Kashiwa-no-ha Smart City

Developed by MITSUI FUDOSAN CO., LTD.

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CSTD 2015-2016 Inter-Sessional Panel on “Smart Cities and Infrastructure” and Foresight for Digital Development"
Ⅰ．Outline of Development

Ⅱ．Smart City Concept (before / after Great East Japan Earthquake “3.11”) 

Ⅲ．Environmental Symbiotic Town

Ⅳ．Safe, Secure and Sustainable Community

Ⅵ．Encouraging Quality of Life & Business
I. Outline of Development
Kashiwa-no-ha Campus Town in Perspective

- 25 kilometers from central Tokyo, midway between Akihabara and Tsukuba
- 30 minutes from central Tokyo by Tsukuba Express

Brand-new 273 hectare town with an estimated population of 26,000

- Utilizing cutting-edge technologies
- Public, Private, Academics and Residents participant through the development
Current Status of Area Development

Aerial photo of site combined with computer-generated images of District 148 and Park City 2nd Town

Kashiwano-ha Park

Site area: 23,344m²
Total floor: 53,277m²
Office, Commercial, Hotel, Rental residence
Since 2014

“Gate Square”

Site area: 23,344m²
Total floor: 53,277m²
Office, Commercial, Hotel, Rental residence
Since 2014

University of Tokyo

“Park City 2nd Town”
119,000 m² (880 units)

Kashiwa-no-ha Park

Chiba University

“Park City 1st Town”
Since 2009
144,000 m² (997 units)

Kashiwa-no-ha Shopping mall
Since 2006
144,500 m² (180 tenants)

“Gate Square”

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Kashiwa-no-ha Shopping mall
Since 2006
144,500 m² (180 tenants)
Development Blocks of Kashiwa-no-ha Smart City

**Park City 2nd**
[2012 completed]
- Housing: 119,000 m² (880 houses)
- Gate Square
  [Completed in 2014]
  - Commerce, Office, rented accommodation, hotel
- Lalaport Kashiwa-no-ha
  [2006 completed]
  - Shopping mall: "LaLaport" Kashiwa-no-ha

**Park City 1st**
[Completed in 2010]
- Commerce: 144,500 m² (185 shops)
- Housing: 144,000 m² (997 houses)
- Local Bank
- Hospital

**Smart City Museum**
[Opened in March, 2013]

**Urban Design Center (UDCK)**
[Opened in Nov, 2011]

**Residence:**
- "Park City 2nd"
- "Park City 1st"
II. Smart City Concept (before / after the Great East Japan Earthquake “3.11”)
Aiming Low-Carbon and Environmental Friendly Smart City (Energy Saving & Energy Creation, Greenery)

[ Technology oriented issues ]
- Storage Electricity power
- Interactive usage of Electric power
- Resilience of infrastructure and buildings

[ Activity oriented issues ]
- Community risk management
- Business & Life Continuity Plan (BLCP)
- Smart Service Business

Optimum energy use in region with smart energy network

Imimization of quality of life and business

Realization of Sustainable Smart City in Japan with integration of regional Energy × Safe / Secure × Smart Services
Kashiwa-no-ha Smart City expects to show a model to solve world’s common challenges.

- **Environmental-Symbiotic City**
  Solution for environmental & energy problems

- **Health & Long-life City**
  Solution for aging society

- **Innovative City for New Industry**
  Solution for vitalizing the economy

Safe, Secure and Sustainable in cooperation with Public, Private and Academic sectors

Smart Center(2F)  Health & Wellness Station(3F)  KOIL(6F)
Ⅲ. Environmental Symbiotic City
Roadmap of CO2 Reduction in Kashiwa-no-ha

**CO2 Emission (t-CO2/yr.)**

- Park City 1st Town HEMS (-10%)
- LaLaport BEMS NAS battery ice-storage Air Conditioning Co-gen2ration (-10%)
- Park City 2nd Town HEMS (-10%)

**148th block (- over 40%)**

- Park City 1st Town HEMS (-10%)
- Improvements of environmental symbiosis and biodiversity
- Effective use of natural, unused, and renewable energy (Energy Creation)
- Building of pluralistic energy system which combines various energy sources
- Implementation of energy saving and management system (Energy Saving)
- Low-carbonization with collaboration of users and the community

**High efficiency equipment**

- LED lighting / HE Air-conditioning
- Reduction of small power consumption

**Expansion of renewable energy**

- Mega-solar + 16000kW (32000kW total)

