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Aiming for Community Development Through Post-Disaster Reconstruction Geared to Environmental Renovation

– Social system innovation in Fukushima –

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National Institute for Environmental Studies, Japan

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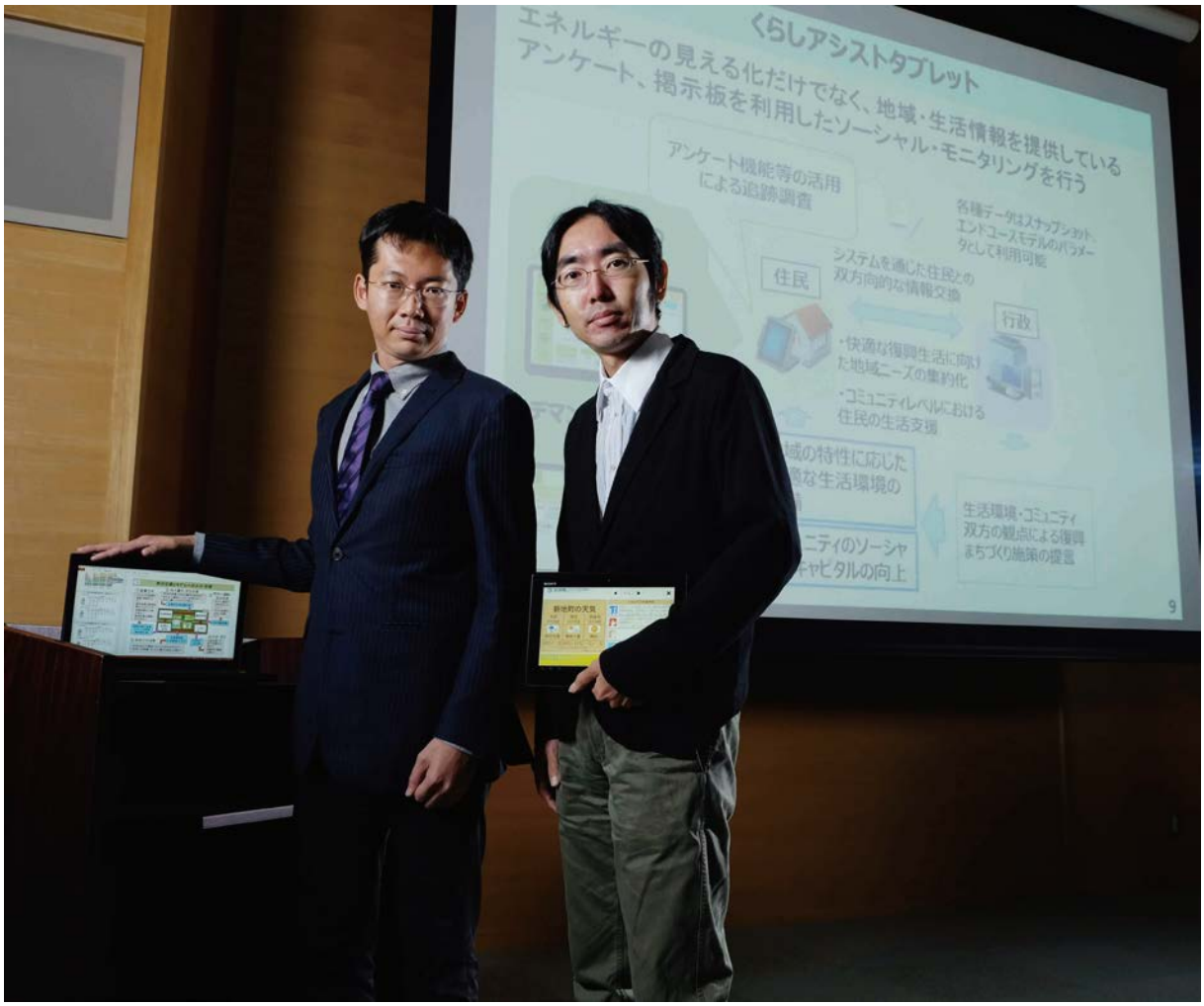
Thanks to the huge efforts of many different parties, intensive reconstruction activities are underway in areas devastated by the Great East Japan Earthquake (GEJE).

Under our Environmental Renovation Research Program, we are conducting research from many different perspectives on implementing environmentally sustainable reconstruction and community development in line with progress of environmental recovery.



Many environmental and social issues need to be tackled to ensure sound community development in devastated areas recovering from the impacts of the GEJE and the Fukushima Daiichi nuclear power plant accident. Because industrial recovery, birthrate and population decline, effective use of local resources, ecosystem conservation and other challenges faced by affected areas are closely intertwined, their solution requires an integrated and multifaceted approach.

Even before the GEJE, the National Institute for Environmental Studies (NIES) had been analyzing the relationship between society, environment and everyday life with the aim of enhancing the outcomes of community development. Since the GEJE struck, NIES has worked with municipalities in the devastated areas to conduct research aimed at supporting reconstruction in a way that takes advantage of the characteristics of the region. In this issue, we focus in particular on our research initiatives in the town of Shinchi in Fukushima Prefecture. Chosen as a “FutureCity”, Shinchi is pursuing initiatives to create a low-carbon, energy-efficient society and disaster-resilient communities. To support these initiatives, we have leveraged ICT (Information and Communication Technology) to deploy a two-way system for sharing a wide range of local information that helps improve quality of life in the recovering community, and have developed a socioeconomic simulation model that considers changes in lifestyles and workstyles. We introduce the outcomes of this research below.

CONTENTS

Cover photo: NPO Miraito

Researcher Interview

Toward community development for a sustainable future

NIES has been conducting research on various scales to assist municipalities in their efforts to recover from the GEJE and build even stronger communities. Kei Gomi and Shogo Nakamura of the NIES Fukushima Branch Preparatory Office's* Environmental Renovation Research Program are pursuing research on environmentally friendly reconstruction for community development aimed at restoring and renovating the environment of affected areas. As an aspect of this research, they are helping the town of Shinchi to draw up a blueprint for leveraging ICT to develop a low-carbon community and tackle issues related to the town's increasingly aged population, and to formulate a long-term comprehensive plan for post-reconstruction community development.

