

What is solar-driven steam generation (SSG)?

As a result, there has been a shift towards inexpensive solar utilization technologies, which function effectively in a decentralized manner, leading to a surge in photothermal research. In this context, solar-driven steam generation (SSG) provides an effective approach for the distributed utilization of solar thermal energy⁷.

Does SSG use more energy than membrane based water treatment?

From an energy perspective, SSG inevitably consumes more energy per unit of water generated than membrane-based water treatment methods (such as reverse osmosis) due to its phase-change process^{17,18} (Fig. 1b). This would lead to a much lower water yield under the same sunlight input.

How can SSG improve energy sustainability?

Developing mutual reinforcement between evaporation and other processes (such as photo/thermocatalysis, thermoelectricity and mechanical oscillation) could provide opportunities for energy sustainability. Moreover, engineering other key parameters of SSG such as mass and heat flows may further unleash its potential for specialized functions.

Are SSG integrations effective for water and energy sustainability?

Numerous investigations have shown that SSG integrations could be highly effective in diverse application purposes that are closely linked to water and energy sustainability. Opportunities and challenges to drive future developments and real-world payback need to be evaluated with careful consideration.

Can solar-driven steam generation be used beyond water purification & desalination?

This Review summarizes the recent progress in solar-driven steam generation in diverse functionalizations and highlights its applications beyond water purification and desalination.

Are covalent organic frameworks a promising material for solar steam evaporation?

Covalent organic frameworks (COFs)¹⁷ as a promising material have drawn increasing interest in the field of solar steam evaporation^{18,19} because it is convenient to uniformly integrate photothermal function units, such as porphyrin²⁰ and azobenzene²¹, into the structure for efficient photothermal conversion.

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