Promotion of Smart Community in Aizuwakamatsu City Area

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Aizuwakamatsu City is a leading city in Japan for tourism, a city with abundant nature, a long history, and rich culture. By harnessing the benefits of its abundant nature, the city is promoting the implementation of renewable energy facilities and is supporting a program to encourage the usage of local products. Through these activities, Aizuwakamatsu City is working to create, invest in, and stimulate industries, build infrastructure for a good quality of life, and provide peace of mind and security to its residents. Fujitsu has partnered with the city for more than 40 years, working together to establish a production base for its semiconductor business. Through this relationship, Fujitsu, along with the Tohoku Electric Power Company, has been supporting the Aizuwakamatsu Area Smart Community Promotion Project since 2011. Here, we introduce this project and explain one of the activities in which we have been involved—creating an energy control center to visualize energy provision and usage. We also describe how regional vitalization is mandatory for smart community development. We use the term "smart community" rather than "Smart City," the term Fujitsu normally uses, to be consistent with the usage of the Japanese Ministry of Economy, Trade and Industry.

1. Introduction

To survey the latent potential for renewable energy in the Aizuwakamatsu region as a preliminary stage of the Aizuwakamatsu Area Smart Community Promotion Project introduced in this paper, we performed a feasibility study of how to promote and support the 2011–12 smart community initiative in cooperation with Aizuwakamatsu City and local businesses (from October 2011 to March 2012).

On 30 April 2013, the Ministry of Economy, Trade and Industry (METI) approved the funding of plans for the introduction and promotion of a smart community that had been jointly submitted by Fujitsu, Aizuwakamatsu City, and Tohoku Electric Power, and preparations are now underway with a view to starting operation of an energy control center (ECC) in the second half of the 2014–15 fiscal year.

In this paper, as part of our efforts to promote the introduction of a smart community, we introduce the construction of the ECC, its links with regional disaster prevention measures and with the promotion of solar power generation and power storage cells, and urban planning measures that take advantage of the heat supply derived from biomass resources. Next, we discuss business collaboration for the creation of new value and services that are sought by local residents.

Since this paper is chiefly concerned with METI's efforts to promote the introduction of a smart community, we will use the term "smart community" to refer to Smart Cities.

2. Efforts to promote introduction of smart community

This work is not simply aimed at the introduction of renewable energy. Its aims also include achieving greater resilience to natural disasters, promoting job creation, contributing to urban planning that puts local residents first, and establishing platforms and mechanisms that are autonomous and self-sustaining. Specifically, we aim to promote the following three activities centered on the ECC. An overview of the ECC project is shown in **Figure 1**.