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Adapting research goals to flexibly address local development needs

Q: When did you join NIES?

Gomi: I joined NIES in April 2014. Before then, I was doing research at a university on the simulation of global warming countermeasures.

Nakamura: I joined NIES a month after Dr. Gomi, so he's my senior, if only by a little. I majored in rural planning a field of agricultural engineering, and was doing research in revitalizing mountainous rural communities.

Q: Did you start focusing on your current research as soon as you arrived at NIES?

Gomi: Yes. That was, after all, the reason we joined NIES – to participate in the research project to support post-GEJE reconstruction. I started working at NIES on April 1, and visited Shinchi for the first time two days later. Although I didn't understand the situation well, I nevertheless found myself participating in a meeting with our local government handlers there.

Nakamura: By the time I joined NIES, quite a lot of progress has already been made on our cooperation with Shinchi. The situation in a town undergoing constant reconstruction can change daily, so I

try to keep abreast of such change and think about what needs to be done accordingly.

Gomi: You need to keep your eye firmly on the goal, but at the same time be flexible enough to go with the flow.
Nakamura: Yes, it's very much a matter of keeping an open mind and responding to changing circumstances.
Q: What did Shinchi look like when you first saw it?
Gomi: There are still some evacuees even today, but three years had gone by since the quake, and the town appeared to be settling down. A lot of progress had already been made on redevelopment in the immediate surroundings of the town hall, but looking beyond, there was still a broad expanse of land where everything had been swept away by the tsunamis. Even though much of the debris had already been removed, and the first phase of reconstruction have been completed by that time, you couldn't help but be awed by the sheer immensity of the destruction caused by the tsunamis.

Coastal region (photo: NPO Miraito)

Reconstruction in progress
(photo: NPO Miraito)

Nakamura: The town is currently in the process of shifting to higher ground. And Shinchi Station, which suffered extensive damage both to the station building and the rail line, is due to resume operations at the end of 2016. Work is progressing on developing the district around the station, including the building of a district energy facility.

Using community monitoring and simulation to aid reconstruction planning

Q: What does the community monitoring that you are doing in Shinchi involve?
Gomi: A lot of progress has already been made on housing and other infrastructure construction in the devastated areas of Shinchi. One component of this redevelopment is the Smart Hybrid Network, which is a community information and communication network linking houses, public facilities, factories, and energy facilities. (See Column 1). The aims of this network are to enable sophisticated, efficient use of local energy resources, support healthcare and welfare activities tailored to the aging population, and boost the town's community functions.
Nakamura: We're currently testing a Life Assist Tablet system on this community network. Residents are provided with tablets equipped with an app that we developed to enable local government employees and residents to share all sorts of local information. We're also monitoring power consumption in real time through terminals fitted in households, and getting local people to respond to questionnaires.
Gomi: I'm also collating various environmental, social, economic and other statistical data along with maps and other information in a database, and am in the process of applying previous research I did on modeling to the affected areas. This involves simulating the population, economy and other aspects of the whole town to analyze what the future holds for the town's industry or population, and the impact of related policies on maintaining the population and stimulating industry. The outcomes of this research are being used to help with formulating the town's comprehensive plan. (See Column 2).

Column 1.
The Smart Hybrid Town vision being pursued by Shinchi in Fukushima Prefecture

Shinchi in Soma County, Fukushima Prefecture, is a small town of 8000 with an area of 47 km². During the Great East Japan Earthquake, about 20% of the town area was inundated by tsunamis that took the lives of 116 people, and caused extensive damage, including the total or partial destruction of 577 houses.

Shinchi's selection as a Future City prompted the conclusion of a Basic Cooperation Agreement in March 2013 between the town and NIES. NIES is currently working with Shinchi on research aimed at creating a community in which environmental sustainability is pursued hand in hand with reconstruction and economic development.

Shinchi has also been designated as a Reconstruction Model City, and has drawn up a Smart Hybrid Town plan as its reconstruction plan. Under this plan, Shinchi is seeking to combine ICT with social mechanisms that underpin communities to restore local community bonds weakened by the evacuation and relocation of residents after the GEJE. The idea is to use tablets, smartphones and other devices to link local residents with the municipality, research institutions and businesses via the Internet, and share information on the environment, energy and everyday life. The municipality is aiming to build a prototype interactive community information platform that enables it to quickly learn about local resident needs and opinions.

For the (1) Local Energy Action Support Network in Figure 1, energy consumption monitoring systems deployed in houses, public facilities, commercial facilities and elsewhere encourage energy conservation. Other devices also monitor solar and other renewable energy generation in real time. This data is aggregated at the (4) Smart Hybrid Center Project to create a community information network that constitutes a distributed energy system that is not only energy-efficient but also resilient to disasters. Energy systems that use this kind of information system are commonly referred to as smart communities, but because the system being envisaged for Shinchi will also enable the sharing of local community, business, environmental and other information as well as energy, it has been named "smart hybrid". This system is being deployed in the redevelopment zone planned in conjunction with the restoration of the rail line with the aim of providing Fukushima Prefecture with a leading model of societal innovation to share with the rest of the world.

The purpose of the (2) Aging Community Support Network is to address issues related to the increasing age of the population and make life easier for elderly residents by enabling communications and sharing information on club activities and other everyday support services.

The planned (3) District Transportation Action Support Network will be an advanced public transportation system that will match positional information of community buses, on-demand taxis and other vehicles equipped with GPS systems with user needs through the Smart Hybrid Center.

In addition to NIES, Shinchi is also working with Fukushima Prefecture; universities; the Ministry of the Environment; Ministry of Economy, Trade, and Industry; energy businesses; manufacturers; IT businesses; and others on a variety of projects aimed at realizing the overall vision.

