Development of Electricity Monitoring and Regional Distributed Energy Management System in Shinchi-Town, Fukushima Prefecture

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Abstract

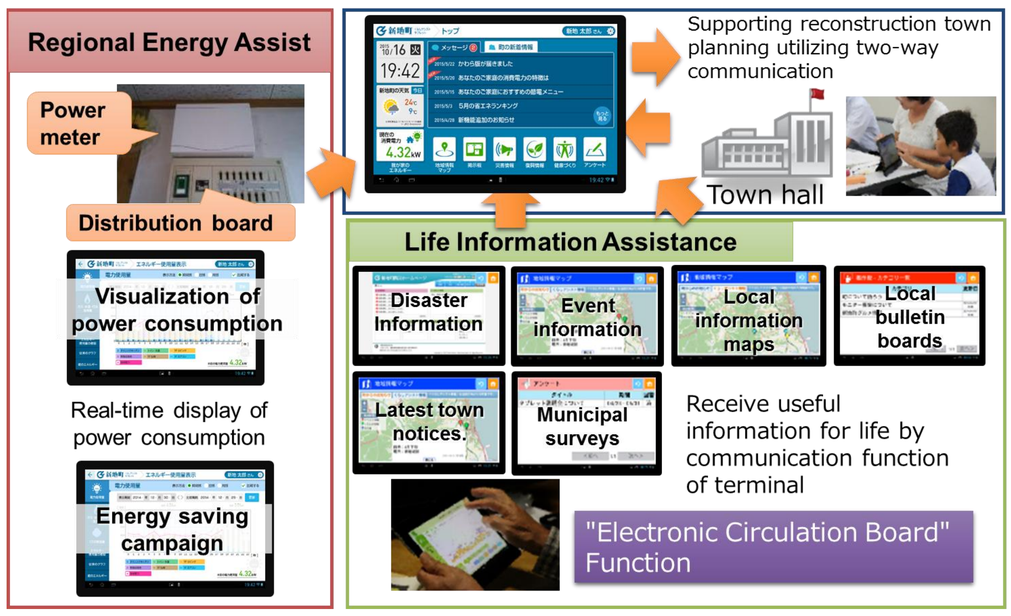
Regional energy management that effectively utilizes distributed energy resource systems and renewable energy sources has become increasingly important. We are developing a planning and evaluation system that makes it possible to support energy conservation and the revitalization of local communities by using information and communication technology (ICT) for disaster reconstruction areas. Currently, our main demonstration field is Shinchi town, Fukushima Prefecture. We are developing a local ICT system called "Life Assist System" and conducting a social demonstration experiment by distributing a tablet style device to about 100 households in the town. With this local information infrastructure, energy consumption monitoring systems are installed in residential houses and these promote energy conservation on the demand side. In addition, a community energy supply system is introduced to supply heat and electric power from the natural gas cogeneration system to facilities around Japan Railways' Shinchi Station. A community energy management system (CEMS) is utilized for integral energy management. We are planning to use the Life Assist System as an information terminal on the energy demand side.

Research Overview

Development of a Local ICT System and Its Application to Residential Electricity Monitoring in Shinchi Town, Fukushima Prefecture

Objective:

To encourage both support for **environmentally conscious behavior** and **the revitalization of local communities** by using **information and communication technology (ICT)**.