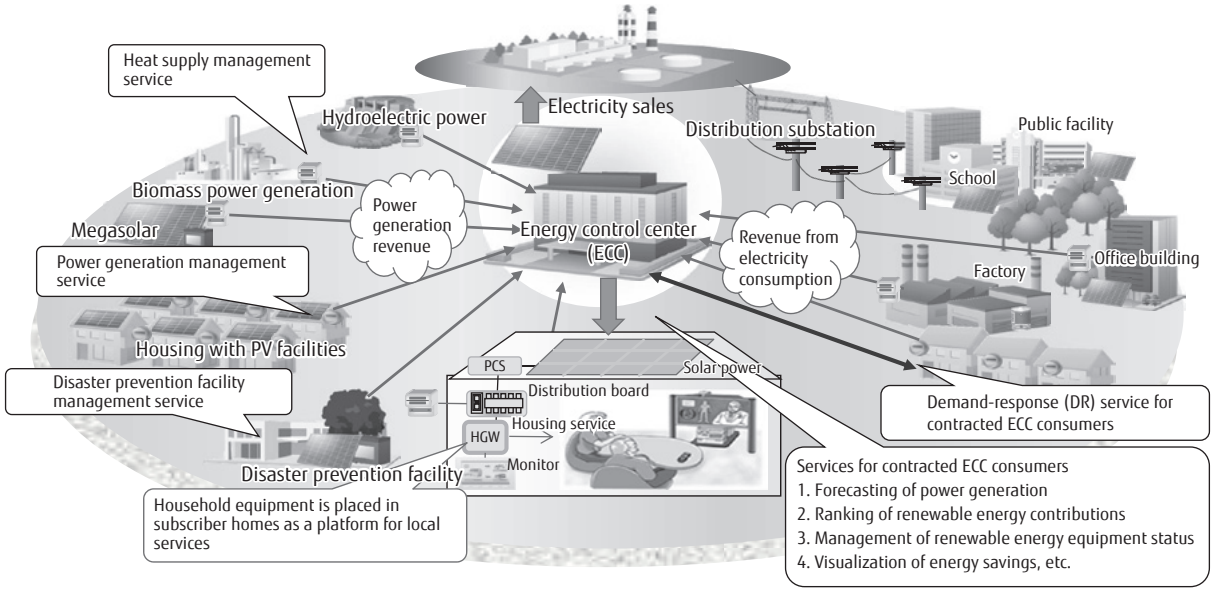

Figure 1
Overview of ECC Project.

1) Construction of ECC
2) Coordination of introduction of solar power generation and power storage cells with regional disaster prevention measures
3) Incorporation of heat supply derived from biomass resources into urban planning

Activity 3) is temporarily on hold with regard to commercialization during the introduction and promotion phase of the project.

These activities are discussed in detail below.

2.1 Construction of ECC

The ECC performs the following four functions in Aizuwakamatsu City with the aim of contributing to the introduction and expansion of renewable energy, the management of renewable energy sources to be introduced in the future, the creation of new services, and the stabilization of local electric power systems.

1) Visualize state of renewable energy generation in local area
2) Manage status of local renewable energy generation and heat supply facilities and provide relevant information
3) Provide demand-response (DR) services for contracted ECC consumers (low voltage)
4) Introduce Yukigunigata megasolar power plant.[note)]

Functions 3) and 4) are described below.

2.1.1 DR services for contracted ECC consumers (low voltage)

This service has contracts for ECC and contracted ECC consumers that are established separately from the electricity supply and demand contracts of existing power companies. For the DR services provided in this project, points are awarded or deducted for peak and off-peak electricity usage in accordance with the customer's service contract. Demand is shifted to reduce peak usage by providing incentives in the form of coupons, regional promotion tickets, or the like on the basis of the total number of points (**Figure 2**).

A DR service menu suitable for the Aizuwakamatsu region will be developed by taking advantage of practical knowledge relating to DR obtained from verification trials (next-generation energy/social systems verification trials) conducted in four cities: Yokohama, Toyota, Kansai Science, and Kitakyushu.

The capital for the incentives provided will come

note) The plant is designed to significantly reduce the workload of removing snow: tilting panels automatically let snow fall to the ground, and pipes on the ground carrying warm water melt the fallen snow.

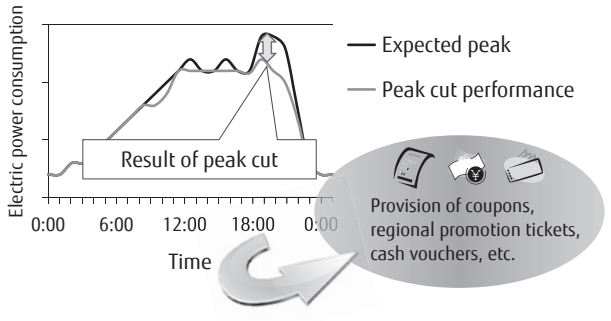

Figure 2
Illustration of shift in demand to cut peak.

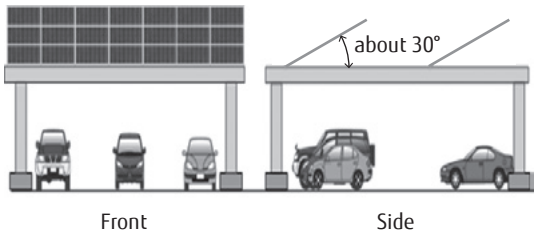

Figure 3
Solar panels steeply tilted to prevent snow accumulation.