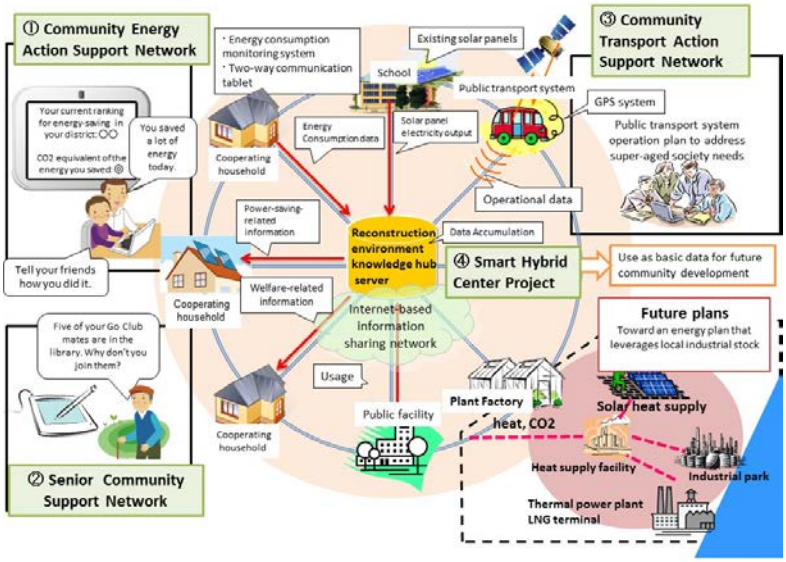

Figure 1. The Smart Hybrid Town vision being pursued by Shinchi in Fukushima Prefecture

Municipality employee explaining reconstruction efforts

Visiting a tomato cultivation facility

Q: What's the most difficult aspect of simulating the future?

Gomi: Well, since Shinchi is a relatively small municipality, the everyday life and economic activities of local residents tend to spill over into surrounding areas. This means that relationships with surrounding municipalities have a major impact. I also found that some of the data that I needed for simulation was not available. Another thing is that the results of this research are to be used by local government personnel who don't need really scientifically complex simulations, so I've developed a new model that is as simple as possible while at the same time covering all essential aspects.

Q: Did you manage to collect all the local data you need?

Gomi: Yes, thanks to the cooperation the people of Shinchi, we managed to do a pretty complete job. We also now have two years' worth of power consumption data from our monitoring, which is enough for simulation. The next stage is to carry out monitoring in facilities other than households. From fiscal 2015, we enlisted the cooperation of factories and such like to start monitoring them, but moving forward, we also want to expand our survey to investigate energy consumption patterns in various other places including the town hall, schools and hospitals.

Nakamura: From spring 2016, the town's public facilities are being monitored under a separate project, and by combining our research with that project, I think we can help put together a picture of energy consumption across the whole municipality.

Gomi: We've obtained detailed energy data from rural districts as well, and since this is the first of its kind in Japan, it should be useful in formulating policy for cutting carbon emissions across the country as a whole. We're currently looking into ways of making use of this data to simulate implementation of a low-carbon society.

Nakamura: For example, a distributed energy system for the district is being deployed in conjunction with the reopening of Shinchi Station on the Joban line from the end of 2016, enabling energy generated in the district to be consumed within the district. Predicting energy demand is an important aspect of ensuring the stable operation of this system, and the results of the monitoring we're carrying out in Shinchi will play a role in this process.

Q: What kind of things does simulation shed light on?

Gomi: It's useful in providing a picture of the whole community for considering how the town will change over the span of decades. It enables us to use past and present data to extrapolate to the future and consider how the town will develop. We're also adapting this simulation technology so that it can be used in other locations in addition to Shinchi. We're aiming to enable it to be used for discussing the feasibility of targets and analyzing the effectiveness of policies when drawing up comprehensive plans for specific localities. Dr. Nakamura's monitoring research using the information network is a grass-roots approach that involves door-to-door visits and such like, while mine is the exact opposite approach, which means that we complement each other.

Column 2.
Model analysis for the comprehensive consideration of environment, society and economy

The consideration of regional reconstruction from a long-term perspective requires analysis of the long-term outlook for industry and population of the country or region concerned. Environment ranks alongside society and economy as one of the many challenges facing countries or regions. Many municipalities in the process of reconstruction also face the issues of aging population and future population decline even if they manage to achieve reconstruction goals. To achieve their goals, municipalities need to consider many different issues in addition to environmental issues, such as reducing carbon emissions and recycling resources, so as to ensure they achieve targets for sustaining population, stimulating industry, developing transportation infrastructure, and so forth while simultaneously meeting environmental targets. With the population of Japan as a whole in decline, municipalities that fail to enhance their appeal will likely see local residents moving away to other communities with more to offer. Communities can also be revitalized by people settling in them to take up job opportunities in surrounding industries or to work at or attend educational facilities.

We have accordingly developed a model for simulating the way communities can achieve housing, industrial and other targets in addition to local environmental targets, including commuting to workplaces or schools outside the community. This is the “Community Snapshot Model” also introduced in this issue’s Summary.

This model first looks at what kind of industrial development is feasible for the region concerned. In Fukushima Prefecture’s Hamadori region, a low-carbon industrial complex with a new type of distributed energy facility at its core would be one option. The model then determines the number of people required by the chosen industry. This in turn enables estimation of the number of people who will reside in the community. The percentage of people who will work in surrounding localities, and people who will commute from those localities also needs to be considered at this stage. Furthermore, if people living in the community do a lot of shopping, industrial production in the community will increase, giving rise to more jobs, and thereby population growth and concomitant growth in consumption. This kind of effect also needs to be calculated.

The model will also analyze the age and gender of workers and residents, calculate the number of children likely to be born. Given a specific population target, this model can then be used to determine the amount of industry required, the number of people commuting to work outside the community, the amount of housing required, the number of people in each age group likely to move in or move out of the community, and so forth. These then become the levels that should be achieved, and can be applied to the consideration of community policy targets.

