EXPLAINER

Low Carbon, High Savings: Reusing Industrial Wastewater for Energy Efficiency

The High-Level Technology Fund is supporting the pilot of a low-cost and efficient cold and hot water waste heat utilization system in a food processing factory in Viet Nam. Photo credit: Asano Taiseikiso Engineering Co., Ltd.

A pilot project in Viet Nam will test a heat exchange technology that reuses industrial wastewater for heating and cooling production processes.

Published: 27 January 2022

Introduction

Heating and cooling demand accounts for about half of total global final energy consumption, and it keeps growing (IRENA/IEA/REN21, 2020). This involves a wide range of residential, commercial, and industrial uses, such as water heating, air conditioning, refrigeration, and process heating.

Heating and cooling are a major source of air pollution. There are however clean and efficient technologies for heating and cooling applications that provide opportunities to save money, lessen dependence on fossil fuels, reduce priority pollutant emissions, and reduce greenhouse gas (GHG) emissions by switching to clean energy sources.

Japan-based Asano Taiseikiso Engineering Co., Ltd (ATK) is working on pilot testing the use of industrial wastewater in its high-efficiency heat exchanger for a clean cooling and heating system in Viet
Nam. ATK is one of the winners of the first Technology Innovation Challenge for Energy supported by the Asian Development Bank (ADB) and the High-Level Technology Fund.

Responding to Rising Electricity Demand

In Viet Nam, a subtropical country, cooling demand is high throughout the year in the building sector. In its rapidly growing industry sector, many production processes use steam, hot water, or cold water at temperatures of around 0°C.

The proposed solution is expected to help recover the waste heat from cooling and heating water in many factories. Once implemented at full operational scale (i.e., pre-cooling and pre-heating), the estimated GHG emission reduction can reach 202 tons of carbon dioxide (CO$_2$) per year.

ATK proposed a low-cost and efficient cold and hot water waste heat utilization system to be pilot tested in a food processing factory in Viet Nam’s capital Ha Noi. By effectively utilizing the waste heat from the wastewater and supplying it back to a facility, such as a boiler or chiller, total energy consumption can be significantly reduced.

Dubbed as “G-HEX,” the technology solution involves a heat exchange unit that is optimized for water-to-water heat exchange. It addresses common problems associated with metal materials (i.e., rust, clogging, performance degradation) by using a polyethylene resin (PE-100) material. It avoids corrosion and rust caused by the heat source water and promotes long equipment life. It also prevents clogging of pollutants and scales, which helps maintain good heat exchange performance while ensuring water quality. A patented aeration technology also enhances the heat exchange performance.

**Figure 1: Concept of Proposed Technology**

The technology is different from other heat exchanges available in the market as it offers lower pressure loss, better durability, and less maintenance. It can also operate in low-quality water conditions.

The factory in Ha Noi uses cold water (0°C) in food production and releases cold water at 2°C. Instead of solely depending on chillers to lower the temperature of raw water (often at 30°C), the G-HEX will help the factory reuse the cold wastewater (pre-cooling). The water temperature and flow rate of the system as well as the electric consumption of the chilling system will be closely monitored to assess and
calculate the reduction in electricity consumption and carbon emission.

**Figure 2: Expected Effect of G-HEX**

The pilot project will also involve market research of the technology in Viet Nam and the ASEAN region. Knowledge-sharing workshops on energy saving will be held to complement the installation and operation of the technology.

The Hanoi University of Science and Technology will provide independent verification of the results of the pilot test, and these results will be the basis of a potential scale-up of the project.

G-HEX has been tested in Japan. It was used to melt snow using warm wastewater heat from factories.

ATK sees potential opportunities for applying this technology to shallow ground geothermal heat, which may be used for efficient household cooling and heating.

**Halting the Rise of GHG Emissions**

ADB’s developing member countries need to invest in clean energy in order to attain their development goals, including their Nationally Determined Contributions (NDCs) under the Paris Agreement.

Viet Nam’s NDC identified advanced technology as one of the major gaps and needs for enhancing its climate change mitigation efforts. The G-HEX technology pilot could pave the way for the application of more technology-based solutions to help the country achieve its GHG reduction targets.

The results of the pilot can also benefit other Southeast Asian countries, where the technology may be replicated to save electricity as well as reduce GHG emissions.

Minimizing emissions is crucial in mitigating the effects of climate change, such as reduced water availability, wildfires, loss of natural habitat for wildlife, and rising sea levels. Collective action is needed to keep global temperature rise below 1.5°C and reduce the damaging impacts of climate change. Using the G-HEX technology could be a small yet important step toward that goal.
What is the High-Level Technology Fund?

Under its Strategy 2030, ADB is mainstreaming the use of advanced technologies by carrying out pilot testing, strengthening project design, emphasizing quality in procurement, and mobilizing subject experts.

The High-Level Technology Fund was established in May 2017 as a multi-donor trust fund in ADB that provides grant financing to encourage more widespread adoption of high-level technologies to address development challenges in member countries. It is currently funded by the Government of Japan.

Following the premise that development impact can be profoundly improved with the right advanced solutions, the fund seeks to promote the integration of high-level technologies and innovative solutions into ADB-financed and administered projects. It also aims to connect technology providers with ADB’s project officers and member countries to explore business opportunities for high-level technology integration.

Resources


Lin Lu
Principal Operations Coordination Specialist, Sustainable Development and Climate Change Department, Asian Development Bank

Lin is responsible for overall coordination of her department’s activities in catalyzing
innovation across sector and thematic areas and across operational and nonoperational departments through the One ADB approach. She is also manager of the High-Level Technology Fund. Lin has led energy projects and technical assistance in Central, West and East Asia. Before ADB, she was business development manager at Hollysys Asia Pacific Ltd. She holds a PhD in Mechanical Engineering from Drexel University.

**Toru Ito**  
Senior Energy Specialist, Sustainable Development and Climate Change Department, Asian Development Bank

Toru Ito belongs to the experts’ pool, and his specialty is gas energy technology. His work involves knowledge sharing on hydrogen energy and providing technical support to natural gas projects. Before joining ADB, he worked for Hitachi, Ltd in Japan as an engineering department manager in the thermal power division. He has around 20 years of experience in thermal power plant engineering (especially gas turbine).

**Tsuyosho Shiga**  
Manager, International Business Promotion Section, Asano Taiseikiso Engineering Co., Ltd. (ATK)

Tsuyosho Shiga has 28 years of experience in geotechnical and geological engineering for civil works and environmental projects where he served as a main engineer and a project manager. He has expertise in soil mechanics, particularly groundwater behavior in urban areas. He worked in Viet Nam at ATK’s Ho Chi Min City office for 3 years, starting in October 2016. He joined a research project for the enhancement of ground source heat pump in Japan in 2020.

**Asian Development Bank (ADB)**

The Asian Development Bank is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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