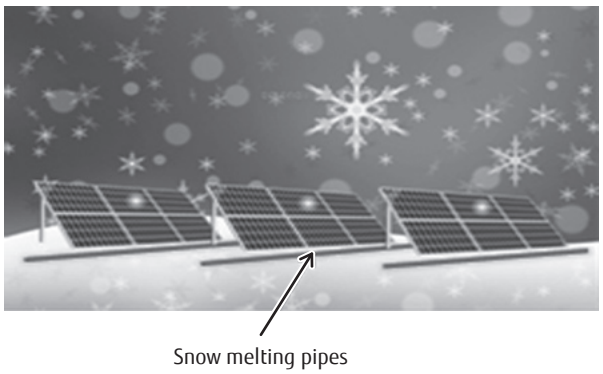

Figure 4
Example implementation of snow-melting equipment.

from revenues received for managing the region's renewable energy power and heat supply facilities and for providing services. It will also come from revenues received for providing support services to the Niigata Yukigunigata Megasolar Power Plant (discussed below). To contribute to the local region, we are also investigating the use of sales promotions such as coupons and regional promotion tickets contributed by local businesses such as shopping malls and other retail facilities. The provision of coupons and regional promotion tickets to ECC service contract customers will lead to increased sales at local shopping malls and retail facilities and thereby channel the economic benefits back into the local economy.

The ECC DR services are due to undergo trial operations from the second half of the 2014–15 fiscal year, once the development of the energy management system (EMS) has been completed. During the introduction of the smart community, the effects of DR services introduced by Fujitsu and Tohoku Electric Power (such as peak cutting through demand shifting) will be identified (including the sensitivity of demand to incentivization), and the needs of customers will be analyzed.

After completing the introductory promotion project, we will expand the DR service menu to gain more subscribers, and then, on the basis of the trend toward revolutionizing electric power systems, we will re-examine the scheme for implementing DR services between the ECC, customers, and electricity companies.

2.1.2 Yukigunigata Megasolar Power Plant

The Yukigunigata Megasolar Power Plant now scheduled for introduction is based on the concept of being able to generate electricity even during periods of snowfall.

The characteristics of this power plant are as follows.

1) As a countermeasure to snow accumulation, the solar cell panels are steeply tilted (about 30° from horizontal), as shown in **Figure 3**, so that the snow naturally drops away, allowing electricity to be generated even in winter.
2) In areas used for parking vehicles, the solar panels are installed high enough so that vehicles are able to enter. The panels are located with due consideration to factors such as avoiding the dangers of falling snow and ensuring there is enough space for vehicles to maneuver in the parking area.
3) In areas not used for parking (such as where buildings have been demolished and the area left vacant), snow-melting equipment is introduced as an advanced snow-clearing system requiring no human intervention (**Figure 4**).

The solar panels installed within the grounds of

the Fujitsu Semiconductor (FSL) Aizuwakamatsu Plant (in the car parks and vacant lots) make effective use of the available space with due consideration given to safety (of people and vehicles) and the ease of maintenance.

The ECC provides the following services to support the stable operation of the Yukigunigata Megasolar Power Plant, which was set up and is operated by the Fuji Electric Group.

1) State measurement services

Provision of environmental conditions such as the amount of solar radiation and air temperature, equipment conditions such as received voltage and current, and fault information such as fault notifications and alerts

2) Monitoring services

Prediction of power generation, revenue, etc., initial response to abnormalities, fault recovery, and periodic reports (performance, etc.).

In addition, we will study the possibility of retaining a portion of the profits obtained from the provision of ECC services to contribute to regional stimulation as part of the incentive capital for DR services as described above. In addition, by locating the ECC operations center in the FSL Aizuwakamatsu Plant, we can help with the creation of jobs in Aizuwakamatsu by promoting the spread of renewable energy and energy management initiatives.