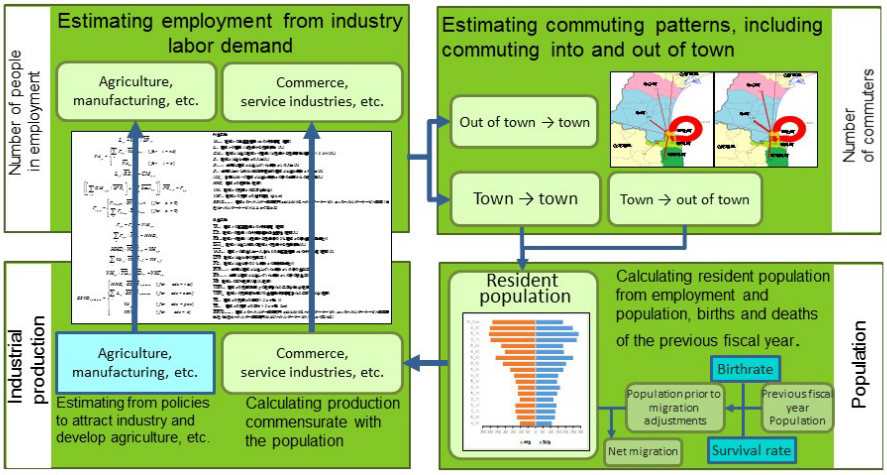

Figure 2. The Community Snapshot Model

Using regional data to express the relationship between industry, employment, commuting and population as simultaneous equations for estimating economic activities and population under specific conditions. For example, this model enables quantitative calculation of the relationship between environmental industry-driven reconstruction and long-term regional population stability

Contributing to environmentally sustainable community development

Tablet workshop

Using a Life Assist Tablet

Q: What exactly can you do with the Life Assist Tablet system?

Nakamura: The system contains two key functions—one providing everyday life-related assistance, the other, energy-related assistance. The purpose of the life assistance function is to support the local community by sharing information, while that of the energy assistance function is to promote energy-saving and reduce carbon emissions through visualizing household electricity consumption. The life assistance function is intended to help strengthen local community bonds by enabling local residents to share all sorts of community-related information. The evacuation of residents to distant locations as a result of the nuclear accident and relocation of residents to higher ground to avoid tsunamis have between them had the effect of weakening local community bonds. We're pursuing research to test the hypothesis that tablets and other ICT devices can be useful in restoring bonds that were sundered when the disaster scattered previously close-knit communities. We're still very much at the trial and error stage, working with municipality personnel, system developers, local resident monitors and others to consider the kind of system we eventually want to create.

Q: How many households are acting as monitors?

Nakamura: Our target is 100 households, and so far we've recruited about 80 households.

Q: Would it be impossible to get all households to cooperate?

Nakamura: Since measuring electricity consumption requires some installation work, and this is still very much an experiment, we're limiting ourselves to households that have answered our call for monitors. The 80 households that we've recruited represent about 3% of the whole town, which is a pretty high percentage for such a project targeting a single municipality.

Q: What is the aim of the Life Assist Tablet system?

Nakamura: Visualization of power consumption through the energy assist function is proving to be somewhat effective, with monitors reporting that they've started paying attention to saving electricity. The bulletin board (life assistance function) that we incorporated as a tool for sharing information now carries all sorts of local community information, town hall notifications, disaster-related information and so on, and we're now improving the system to make it easier for residents to post and view information. We're also looking into enabling people to access the bulletin board through their PCs or smartphones. We hope that by making it a system that municipalities can operate, it will play a role in creating an environmentally friendly smart community.

Environmental Renovation Research Program: presenting models for community renovation through supporting reconstruction

Q: How often do you go to Shinchi?

Nakamura: I go about twice a month on average. In March 2015, I stayed for eight days to carry out a door-to-door field survey. This helped me a lot to become acquainted with town hall staff and Life Assist Tablet

Shinchi Town Hall

NIES class on energy held at Shoei Junior High School

monitors.

Gomi: I don't go as often as Dr. Nakamura as my research doesn't involve that much fieldwork, but I meet with town hall staff about once a month to discuss analysis-related issues.

Q: From fiscal 2016, you'll be based in the Environmental Creation Center in the town of Miharu in Fukushima Prefecture. Do you think your research will change as a result of this move to Fukushima?

Gomi: Once I'm living in Fukushima, I think that I'll make new discoveries and be able to meet more often with local people, and I'm sure this will be invaluable for my research. However, it's not as if my research will benefit automatically just by moving. The important thing is for me to become part of the community and engage with it while honing my skills as a researcher.

Nakamura: This community development research that we're doing doesn't have a clear goal, and the methods we use tend to change according to what we set as our goal. But whatever approach we take, our ultimate goal is the same — the sustainable development of Fukushima.

Gomi: We're working not only with Fukushima Prefecture and Shinchi municipality personnel, construction companies and energy businesses, but also with agribusiness, forestry co-ops, manufacturers, banks and other service providers, so this research has brought us into contact with a very wide variety of industries. To do research that's going to be useful to Fukushima's reconstruction, I think it's vital that we sustain this cooperation and generate new synergies in the local community.

Nakamura: Our tablet approach has elicited all sorts of candid opinions from various people in the town, which makes it even more interesting.

Q: Three research programs—Environmental Recovery, Environmental Renovation, and Environmental Emergency Management—are being run at the Environmental Creation Center, aren't they?

Nakamura: Yes. We're all in the middle of discussions at the moment regarding the direction of our research since moving to Fukushima.

Gomi: We're also discussing the kinds of joint research projects the three programs could cooperate on. The other day, we participated in a workshop on joint research topics at which we brainstormed about how the research topics that some of us are pursuing might benefit from being conjoined to others, and such like.

Q: How do you both see your research panning out?

