

SolarWave Elixir: a Sustainable Solution for Energy-water Cogeneration

 Energy & Environment

 Manufacturing

Energy Conservation/Generation/Management/Storage (Battery)

Nanotechnology and New Materials

Opportunity

Freshwater and electricity are two intertwined fundamental components in the further development of modern society. The growing population, changing climate and increasing pollution have exacerbated global water and electricity scarcity. Solar energy, as the most inexhaustible and environmentally friendly energy source, has attracted tremendous attention for the production of green electricity and clean water. However, previous works have mainly focused on the material or structural design of individual modules. There is a lack of research on the energy interaction between the power module and water module, as well as on optimization strategies for enhancing the energy exchange between them. This limitation hinders attainment of the optimal performance of the cogenerator. In addition, the long-term stability, durability, and reliability are crucial for the cogenerator and should be taken into consideration.

Technology

This invention presents a rationally designed hybrid system based on the passive interfacial cooling (PIC) strategy. The PIC region within the system intensifies energy exchange between the power generation and water generation modules, thereby boosting the utilization of waste heat and latent heat from the hybrid modules and minimizing the energy loss. As a result, the cogenerator exhibited a superior power density of 1.5 W m^{-2} and an outstanding water evaporation rate of $2.81 \text{ kg m}^{-2} \text{ h}^{-1}$ under 1 Sun illumination, which were 328% and 158% higher than those of devices without the PIC effect. The effectiveness of the PIC strategy in enhancing photovoltaic-based power generation systems has also been established, resulting in an increase in power density from 55.7 W m^{-2} to 75 W m^{-2} . Together with its excellent salt rejection ability, stability, durability, and applicability under various harsh conditions, this invention exhibits broad prospects for commercial applications.

Advantages

- High efficiency
- Low-cost
- Zero carbon emission
- Long-term stability and durability

Remarks

1. International Exhibition of Inventions of Geneva (IEIG) 2024 - Gold Medal

IP Status

Patent filed



Technology Readiness Level (TRL) ?

6

Inventor(s)

Prof. LU Jian

Dr. MAO Zhengyi

Dr. WANG Qiliang

Mr. YAO Yao

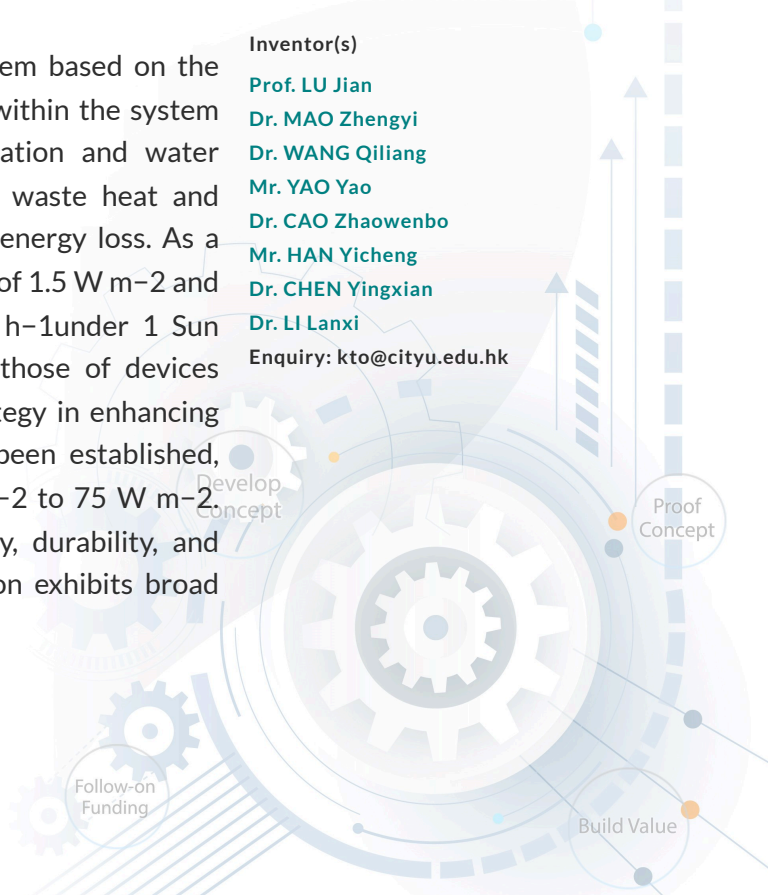
Dr. CAO Zhaowenbo

Mr. HAN Yicheng

Dr. CHEN Yingxian

Dr. LI Lanxi

Enquiry: kto@cityu.edu.hk



Applications

- Electricity-water cogeneration
- Desalination
- PV cooling