2.2 Coordination of introduction of solar power generation and power storage cells with regional disaster prevention measures

Figure 5 shows the model used to link local disaster prevention measures with efforts to promote the introduction of solar power generation and batteries, chiefly in Aizuwakamatsu City.

Through the effective use of electric vehicles (EVs), this model promotes the efficient introduction of solar cells and batteries into disaster prevention facilities. A key feature of this model is that the EVs normally used as official transport in Aizuwakamatsu City can be used effectively as batteries in the event of a disaster.

At disaster prevention facilities, fixed batteries are due to be installed in addition to solar cells in preparation for disasters, but it is envisaged that these facilities alone may be unable to deliver sufficient electric power.

Therefore, a mechanism is provided whereby the ECC constantly collects information from EVs (including their location and remaining battery power) and

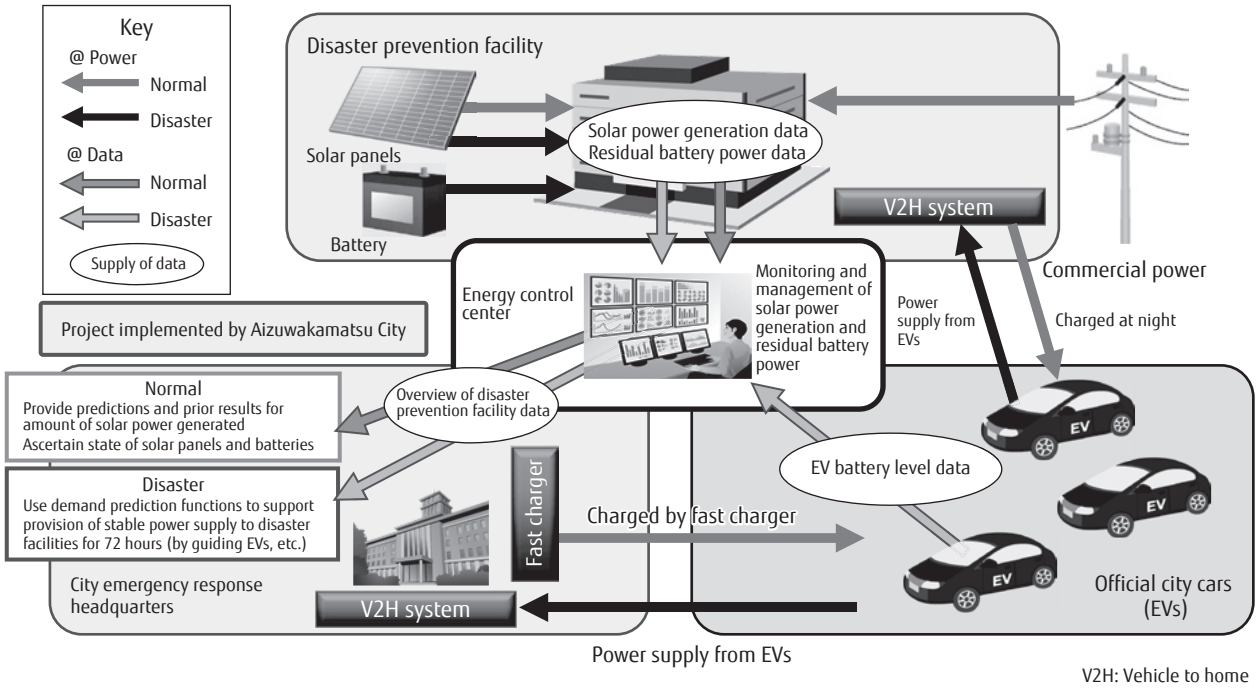

Figure 5
Model of linkage between solar power, battery storage, and local disaster prevention measures.

guides them to suitable disaster prevention facilities on the basis of this information when a disaster occurs.