Nakamura: Shinchi is a specific case, and the challenge will be to apply the outcomes of our research there to other localities. There are ideas for joint research with other municipalities, and I hope that we can make use of our achievements here in Shinchi. Anyway, I want to think about how we can use our research in Shinchi as a departure point for the next step.

Gomi: Simulation research requires that you think of all sorts of things in terms of numbers. If the numbers derived from my research here are to be useful to Fukushima's reconstruction, I need to translate them into a form that local people can use, so in addition to being a number specialist, I also need to be a translator of

numbers. I also hope to be able to use simulations even in localities facing difficult problems such as natural disasters or increasingly aged populations to offer the local people broader choices and show them new possibilities in a way that leads to concrete initiatives.

Column 3.
Community development workshops at Shoei Junior High School

Shinchi Municipal Shoei Junior High School, the town's only junior high school, has a student population of about 250. NIES has enlisted the cooperation of Shinchi Municipal Board of Education and Shoei Junior High School to hold two community development workshops for the students of the school.

The views and wishes of the young generation that represent the future of Shinchi are vital to any consideration of a long-term vision for the municipality beyond reconstruction, and the aim of these workshops was accordingly to develop a picture about the kind of community that the municipality's young people wanted to create. The first workshop was held in January 2014 for the first-year students of that year under the theme "Our Vision of Shinchi in 2050". The second workshop was held in December 2014 for second-year students (the same student year as for the first workshop) to draft a more concrete vision for the future of the town in the form of a map under the theme "OurMap of the Future: Shinchi in 2050". Both workshops stimulated lively discussion among the students, the results of which were organized to be incorporated into Shinchi's comprehensive plan.

Figure 3. Example of the output of the 2nd Shoei Junior High School Workshop

Students were asked to provide their opinions on what they hoped would be preserved, and what they hoped would be new in the Shinchi of 2050. Those opinions were then sorted and inserted into a map of the town. The lively discussion among students covered a wide variety of topics from preservation of natural scenery and traditional culture to attracting commercial facilities.

Summary-

Environmental renovation research to support integrated community development linking reconstruction to the future

During the five years that have gone by since the GEJE, much progress has been made on reconstruction projects and initiatives to restore the environment. This progress has in turn increased the need to consider not only the issues that existed before the disaster, but also the kind of development required to provide the local community with a better and more sustainable future. We are conducting research to support the initiatives of the municipality, local residents and private businesses with the aim of implementing a new kind of community development that strikes an ideal balance between society, economy and environment.

Environmental renovation research to comprehensively support all aspects of community development planning

In addition to relatively short-term issues such as the restoration of buildings and redevelopment of railways and ports, environmentally sustainable community development also requires simultaneously addressing more long-term community-wide issues such as community revitalization and the restoration of community bonds sundered by disaster. Under our Environmental Renovation Research Program, we are working with local residents and businesses both on shorter-term goals such as the recovery of population and economic activity within the reconstruction process, and on longer-term challenges applying to the whole community, including the creation of an autonomous district energy system and recovery of environmental resources.

We are also analyzing data related to municipality policies and projects and running simulations on various scales to support the consideration of plans for ensuring that specific reconstruction projects such as redevelopment of the station district lead to revitalization of the future community, and are developing community participation-type methods for appropriately incorporating the views and wishes of local residents in policymaking (Column 3).

Post-disaster reconstruction and formulation of a long-term vision for society

Even before the GEJE, Fukushima was undergoing population decline in conjunction with a declining birthrate and the increasing age of its population. Since communities throughout Japan face the same issues, we should play a leading role in tackling them within the framework of reconstruction while maintaining economic activities and the quality of everyday life in the community. Resolving these issues will require combining technology with social systems and institutions to implement social system innovation (Column 4) in Fukushima; the outcomes can then be applied throughout the country. This in turn will require consideration from a long-term regional perspective of effective housing, education, child support and other policies essential to enabling people to live comfortably while facing issues such as climate change and resource shortages alongside the impacts of the GEJE.

To construct future municipality-level scenarios for population, commuting, industry, and energy, we have developed a Northern Hamadori Snapshot Model as a comprehensive assessment model capable of running complex socioeconomic simulations (Column 2). This model can calculate the level of industrial revival and housing construction required to maintain population, generation-specific resident inflow and outflow, birthrate and other parameters to come up with concrete targets for regional policies. We have used this model, for example, to create multiple scenarios up to 2050 for the town of Shinchi in Fukushima Prefecture that present a concrete and quantitative picture of the kind of industry required to drive reconstruction and local development while maintaining population, including the employment situation and a new energy supply system (Figure 5).

Column 4.
What we mean by social system innovation

Social system innovation is a vital aspect of ensuring the balanced environmental, social and economic development of a municipality undergoing reconstruction. Innovation means giving birth not only to new technologies, but also to new ideas regarding organizations, systems and a great many other aspects of society.

Social system innovation may start with the testing of a new technology. Once verified, the technology can be applied to a particular framework. Since changing an existing mechanism across the board is difficult, the new technology is first deployed in a small-scale model district. The use of a monitoring system to encourage energy-saving that we introduce in this booklet is one such initiative. If in time such an innovation is shown to be necessary or effective, and new systems including legal reform if required are established to support its spread, the innovation eventually becomes a target for society as a whole. Social system innovation is a process involving people in many different positions whereby environmental, social, and economic value is enhanced through the birth of radical technologies and other innovations at the niche level and their subsequent uptake at the social system (regime) level, leading eventually to widespread change at the social landscape level that in turn drives new niche innovation.

We believe that Fukushima can play a leading role in addressing issues related to post-disaster reconstruction by applying the concept of social system innovation.

