Approach to achieving resilient and smart cities

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SHIMIZU CORPORATION
About Shimizu Corporation

Founded 210 years ago, Shimizu is one of the largest Architecture / Engineering / Construction firms in Japan.

Shimizu Corporation (Consolidated Accounting for FY 2012)
Founded : 1804
Net Sales : US$ 15,043 million
Ordinary Income : US$ 184 million
Employees : 15,616 (As of March, 2013)
Business Line : Building, Civil Engineering, Engineering, Construction, Real Estate Development
Corporate Slogan : Today's Work, Tomorrow's Heritage

International Business Network

Head Office
Tokyo, Japan
Approach to achieving resilient and smart cities

1. Concept
2. Smart city cases
3. Future outlook
1 Concept

- The “ecoBCP” concept
- Shimizu’s approach to resilient & smart urban regeneration
The “ecoBCP“ Concept: Basic concept for resilient & smart cities

Low Carbon/Peak Shaving (eco) + Business Continuity Plan (BCP)

Applying energy conservation measures during normal times to build facilities and communities while assuring business continuity and energy independence in the event of an emergency.

Normal times

- Energy Conscious
- Comfort/Wellness

Emergency

- Earthquake/Tsunami Countermeasures
- Securing Energy Supply

QOL

- Quality of Life
- Comfort, health, safety, security

Energy

- Peak Shaving/Demand Response
- Energy measures

Resilient and smart cities
Shimizu’s approach to resilient & smart urban regeneration

- Staged “ecoBCP” solutions from facility-level to district-level and area-level.
- Increasing community value and competitiveness by enhancing “ecoBCP” and community-help.

### Enhancing “ecoBCP” of disaster prevention facilities

**1. Facility level**
- Energy conservation and the improvement of QOL during normal times
- Securing energy supply during emergency

### District-wide energy utilization

**2. District level**
- Utilizing district heating/cooling/power supply
- Accommodating those unable to return home in the event of an emergency

### Area-wide “ecoBCP” management

**3. Area level**
- Area energy management
- Area business/life continuity management

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**BC**: Business Continuity  
**LC**: Life Continuity 
**DC**: District Continuity  
**CC**: Community Continuity  

- Photovoltaic generation system
- Distributed Generator
- Electricity storage
- Co-generation
- Autonomous disaster prevention facility
- Area management center
- Grid power
- Electricity
- Heat
- Information
2 Smart city cases

- Kyobashi Smart Community
- Kesennuma Smart Industrial Park
- Chubu University Smart Campus
- Smart building demonstration project
2. Smart city cases: Kyobashi Smart City

- ecoBCP management and enhancing community value and competitiveness in the area around Shimizu’s head office.

**A high-performance, eco-friendly, and disaster prevention facility**

**Facility level**
- A high-performance, eco-friendly office building
- Accommodating those unable to return home in a disaster

**District level**
- District heating/cooling, effective use of waste heat
- Mutual exchange of supplies in the event of an emergency

**Area level**
- Area energy management
- Area business/life continuity management

- CASBEE: rank S  
  BEE score: 9.7 pts.  
  (highest score ever)
- Community disaster prevention facility:  
  Accommodates 4,000 employees and others unable to return home.

- DHC system: comprehensive energy efficiency rate of 1.39  
  (most efficient in Japan)

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## Kyobashi smart city

### Facility level:

**Shimizu’s head office: an ecoBCP model building**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Chuo City, Tokyo</td>
</tr>
<tr>
<td><strong>Completed</strong></td>
<td>May 2012</td>
</tr>
<tr>
<td><strong>Site area</strong></td>
<td>3,000 m²</td>
</tr>
<tr>
<td><strong>Building area</strong></td>
<td>2,200 m²</td>
</tr>
<tr>
<td><strong>Total floor area</strong></td>
<td>51,800 m²</td>
</tr>
<tr>
<td><strong>Floors</strong></td>
<td>3 underground levels, 22 above ground levels, one penthouse</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>110 m</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Reinforced concrete (partial steel frame) Seismic isolation structure</td>
</tr>
<tr>
<td><strong>CASBEE</strong></td>
<td>S Rank (BEE = 9.7; highest score ever achieved)</td>
</tr>
<tr>
<td><strong>LEED</strong></td>
<td>NC Gold</td>
</tr>
<tr>
<td><strong>CO2 emissions</strong></td>
<td>Reduced 58% in 2013 (compared to the average of general office buildings in Tokyo, 2005)</td>
</tr>
</tbody>
</table>
2. Kyobashi smart city:

Area level: ecoBCP management

- Area energy management (EnMS; ISO 50001 certified)
- Area business continuity management (BCMS; ISO 22301 certified) (Model projects of group business competitiveness enhancement: FY 2012, METI)
- Area management with “ecoBCP cloud system (CEMS)”
- District power supply (planned)

- Facility level: Shimizu’s head office
  High-performance, eco-friendly, and disaster prevention facility
- District level: DHC
  District-wide high-efficiency energy utilization
- Planned area
  Area-wide ecoBCP management
- DHC area
- Shimizu’s head office
- District power supply (planned)

METI Subsidized Project
Energy management for a cluster of seafood processing facilities involved in earthquake restoration projects.

Sponsored by METI (Project to promote the adoption of Smart Community technologies).

City of Kesennuma, Ebara Environmental Plant, Smart City Project (Shimizu Corp.), Hachiyo Suisan, Abecho Shoten, Kesennuma Fisheries Cooperative Association, and others.

Using CEMS as requested by the power producer and supplier (PPS) to coordinate power use at 11 seafood processing facilities.

Utilizing EVs and PHVs power to cut peak use and serve as emergency power.
Chubu University Smart Campus

- Stepwise smart renovation at department level
- Installation of micro-grid (PV/CGS/Battery)
- Energy management of department facilities
- Phase-1: Energy saving: 30%/Peak shaving: 24%

Phase-1: Department-A (five buildings)
- Management of Micro Grid
- Dept. energy management
- Automated control of HVAC/Lighting
- Peak shift of Lab. equipment
- Load navigation to Faculty/Staff

Smart BEMS

Faculty/Staff

Navigation

Smart BEMS

Automated control

Manual control

Micro Grid (added)

PV panel

CGS

Battery

Lighting

HVAC

PC

Lab. equipment

Appliance

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US-Japan smart grid demonstration project:

Smart building demonstration project (Albuquerque, New Mexico)

Demand response level -1: Peak-shifting/peak-shaving controls
Demand response level -2: Controls of purchased power as zero
Demand response level -3: Supply of power to the grid

Smart Grid

Community EMS

Power monitoring
Demand response signal output

Solar power: 500 kW
Storage cells: 2 MWh

PNM/DOE

Power
- Photovoltaic power generation 50 kW
- Power conditioner
- Lead storage cells 160 kWh

Heat
- Air-cooled chiller 70 USRT
- Absorption-type chiller 20 USRT
- Cooling tower
- Heat storage tanks

Micro-grid
- Fuel cell CGS 80 kW
- Gas engine CGS 240 kW

Micro-grid controls

Smart BEMS

METI and NEDO Subsidized Demonstration Project

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3 Future outlook

- Achieving real sustainability
- The GREEN FLOAT concept
3. Future outlook

Achieving real sustainability

- **Resilience**
  - Responding to various risks

- **Wellness**
  - Creating healthy and comfortable environment

- **Management**
  - Community revitalization

- **Environment**
  - Responsibility for the planet, community, and people

- **Smart energy**
  - District-wide energy utilization

- **Responsibility**
  - for the planet, community, and people

- **Environment**
  - Wellness

- **Resilience**
  - Responding to various risks

- **Management**
  - Community revitalization

- **Environment**
  - Wellness

- **Responsibility**
  - for the planet, community, and people
3. Future outlook

The GREEN FLOAT concept

A future environmental island floating on the Equatorial Pacific

- **eco**
  - A botanical city that draws on lessons learned from nature

- **Future**
  - A comfortable city even in challenging equatorial climates

- **BCP**
  - A maritime city resistant to disaster

**Carbon minus**
- A botanical city that continually absorbs carbon dioxide
- Food independence, zero waste
- Self-sufficient food supply
- Waste recycling

**A city rising into the air**
- Temperatures at 1,000 m elevation are 26–28°C year-round.
- Cleaning up the Pacific Garbage Patch
- Cleanup and conversion of drifting islets of trash into energy resources

**Floating structure**
- Unaffected by earthquakes or tsunamis
- 100% renewable energy
- Ensuring reliable power supplies, even in the event of emergencies by drawing on space solar power satellites and other energies

**Cleaning up the Pacific**
- Cleanup and conversion of drifting islets of trash into energy resources

**100% renewable energy**
- Ensuring reliable power supplies, even in the event of emergencies by drawing on space solar power satellites and other energies
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