In this way, disaster prevention facilities are able to obtain electricity from the batteries in EVs as well as from their solar cells and fixed batteries, enabling them to more likely remain powered during electricity outages of up to 72 hours.

2.3 Incorporation of heat supply derived from biomass resources into urban planning

Projects involving the supply of heat or of combined heat and electricity have already reached an advanced stage in Europe. In the provincial cities of Germany, a combined heat and electricity supply model (**Figure 6**) has been developed whereby woody biomass is burnt to generate electricity while at the same time producing thermal energy that is used to provide homes with heating and hot water. The leftover heat is supplied to horticultural facilities and the like. This model has attracted interest due to its ability to create renewable energy while at the same time creating jobs in sectors such as forestry and agriculture.

Since Aizuwakamatsu has a cold climate and an abundance of woodland resources, we looked into commercializing a similar model and using the ECC to provide services to suppliers of heat and electricity (including monitoring and demand adjustment for a stable energy supply).

This enterprise model is expected to not only produce electricity and heat from woody biomass but also to promote forestry and agriculture. In the future, it will be necessary to devise a medium-to-long-term strategy for this project.

3. Future prospects

Although smart community promotion projects have been implemented in various regions as a means of urban planning based on the use of renewable energy, there are many who feel that these projects are pointless unless they lead to regional stimulation and job creation at local authorities and local businesses.

At meetings related to smart community projects, it has been said that the following two things are needed to achieve this aim:

1) Creation of new value by cross-industry cooperation

It is possible to create new value by forging links between different businesses and/or business sectors.

2) Provision of services that take local residents into consideration

The most important ingredient of a smart

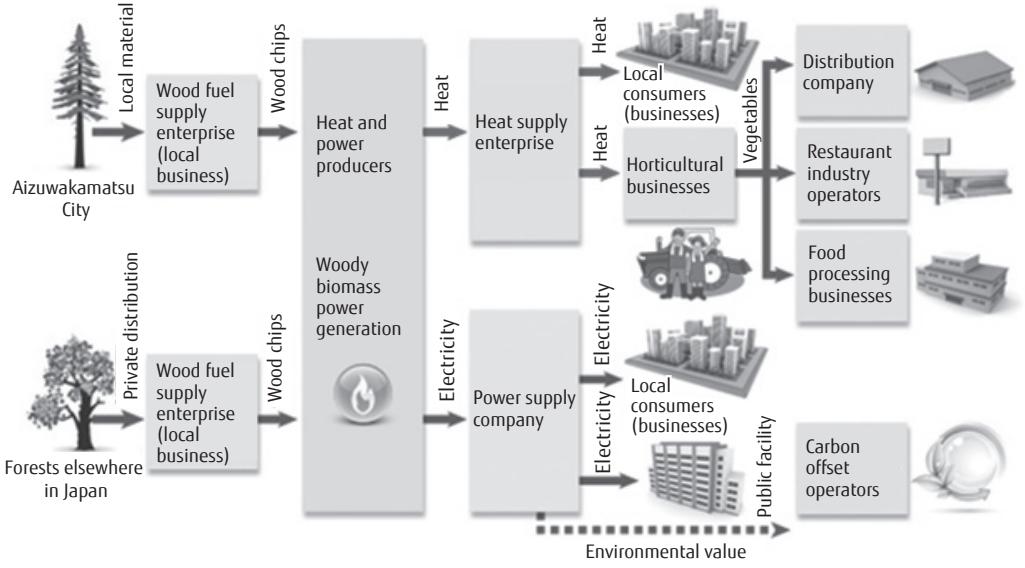

Figure 6
Overall picture of business model.

community is its local population. A business will survive if it can provide services that local residents need.

Given these requirements, we will discuss how it might be possible to construct a smart community capable of contributing to the development of Aizuwakamatsu by building on the foundations (ECC, Megasolar, etc.) of the Aizuwakamatsu Area Smart Community Promotion Project on which we are currently working.

