Higashi Matsushima: Developing a Smart Community and Recovering from the 3/11 Disaster

日本の環境未来都市の実情: 震災復興に基づいたスマートコミュニティへ向けて

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Kosen (National Institute of Technology)

- The age of 15 to 22
- 5 years + 2 years of advanced course
- 55 campuses
- 10,000 graduate students per year
- Region oriented
Damages and the city status at the starting point

M9.0 is the largest earthquake in recorded history in Japan

★earthquake center

Higashi-matsushima City

Damages 1/2 Ishinomaki city
Damages 2/2 Onagawa town
Current status of Higashi-matsushihama city

Right after the earthquake

Present

Photo provided by Higashi-matsushihama city
The tasks to be settled on site

- Disaster prevention system covering the city
  Not clear if new system would work with same or upper level of disaster

- Surveillance system covering the temporary houses
  Not feasible to check the situations of 1,801 houses scattered over 21 districts within 101.9 km²

- Age composition in Higashi-matsushima city
  Old people over 65 years occupies 20.6% out of 42,908 inhabitants
  e.g. solitary death in temporary house has occurred
The future city project in terms of the safety, environment, energy and super-aged society
Future city project of Japan

Purpose (Cabinet Office): To create an unprecedentedly successful practices in technology, socioeconomic systems, services, business models and city development in regard to the environment and preparation for a super-aging society, as well as to realize demand expansion and employment creation, etc. by promoting and developing such practices in and outside Japan, and ultimately to realize sustainable socioeconomic development for the entire nation.
Strategic map of Higashi-matsushima city

“Higashi Matsushima City”
Sustainable growth, Safety and Civil Satisfied and Compact size

Government
Development Management
Investment Management based on Long Term Developing Plan

Residents
Efficient Management by Self-Governing

S rank by CASBEE (Comprehensive Assessment System for Built Environment Efficiency)

1. Reduce Environmental Impact
2. Reduce Carbon De-oxide
3. Prohibition of Overdevelopment

1. Consensus of Environment Preservation
2. Healthy Aging
3. Increase Safety of Town

1. Green & Ecology Tour
2. Job Creation
3. Reduction of Medical Cost

SECTION
CONCEPT
EVALUATION
KEY WORD OF SOLUTION
RESOURCES
INTERFACE
INFRASTRUCTURE

MULTI MEDIA TERMINAL

MULTIPLEX BROADBAND: Electric Cable, Optical Wire, LAN, Community Wireless System

Environment
(Low Carbon, Energy Saving)

Energy Independent, Zero Carbon City
Net Zero of Greenhouse Gas
Multi Utility
Smart Grid
Demand Response
Ecological House
Battery
Fuel Cell
Cogeneration System
Clean Car
Sunshine and Wind
Forest
Recycle Materials
Micro Algae
Rubble

New Power Generation
(MSW, PV, Wind mill)
Biomass, Wave and tide
Environment Education
Green Tourism
Car Sharing

ELDERLY
(Local Medical Services)

Age Consciousness and Seamless Care
CASBEE/Health S rank, Cost of Medical Care
Remote Care System
Health House
Corporative House
Long Term Resort
Care support Network
Barrier Free Town
Community Bus

Medical Data
Broad Band Network
National Scenic Spot Matsushima
Railroad Senskei Line

Case Study: Matsushima Base Camp of Air Defense Force

Disaster Prevention
(Disaster Free)

Disaster Prevention
Seismic Resistant Building, Self-Energy Supply
Houses on upland
Anti Seismic Structure
Disaster Prevention
Command Center
Local SNS
Satellite Communication

Evacuation Tower
Indication of Land Height

Take the Opportunity of the Disaster to Increase a Sense of Community
→ Strengthen Social Capital (Keyword: “Kizuna (Linkage)”)
The model of smart community
The concrete projects and structure of organization for the management

• Stakeholders
  – Government, local body, city council
  – Private companies of different sizes
  – financial institutions
  – Academic organization
  – NPO, NGO
  – citizen

• HOPE for management organization
  Higashimatsushima Organization for Progress and E (economy, education, energy)
Organization of project and HOPE

Higashimatsushima Organization for Progress and E (economy, education, energy)
The activities in FY2014
The activities in FY2014

1) Aware of each task in the region
2) A least one private company registered with citizens in Higashi-matsushima city
3) Improve the skills of citizens according to the needs

Division of recovery from seismic disaster
Division of innovation
Division of business promotion
Division of research and development
To keep activities alive on site

- Make the community sustainable with promotion of industry and ensuring job security
- The activity of the community can expand internationally as local, ‘inter-localization’
- Difficulties are existing complicated codes and regulations, and insufficient resources including project leaders
- The collaboration between stakeholders
- Matching the needs of region to the seeds of private companies
Case 1: The project to improve indoor environment of temporary houses

- The typical temporary houses

1 unit for one family
Environmental problems in temporary houses

- Indoor thermal environment
  The performance of insulation and air leakage area is not enough e.g. heat stress disorder in summer
- Condensation and mold
  60-70mm thickness insulation covers the envelope, the column is steel without insulation
- Indoor air quality affected by combustion equipment
  The kerosene heater exhausts combustion air into
  Most houses do not have the ventilation system with enough air flow rate nor heat exchanger
Necessary features to the system

• Energy self-sufficient
  The power will be lost just after the earthquake and all devices using electricity will not work anymore e.g. battery.