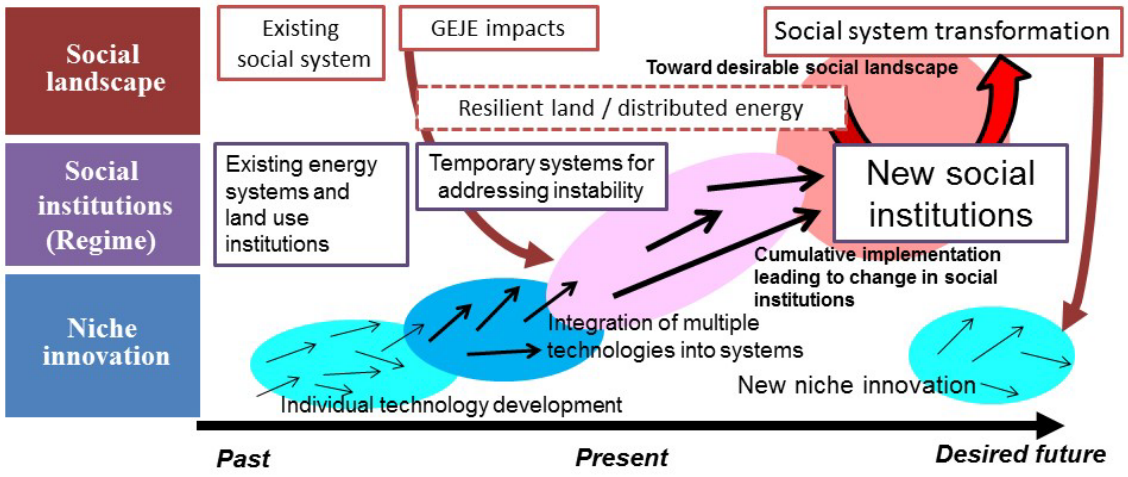

Figure 4. Social system innovation

Social monitoring system development and testing

Providing effective support for reconstruction requires knowledge about the everyday needs of local residents, and local environmental and other information. To this end, NIES worked with Shinchi to develop a Shinchi Life Assist Tablet, and has recruited approximately 80 households so far to serve as monitors for its research. The Life Assist Tablet system is equipped with two key functions.

The purpose of the Community Energy Assist function is to promote environmental awareness among residents by measuring and visualizing household energy consumption in real time. We are also considering easy and fun ways of promoting energy-saving, such as distributing individualized energy-saving reports to each household based on household power consumption patterns, and holding events to showcase outstanding examples of household energy-saving. The results of this monitoring are being collated and combined with existing prefectural and other statistics to diagnose local characteristics. We are also exploring how this data can be used as basic data for the district energy project and reconstruction planning for low-carbon community development, and the further development of this mechanism as new information infrastructure within the reconstruction

community development process.

The other key function, the Life Information Assist function, is a bulletin board for posting town hall information and notifications, event details, and reconstruction and other information useful to everyday life in the community. It also serves as a forum for local residents to share information with each other, and includes a questionnaire function and a community information map for sharing information in a map format. By providing this tool for two-way communication between the local government and residents, and between residents themselves, we are analyzing local characteristics and researching methods for restoring community bonds that can easily be severed in municipalities struck by disaster through evacuation and relocation.

As we continue to deploy the Shinchi Life Assist Tablet system, we are working with Shinchi Town Hall to hold meetings with local residents to explain the system, recruit monitors, visit households, install equipment, conduct follow-up surveys on system usage, and investigate demand for new features. As such, this project could be seen as constituting a new approach to socio-environmental research, one that we are considering applying also to other municipalities.

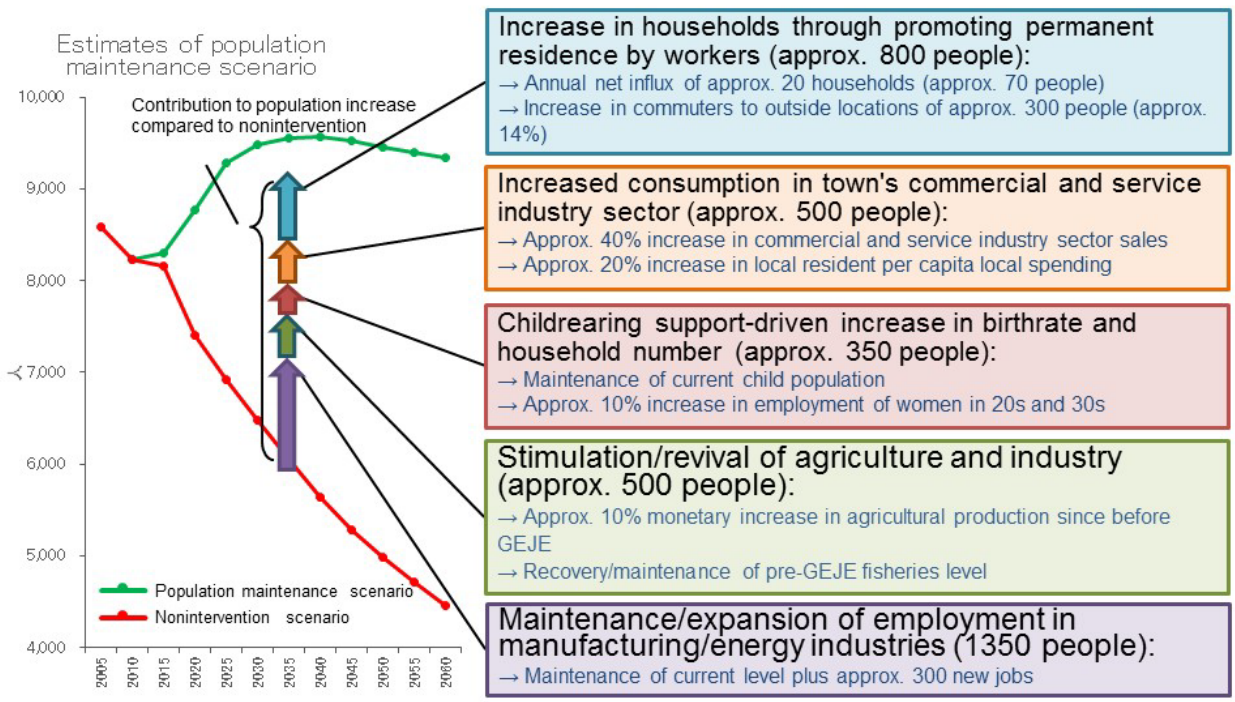

Figure 5. Population projections up to 2060 for different scenarios for Shinchi in Fukushima Prefecture