3.1 Business collaboration towards creation of new value

In addition to the Aizuwakamatsu Area Smart Community Promotion Project (**Figure 7**) introduced here, we are also involved in various other projects such as the introduction of a smart grid communication interface (with the Ministry of Internal Affairs and Communications). We are working to use the home energy management system (HEMS) and advanced sensors in urban planning to promote the effective use of energy and to create a safe living environment for local residents.

In the future, through partnerships with these projects, the ECC will contribute to the expansion of renewable energy and the provision of a stable supply of energy for the realization of a smart community in Aizuwakamatsu.

The work being done independently by Fujitsu is discussed below.

We are converting the clean room at FSL's Aizuwakamatsu Plant into a vegetable processing factory, and, in a project assisted by the Reconstruction Agency and METI, we are conducting trial operation of a large-scale vegetable processing factory involving six businesses (including a local business, Aizufujikako Co., Ltd.) and one university, with Fujitsu Home & Office Services Ltd. acting in an auxiliary capacity. We plan to start delivering low-potassium lettuce for people who have been put on a low-potassium diet, such as patients who are on dialysis or have chronic kidney disease, in April 2014.

Our aim is to operate this factory efficiently by

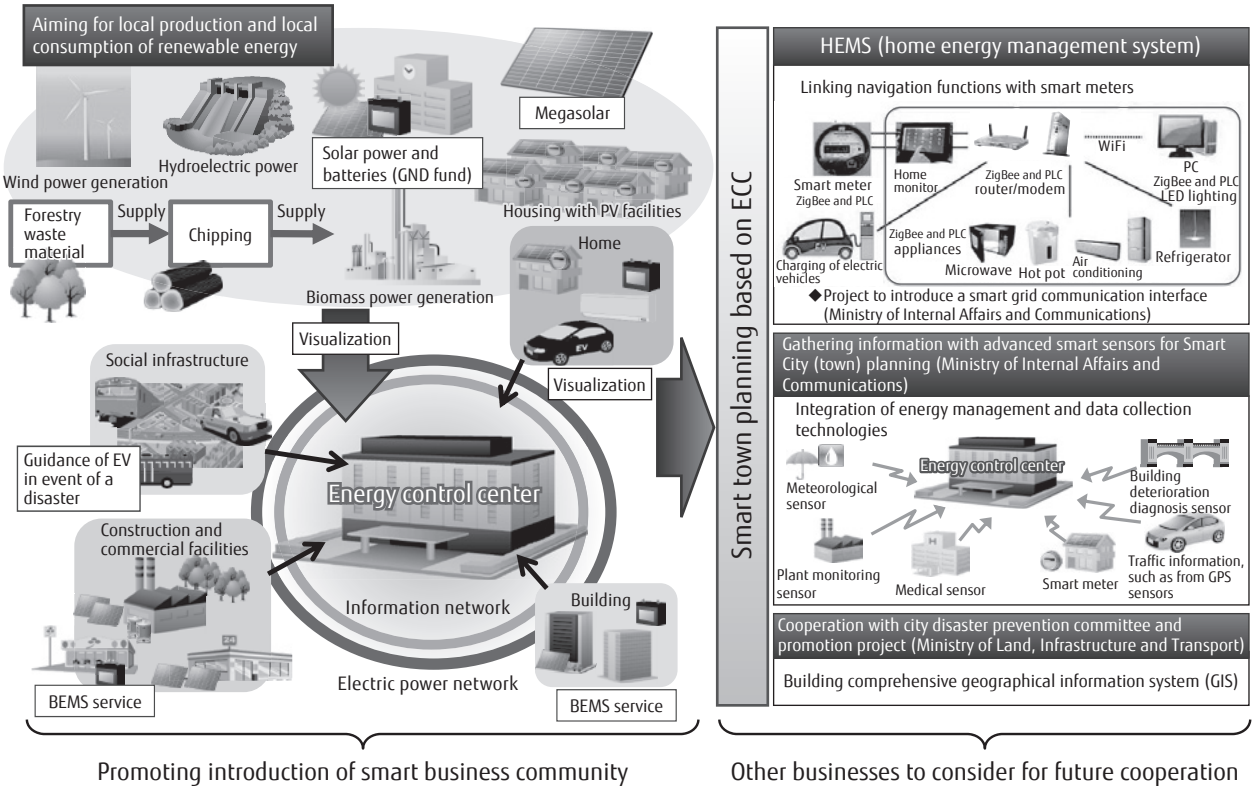

Figure 7
Aizuwakamatsu Smart Community Promotion Project.

exploiting our know-how on matters such as contaminant management that we have accumulated in the semiconductor manufacturing industry in order to provide high-quality vegetables by utilizing Fujitsu's "Akisai"[1] cloud for the food and agricultural industries (reference model).

By concentrating the ECC, the Yukigunigata Megasolar power plant, and the vegetable processing factory at the FSL Aizuwakamatsu Plant in this way, we will be able to pursue studies aimed at providing new regional contributions and stimulation resources resulting from the synergy among these individual facilities.

We are also investigating ways of running the vegetable processing factory in a way that is appropriate for a smart community and that contributes to a stable supply of electricity in the region by utilizing the DR services and other services provided by the ECC, such as avoiding power demand peaks during the summer and shifting the lighting of cultivated plants to the nighttime.

We will also continue to use this project as a source of content for education. By providing a place for hands-on learning where people can hear, see, and experience what happens in semiconductor manufacturing, vegetable processing, renewable energy management, and so on, we will be able to provide schoolchildren of all ages with a greater understanding of renewable energy and IT and possibly spark their interest in these areas. The efforts of smart community businesses in the Aizu region have already drawn inquiries from local schools, and it is highly likely that they have been able to make a local contribution in this field.