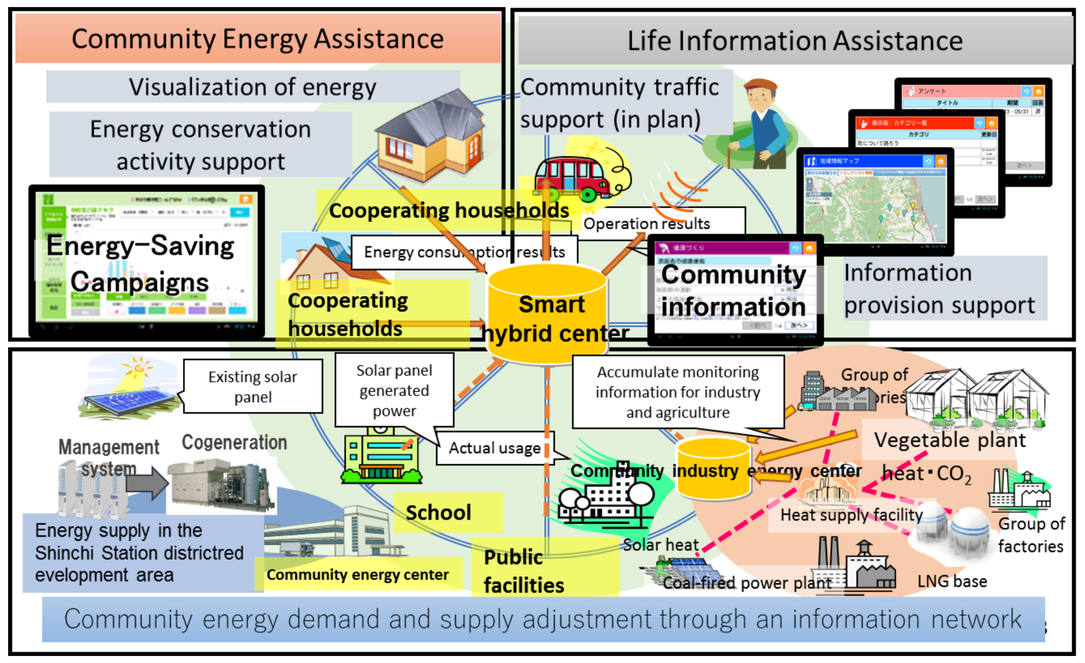


Main functions of the local ICT system called "Life Assist System."

Smart Hybrid Town Concept in Shinchi

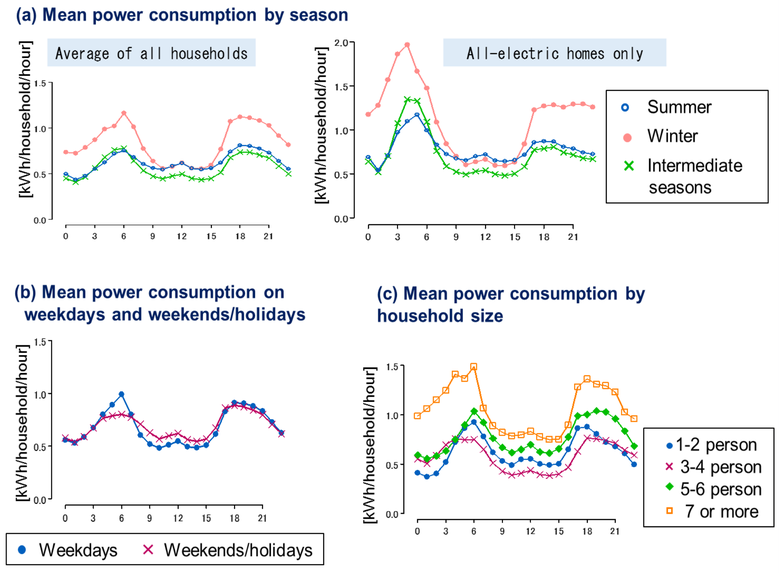
Shinchi proposed "**the smart hybrid town concept**" for disaster reconstruction. This concept aims to reconstruct the area by combining ICT with the social mechanism that supports the community to improve the environment, economy, and society.

Under **the Life Assist System**, as part of the smart hybrid town concept, tablet devices serve as the user interface for the residential side.

