoactive components, over the evaluation and development of solar photoreactor designs, as well as creation of R&I templates or system evaluation activities for pilot plants. The current projects use a wide range of raw materials to produce various solar chemicals and fuels. These include among others: Hydrogen, Syngas, Ammonia, Methan, Methanol or Ammonia. The wide range of products show and underly that IEA SHC Task 72 is not focussed on one product but really focusses on the development of photoactive reactors/collectors under real sunlight for various applications.

In addition, bonds have been established to IEA Hydrogen Task 45, Subtask 2 Photochemical Hydrogen Production via Bettina Muster-Slawitsch and Sarah Meitz from AEE INTEC, as well as Greg Metha and Rob Dickenson from Subtask 2 IEA Hydrogen Task 45. Sarah and Bettina have been invited to the Solar-to-X Workshop in Paris in February 2025, co-organized by Mission Innovation Solar-to-X, Hydrogen Task 45 and the international network SUNERGY.

Participating Countries:

Australia

Austria

Canada

Germany

France

Italy

Netherlands

Spain

South Africa

United States of America

(countries with experts active in the 1st year of Task 72)

11/2024 – 10/2028
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SOLAR PHOTO REACTORS – EVALUATION METRICS FOR VARIOUS SCALES

The work programme of Task 72 puts high relevance on the definition of clear key performance indicator definition, in order to be able to compare photoactive materials, reactor designs or system performance clearly. Specifically, within Subtask A the high relevance to define these indicators at an early stage of Task 72 was highlighted, as a wide range of different indicators exist in literature. Therefore, a cross-Subtask activity was initiated start the process of KPI definition. A survey was conducted in autumn 2025 among 29 experts to gather the current status of evaluated/used KPIs in the current projects and views on their importance. The outcomes of the survey highlighted the needs for harmonized definitions.

At the Lisbon expert meeting the further process was defined in an expert workshop by structuring the required key performance indicators by evaluation scale and objective. Four categories were formed with four respective focus expert groups to work on a definition proposal within the coming year 2026.

RESEARCH SCALE	RESEARCH OBJECTIVE
Lab scale under artificial light	Material development, material stability, new materials
Lab reactor testing under artificial light	Most efficient reactor type
Real sunlight experiments for specific reactors and catalyst (small-medium scale)	Assessment under real conditions; evaluating catalyst performance and reactor performance under real sunlight, thermal effects etc.
Larger prototypes	Demonstration, Evaluation of system effects

SOLAR PHOTOREACTOR DESIGN TEMPLATE

In Subtask B a design template has been created by a group of experts to collect all relevant process and component characteristics relevant for the design of a solar photoreactor. This work is highly relevant not only for own research, but also for communication to the solar industry, as it will be a core output document of Task 72 to facilitate the design of solar photoreactors taking into account all aspects from the photochemical, process engineering and solar harvesting side.

MULTIPRODUCT PHOTOREACTORS

In 2025 several projects showed the importance of focussing on the use of the full solar spectrum, by synergizing the production of heat, photochemical products and electricity in one collector.

Photoactive materials usually use the high energetic part of the solar spectrum in the range < 700nm. The development of solar photoreactors under real sunlight will therefore require good heat management, as the rest of the sunlight is usually converted to heat. This heat can be used directly as product, which is for example greatly show-cased in the development of Sparc Hydrogen, a start-up company in Adelaide, Australia.

Within Task 72, several experts are working on the European project SPECTRUM, aiming to combine photocatalytic hydrogen production from wastewater not only with heat, but also electricity production. The Austrian project SOPHIE targets a similar route, the combination of photochemical processes with PV and heat output within a single collector. While these concepts of photoreactors with 3 energy outputs are at an early stage, they could potentially be a highly interesting technology for land-efficient solar energy production.

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