Furthermore, we can expect this project to become a focal point for industrial tourism. As a model case of renewable energy utilization, we will prepare content for use in industrial tourism aimed at businesses and regional authorities. By combining daytime site visits with nighttime excursions to Aizu's hot springs, restaurants, and the like, visitors will be able to enjoy their time there while contributing to the local tourist trade.

Aizuwakamatsu City has many other renewable energy businesses that use the area's abundant natural resources such as hydro, wind, and biomass power. We plan to study how collaboration between these businesses and the local authorities can establish model examples for others to use.

3.2 Services needed by local residents

In the initiatives introduced so far, there is no way a sustainable business can be established unless it actually gives people what they need.

At Fujitsu, we are using "field innovation"[2] as a technique for visualizing issues and needs. In the past (and especially in the business arena), we have supported the proposal of measures and the formation of consensus for change and the clarification of issues. In the future, by applying this technique to the Aizuwakamatsu Area Smart Community Promotion Project, we will help to clarify the issues and needs of local authorities and residents.

More details about our efforts in this regard can be found in the article "Smart Community Reflecting Residents' Wishes: Example of Awaji Green Island" elsewhere in this issue.

4. Conclusion

Over three years have passed since the Aizuwakamatsu Area Smart Community Promotion Project was first set into motion in the Aizuwakamatsu region. During this period, we have listened to the opinions of many people from local government, businesses, and the like, and we have sketched out their respective ideas, but putting them into practice would require a considerable amount of time and expense.

The most important thing for keeping people motivated over the long term is to incorporate the opinions of local stakeholders (local residents and businesses) to raise their sense of involvement.

To engage with local residents in this project, we factored in awareness-raising initiatives for them, including visualizations of renewable energy and the use of DR services for regional stimulation (such as coupon-based collaboration).

Through these activities, we are contributing, together with all the local stakeholders to the realization of the Aizuwakamatsu Smart Community. Part of this project was implemented as part of two initiatives sponsored by METI and the New Energy Promotion Council: "Smart Community Construction, Introduction and Support" and "Advanced Agriculture System Verification."

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