• Securement of data communication
  Losing the information of disaster provides confusion and disruption

• Monitoring system for each house
  As many people are living alone, a monitoring system should be located in each house

• Remote control of HVAC system by local body
  It can prevent from possible danger of the old people by heat stress, etc.
16. Installation of smart-devices in temporary housing
(The situation of Higashi-matsushima)

Smart-device: An independent power supply system combining solar panels, small-scale wind-power generator and storage batteries to provide electricity for lighting, telecommunications and measurement instruments.

Toward creating disaster-resilient city with high environmental performance, efforts to build independent local energy system have been started.
System configuration

- Multi-function portable smart device with battery and wireless communication

- Temporary houses, 1500 in Higashimatsusima city (measuring equipments of indoor environment, PMV (power, comfort index), controlled battery)

- Meeting rooms in 5 districts (measuring equipments of indoor environment, PMV (power, comfort index), controlled battery)

- District of temporary houses

- Internet repeater Ex. Located at near factory, building

- Wireless LAN

- Temperature, humidity, PC, etc.

- Air conditioner battery

- Views of inhabitants

Indoor environment monitoring of temperature, humidity, etc.
- Supply the data to many houses to local body
- Security to avoid solitary death by monitoring indoor environment

Improvement of indoor environment quality by the HVAC control
- Avoid heat stress disorder of the old
- Heat supplied meeting room as the shelter in emergency

Multi-function portable smart device
- Portable and easy installation
- Energy self-supplied (solar, wind, human)
- Components: communication, monitoring, record, generation
- Function of information indication
  - Information supply in emergency
    - Ex. Emergency manual, radio, earthquake, water supply
  - Monitoring security
  - Environment monitoring
    - Ex. Indoor/outdoor temperature/humidity, wind speed/direction, solar radiation, precipitation amount, NO2/radioactive material
- Energy function
  - Power supply: ex. Mobile phone, battery, cell charge

Smart device for houses and offices
- Devices located within house
- Normal mode and emergency mode
- Components: communication, monitoring, record/visualization, generation
- Function of information indication
  - Information reception in emergency
  - Supplying environment monitoring data
    - Ex. Energy consumption, discomfort index, etc.
- Function on energy
  - Automated control of energy equipment
    - Ex. Air conditioner at house, HVAC system in offices

Local body, system administrator, inhabitants, etc.

Holistic data management on internet and cloud
Case 2: Development of compact Agri-server

- Agricultural Support Systems utilizing ICT
  self energy support
  monitoring weather data, etc.

- Staff
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Let's refer to the same farming!!

Agricultural Support Systems (Expert Systems)

Expert

Novice

NO Technical skills

Technical skills

Growth Data

Meteorological data

Agricultural data
Photos of Field Monitoring System

Four Agri-server units and two Power generation systems were installed.
Case 3: The establishment of a limited liability company

- ‘Machi no chikara’ => the power of community
- To provide goods necessary to achieve the smart community in Higashi-matsushima city
- Task oriented activity
- Denmark, Finland, France and Spain
The products for the safety

- Lighting system with hybrid power generator (solar and wind) and battery
- Festival showing solar cooker
- Bio-powder to improve soil quality
- Tsunami alarming system
The products for the energy

- iPAD HEMS, Home Energy Management System
- Solar cooker
- Equipment to set the solar panel on the roof
- Equipment to set the solar panel on the ground
- Power generator using hot spring water and steam
- Hybrid power generator and battery
- Energy conservation system for the electricity
The products for the super-aged society

Collective house

‘super hinge’ Hinge of doors

iPAD HEMS, Home Energy Management System

Cosmetic Humidifier
Current and future activities

Schedule
- 2014.11.8  Hasekura project 2.0 (Spain and Japan) workshop for Japan chapter establishment
- 2014.11.19～21 ISTS 2014, National Taipei University of Technology, Taiwan
- 2014.12.5～7  International Conference of Future City Initiative, Higashi-matsushima city, Miyagi, Japan
- 2014.12.9  JASFA forum for activity report in Sendai
- 2015.2.4  JASFA forum for activity report in Tokyo
- 2015.2.25 Kick-off meeting of the research network of National Institute of Technology
- 2015.3.14 The meeting with OECD for the tertiary education based on KT (Knowledge Triangle)
- 2015.3.14～18 The event and poster exhibition at UN World Conference on Disaster Risk Reduction in Sendai, Japan
- 2015.3.27～28 Workshop on business-academia collaboration, Hsuan Chuang University, Taiwan
- 2015.5  International conference of Smart City in Kyoto

Undergoing projects
- FY2011 to 2015, MEXT, Project for the recovery from the Disaster
- PMI (project Management Institute), Japan chapter, ‘Project management for the recovery from disaster’
- NIT research network: Advanced ICT Agriculture Task, Future Disaster Prevention Task
- MEXT, COI (Center Of Innovation projects, NIT, Tohoku university and Yamagata university
Conclusion

• The framework of future city project for the safety, environment, energy and super-aged society
• The framework of organization for the management, HOPE and some activities
• To collaborate with stakeholders
• To match between the needs in region and the seeds of private companies
• To grow the leaders who manage the project
Thank you for your attention
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