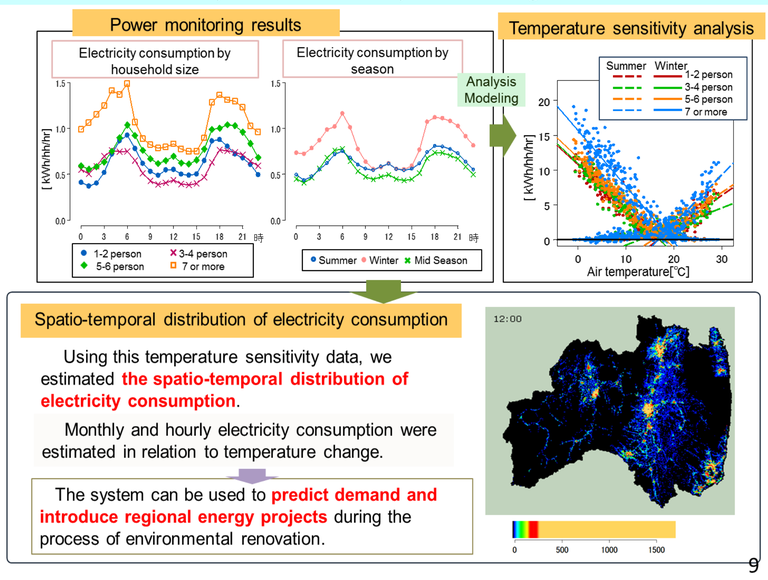


Energy Consumption Monitoring Using the Local ICT System

Examples of Power Monitoring Results



Analysis of Electricity Monitoring Data



Using this temperature sensitivity data, we estimated **the spatio-temporal distribution of electricity consumption**.

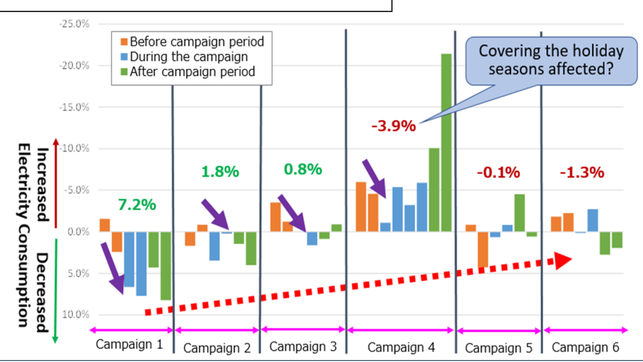
Monthly and hourly electricity consumption were estimated in relation to temperature change.

The system can be used to **predict demand and introduce regional energy projects** during the process of environmental renovation.

Energy-Saving Campaigns

- **Six energy-saving campaigns** have been conducted since the system was implemented in 2014.
- **The power-saving effect was largest in Campaign 1.**
- Conducting the initial campaign had the strongest effect, but each campaign thereafter decreased gradually in efficacy.

	Period	Participating households	Incentives	情報提供方法
1	Sept. 2014	22／46	Yes (top 3)	Via tablet
2	Nov. 2014	12／46	Yes (top 3)	Via tablet
3	March 2015	24／55	Yes (top 3)	Advisory report (customized)
4	Dec. 2015	75	None	Advisory report (customized)
5	March 2017	75	None	Advisory report (general)
6	Nov. 2017	68	None	Advisory report (customized)



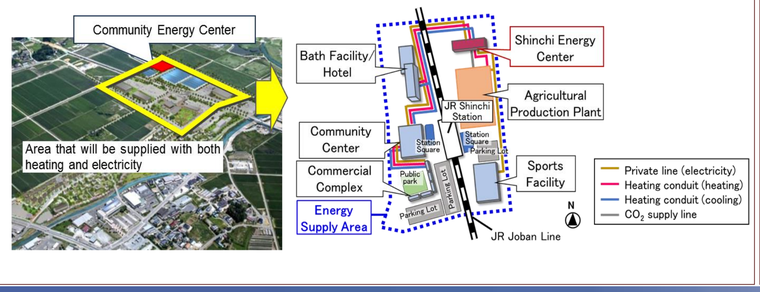
JR Shinchi Station District Community Energy Project

The Smart Community Project

A community energy supply system is introduced to supply heat and electric power from the natural gas cogeneration system to facilities around Japan Railways' Shinchi Station.

As part of this project, electricity could be supplied via transmission to an even larger area. In the case the system is connected to the CEMS, a demand-response control framework could be introduced.

In addition to reducing peak loads at existing power plants, this system would contribute to adjusting the supply-demand balance at cogeneration plants and adjusting the balance between supply and demand when unstable power sources are introduced.



Shinchi Energy Center

The exterior of Shinchi Energy Center

The district heating and cooling system that utilizes natural gas supplied by pipelines has been introduced.

The total energy efficiency is increased by introducing a cogeneration system that utilizes waste heat from power generation. This project involves cogeneration for cooling requirements during the summer.

LNG Cogeneration | Aabsorption Chiller (genelink) | Solar panels | Control room

Future Direction: Connection with CEMS

- The supply-demand balance adjustment within the area becomes crucial.
- The local ICT System's ability to send energy-saving requests may be used as **an interface for the demand side** to connect to CEMS of the local energy project around Shinchi Station.
- **A demand-response control framework** could be introduced.