On our research-

Research initiatives to support environmentally sustainable reconstruction

Five years have gone by since the GEJE struck. With the passage of time, the focus of interest has expanded from the reconstruction of devastated areas and remediation of environments contaminated with radioactivity to consider the kind of development that should be pursued to create better communities. We are leveraging our experience of the disaster and subsequent restoration and reconstruction to conduct research that supports the planning and implementation of initiatives and related projects of local governments, residents, and private businesses with the aim of facilitating a new kind of community development that strikes an ideal balance between society, economy and the environment. While we approach our research from the same perspective as local residents, we also apply a bird's-eye view to our endeavors.

In Japan

Initiatives aimed at post-disaster reconstruction are being pursued in a wide range of fields. The Japanese government established a Reconstruction Agency, and local governments drew up reconstruction plans that they have since been implementing to restore areas devastated by the tsunamis; build new housing; and reconstruct roads, ports, railways, and other infrastructure. In Fukushima Prefecture, progress has been made on recovery from the nuclear disaster and environmental decontamination, and evacuees are beginning to return. In Fukushima Prefecture's coastal Hamadori region, for example, central, prefectural and municipal governments are working with various other parties on implementing the Innovation Coast Scheme, a plan for driving reconstruction in the region by integrating research and cutting-edge businesses in energy, agriculture and forestry.

Since the Fukushima Daiichi Nuclear Power Plant accident, more priority is also being put on rethinking energy systems, and on deploying distributed energy systems that make use of renewable and untapped energy sources and other local resources. Various technologies are now being developed particularly for building autonomous, community-wide energy supply mechanisms that make use of local energy and environmental resources, and using such systems to drive regional revival. For example, projects have been launched in Fukushima Prefecture to integrate local energy resources with cogeneration systems that make effective use of energy by producing both electricity and heat, and further combining the systems with information technology to make them even more efficient. Under the Innovation Coast Scheme, plans are being drawn up not only for large-scale renewable energy facilities, but also for new autonomous community energy systems that combine local energy resources with industrial facilities, sewage/waste treatment plants, and other environmental facilities. Research institutions are working with central, prefectural, and municipal governments and private industry to implement the Innovation Coast Scheme as social system innovation.

At NIES

Under our Environmental Emergency Research programs, we conduct a wide range of research related to disasters and the environment aimed at the reconstruction and regeneration of areas that have been devastated by disasters. The Environmental Recovery Research Program is concerned with research on the environmental recovery of affected areas, including developing technologies for treating and disposing of waste contaminated with radioactive substances, and elucidating the behavior of radioactive substances in the environment and assessing their impacts on ecosystems. The Environmental Renovation Research Program introduced in this booklet supports reconstruction efforts through research on environmentally sustainable means of combining various technologies and policies to revitalize local communities and improve quality of life. Even before the GEJE struck,

we had long compiled various societal and environmental data to run computer simulations and make various policy recommendations for tackling environmental issues. Under the Environmental Emergency Research programs, we use data to apply the findings of existing research to analyze local features. We also conduct research aimed at enhancing reconstruction efforts by leveraging IT to involve local residents in the process of considering future visions tailored to local characteristics.

Under the Environmental Renovation Research Program, we first analyze local environmental data to produce a community environmental diagnosis (Figure 6). The first step in creating a community capable of maintaining its appeal and vitality through leveraging unique characteristics and features is to investigate the kind of resources available in the community. This entails collecting information on such aspects as housing energy consumption and factory waste heat utilization as well as basic information on the natural environment, roads, housing, factories and so forth, and using a geographical information system to analyze the resources available for use. This enables the investigation of how much renewable and other local energy is available from both energy supply and consumption perspectives. In Fukushima Prefecture's Hamadori region, for example, this methodology revealed the potential for use of community energy for an industrial estate or a pipeline linking a newly constructed LNG terminal with Sendai.

