Data-Driven DSR Control Technology for Energy Sharing

Hideki Shimada

AIST Tsukuba West, 16-1 Onogawa, Tsukuba, Ibaraki 305-8569, JAPAN

hideki-shimada@aist.go.jp

Achieving carbon neutrality in Japan by 2050 requires significant reductions in greenhouse gas (GHG) emissions across all sectors. While industry, commerce, and transportation have shown declining trends, household emissions remain inconsistent. The household sector accounts for about 16% of national emissions and 27% of electricity demand, making it a critical but challenging area due to the diversity of lifestyles and consumer behaviors. Japan's Plan for Global Warming Countermeasures calls for a 66% reduction in household emissions by 2030 compared to 2013 levels, emphasizing lifestyle changes while making little reference to innovative technological solutions.

This project addresses that gap by developing technologies for data-driven control of demand-side resources (DSR) to enable household energy sharing. AIST and the University of California, Davis have been collaborating to integrate Japanese and U.S. energy big data to design flexible control systems. Research will focus on three areas: (1) forecasting household electricity demand and supply using big data, (2) developing external DSR control schemes that optimize energy use, sharing, and sales while maintaining satisfaction, and (3) creating data-driven power system analysis methods to incorporate grid constraints into DSR control.

By tailoring DSR technologies to household diversity, the project offers a technological pathway for substantial GHG reduction, complementing behavioral measures and supporting carbon neutrality.