Advanced Core for Energetics, Hiroshima University Vol. 98

HU-ACE NEWS LETTER

Advanced Core for Energetics, Hiroshima University

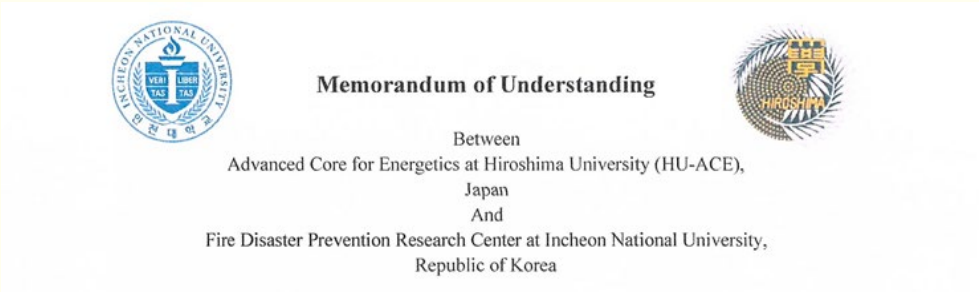
Vol.98
2025.2

Activities of the Core

Feb. 1, 2025	The 9th Higashihiroshima-Ene/Eco Seminar (co-organized by HU-ACE)
Feb. 13, 2025	The Carbon Recycling Special Lecture (NEDO Project) 4th Lecture: "CO2 Fixation and its Application to Chemical Products“ (co-organized by HU-ACE)
Feb. 19, 2025	The 100th HU-ACE Steering Committee Meeting
Feb. 19, 2025	The 119th Hiroshima University Biomass Evening Seminar (co-organized by HU-ACE)

Conclusion of the Memorandum of Understanding (MOU) on International Exchange with the Fire Disaster Prevention Research Center at Incheon National University, Republic of Korea.

Our institute signed an international exchange agreement (MOU) with the Fire and Disaster Prevention Research Center at Incheon National University (Republic of Korea) on January 15, 2025. The research center at Incheon National University conducts advanced research on fire and disaster prevention technologies, and this agreement aims to advance countermeasure technologies for energy-related fire and explosion disasters, including those involving batteries and fuel cells. With the signing of this MOU, research and educational exchanges between the two universities are expected to be further strengthened, significantly expanding opportunities to share knowledge and technology. Moving forward, we look forward to fostering a closer partnership through joint research projects and exchanges of students and faculty, contributing to the development of safety and disaster prevention technologies.



Memorandum of Understanding

Between
Advanced Core for Energetics at Hiroshima University (HU-ACE),
Japan
And
Fire Disaster Prevention Research Center at Incheon National University,
Republic of Korea

Related Events

Apr. 23, 2025: 16:20-17:50 The 120th Hiroshima University Biomass Evening Seminar (co-organized by HU-ACE)
Jun. 30, 2025-Jul. 1, 2025: The 9th International Symposium on Fuels and Energy (ISFE2025)

Contact us for more information : hu-ace-info@ml.hiroshima-u.ac.jp

Research consultation and joint research are welcome.

Issued by Advanced Core for Energetics, Hiroshima University
HU-ACE Secretariat, URA Division, Office of Research and Academia-Government-Community Collaboration, Hiroshima University 1-3-2 Kagamiyama, Higashi-Hiroshima, 739-8511 Japan
E-mail: hu-ace-info@ml.hiroshima-u.ac.jp, tel:+81-82-424-4425, URL: https://hu-ace.hiroshima-u.ac.jp/en/

HU-ACE NEWS LETTER Advanced Core for Energetics, Hiroshima University Vol. 98

Research Topics

No. 61

Reduction of pumping power in Ground source heat pump systems

Sayaka Kindaichi

Hiroshima University, Associate Professor

Research fields: Architectural environment, Building equipment

Keywords: Energy-savings, Renewable heat, Heat pumps

Abstract

Background

A heat pumps are useful devices for both cooling in summer and heating in winter. Ground source heat pumps (GSHPs) provide more efficient cooling and heating than conventional air source ones. GSHPs, however, require water pumps to deliver the ground heat to the heat pump, which may increase in the total energy consumption.

Methods

We have proposed a GSHP system in which a buffer water tank was installed between a heat pump and ground heat exchangers, and water pumps were operated intermittently utilizing the heat capacity in the tank (Fig.1 left). The energy consumption of the proposed system and conventional one (Fig.1 right) were compared in a simulation model assumed an office building with a floor area of 2500 m^2.

Results

Fig.2 shows WTF (water transfer factor), an index representing the efficiency of the ground heat delivery. The values of WTF were higher during cooling than heating in all cases, indicating that the ground heat was more effectively delivered to VRF systems with smaller energy during cooling. This is because relatively high heat load ratios during cooling prevented excessive water flow. The proposed system thus enables efficient ground-source water transport via adequate intermittent control while reducing the pumping power regardless of the heat load.

As shown in Fig.3, the total energy consumption of the proposed system was reduced by 25% than the conventional one, even though the energy consumption for heat pumps (VRFs) in the proposed system was slightly larger than those of the conventional systems. This indicates that intermittent operation reduced the pumping power and total energy consumption due to appropriate design and control of the proposed system.

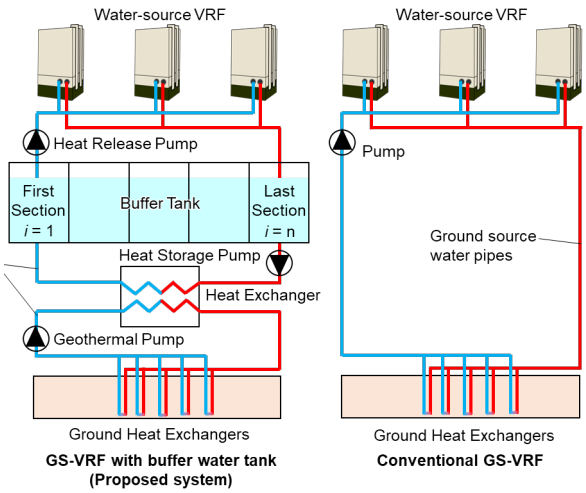


Fig. 1. Conceptual diagrams (left: Proposed system, right: Conventional system)

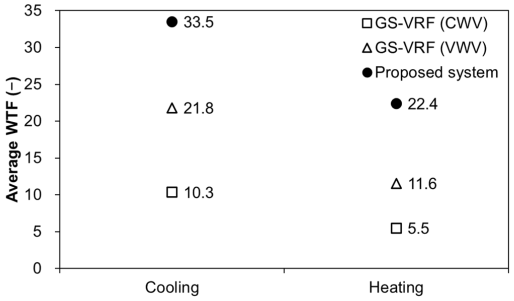


Fig. 2. WTF (Water Transfer Factor)

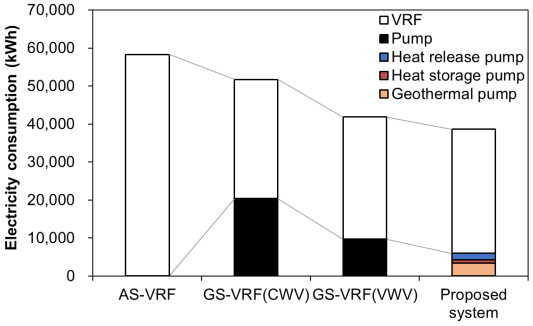


Fig. 3. Annual energy consumptions

References

1. T. Tanaka, S. Kindaichi, et al, Energies 17 (2024) 5564. https://doi.org/10.3390/en17225564