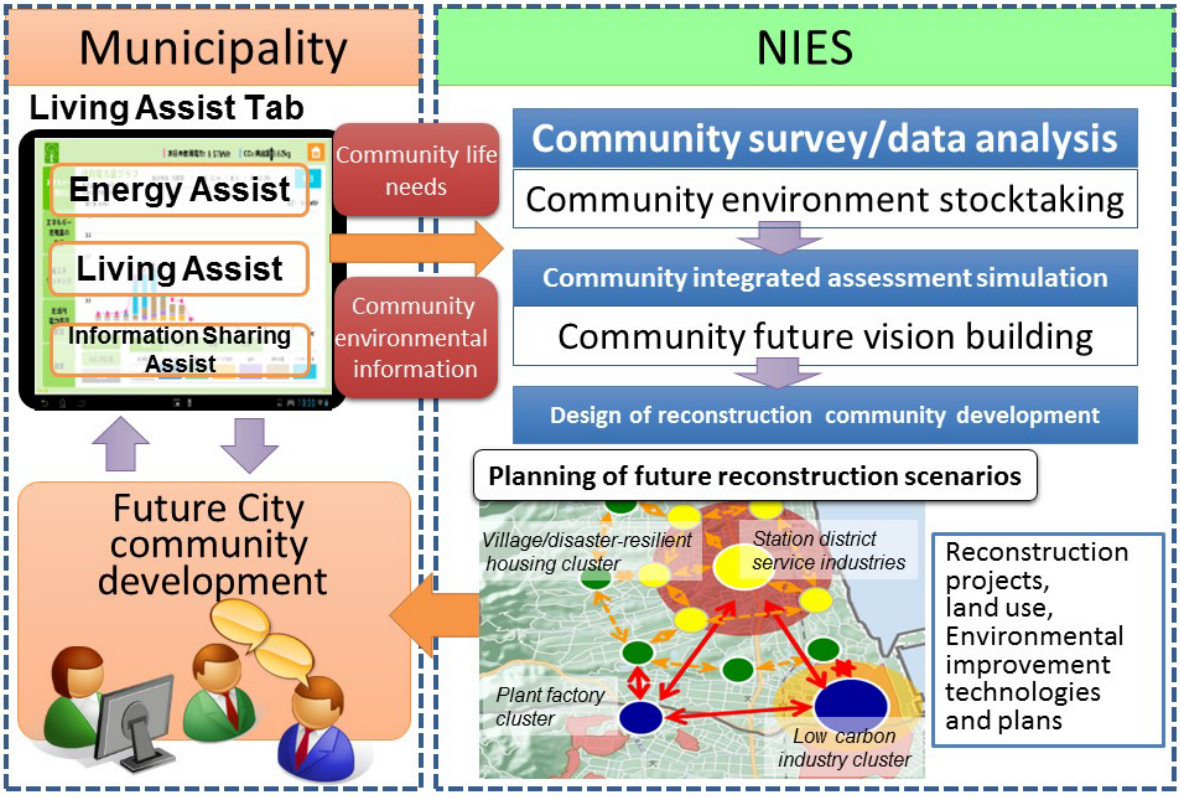

Figure 6. Environmental Renovation Research Program framework (as applied to Shinchi, Fukushima Prefecture)

The next step is to conduct simulations to analyze the actions required to drive the community's evolution into a particular desired form.We help communities to formulate comprehensive plans by using integrated models to simulate future populations, economic factors and other aspects, and consider effective methods for creating communities that continue to be dynamic and appealing places to live on into the future. We are also developing methods for soliciting and organizing the opinions and wishes of local residents regarding the future of their community to incorporate into plans.

To support the formulation of concrete plans particularly for districts destined to serve as hubs for environmentally sustainable reconstruction community development, we are also developing systems capable of simulating spatial plans and energy plans using local community resources. For example, community environmental diagnosis databases and community information network (see below) monitoring results can be used to aid the design of distributed energy systems that leverage the most suitable energy sources or equipment for the community concerned. For the redevelopment of the JR Shinchi Station district being carried out by Shinchi in Fukushima Prefecture following its devastation by the tsunami, we looked into energy systems best suited to low-carbon, disaster-resilient community development, and are considering designs that combine such a system with plant factories, health promotion and other facility development plans (Figure 7). We are also looking into incorporating community recycling and ecosystem rehabilitation components into such plans in the future.

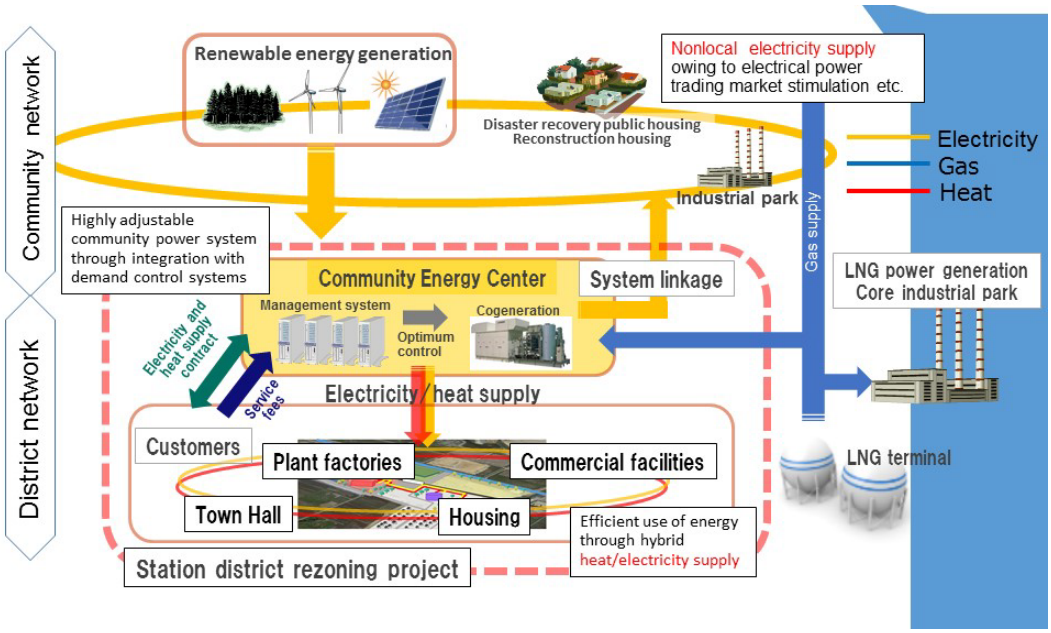

Figure 7. Reconstruction community development design for Shinchi Station district redevelopment

Further, we are conducting research on the use of ICT to grow information networks composed of specialists, municipalities, businesses, and local residents in a particular region to contribute to community development that addresses diverse local problems and breathes new life into the community. For example, in Fukushima Prefecture's Shinchi, we have worked with the municipality and private companies to develop a Life Assist Tablet that includes smart energy system functions suitable even for deployment in a small-scale municipality of about 10,000. The tablets not only enable the visualization of power consumption and CO_2 emissions in user households, but also provide a picture of energy supply and demand in Fukushima Prefecture that could be obtained up to now only through statistical data.

This information is being used to consider the community energy system being planned for the Shinchi Station district redevelopment project in conjunction with the restoration of JR rail lines in the Hamadori region. Together with this Community Energy Assist function, we are supporting the creation of environmentally sustainable local communities by also providing a Life Information Assist function for the two-way sharing of useful local community information in real time to assist reconstruction. We continue to conduct research on the use of this kind of community information network to support the creation of new community bonds in tune with the 21st century.