**Large scale installation of energy storage**

- EV battery NAS battery, fuel cell

**Integrated management platform**

- Advanced AEMS
  - Optimize control of whole town
  - Forecasting of demand and power generation
  - Demand response control

**Disaster Base Function**

- Business Continuity Plan
- Life Continuity Plan
- Disaster Base
- Plant factory
- Dispersed power source
- Well water and storage tank

**Progress of town development**

- 21% (2015)
- 80% (2020)
- 90% (2025)
- 100% (2030)

**Large scale installation of renewable energy**

- Mega-solar 16000kW

**Kashiwa-no-ha Model**

- 21% reduction on the demand side in the region
- 42% reduction
- 50% reduction
- 60% reduction

**CO2 emission on BAU**

- 53,000t-CO2

- 25,000t-CO2
- 24,000t-CO2
- 21,000t-CO2
Shopping Mall: Commercial

Energy Generation:
- Renewable Energy
  - PV: 716kw
  - Wind turbine
  - Solar thermal
  - Underground heat
  - Geothermal

Energy Saving:
- Hybrid with Traditional Passive Design
  - Greenery Facade
  - Sun shading design
  - Natural ventilation
  - Evaporating pavement
  - Cool/heat tunnel

Energy Storage:
- Nas battery: 1800kw
- Li battery: 500kw
- Thermal storage by ICE tank
- Interactive use through car battery

148th Block: Office, Commercial

148th Block: Hotel, Residence

Park City 1st, 2nd: Residence

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Hybrid Design of Passive and Advanced Technology

Automatically AC control system for optimizing each work environment status.

- Task-ambient air-con. control system using IC-tag motion sensor
- Desiccant air-con. system using exhaust heat from co-generation
- Optimization of energy use by accumulating and analyzing data utilizing information technology.

- Hybrid AC with Natural ventilation at the time of uneven load distribution
- Wind volume control with air-con preference incorporated into IC-tag
- Natural Ventilation
- Air-con control by IC-tag judgment based on population concentration

Sensor of Outside air-temp, humidity and Rainfall

IC server

Sensor for IC-tag

Office
Visualization and Advising the Regional Energy Use

 Decrease the regional power consumption by controlling the balance between both demand and supply side through the information of regional energy on a real-time basis.

【User interface】

PC

(Tablet) (Housing)

Control panel (Office) Digital signage (Common space)

Visualization of energy Navigation and advice energy saving methods

Energy Saving Navigation (ex: Demand Response)

Target value

Automatic revision of monthly target value concerning

Integrated Network

Energy consumption info

HEMS

BEMS

Housing

Hotel

Office

Commerce

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NSRI

18th Block

【1st Block】

【2nd Block】

【Lalaport】
Multiple HEMS engaging in Health and Energy issues

Health & Home Energy Management System

- Visualization of health data
  - Record daily health info automatically to ITC and check on PC and smart phone
  - Use of 24-hour wearable wristband life recorders and body composition scale with telecommunication function

- Start demonstration service from Feb 2013

- Visualization of energy
  - Visualize consumption of electricity, gas and water
  - Enjoy energy saving using ranking and SNS
  - Grant regional points in accordance with amount of energy saved

Provide all houses at Park City 2nd Block as standard equipment (880 houses)
Electric Vehicle and Motorcycle sharing

- Sharing electric cars and bikes using ICT system
- Started the service from June 2011, and there are approx. 400 members now
  - Mercedes: Smart × 3, Smart EV × 1
  - YAMAHA: EC-03 × 5, PAS × 2
  - Kashiwa smart cycle (bicycle) × 50

Digital Signage

- Installed 3 signage systems at Kashiwa-no-ha Sta.
- Operated from 31st March, 2013
  - Deliver town info through ICT
  - At normal times, provide life support
  - In case of emergency, provide disaster prevention service through EBS

Added disaster prevention function

- Added Nissan LEAF and EV Power Station
- Equip a “disaster prevention box” which contains AC power source and lighting at EV power station

In case of blackout, supply electricity to digital signage

Disaster Prevention Service for Town

- Info. distribution management server
  - Regional info
  - Town promotion info
  - Event info
  - Energy supply and demand info
  - Traffic info
  - EBS (in case of emergency)
Eco-friendly Activity for Kashiwa-no-ha Community

Propose new life style in cooperation with public and private sectors and schools led by UDCK

Provide system which encourages Residents to participate in smart city. Create sustainable community.

Variety of Activities for Settles

- **Urban Design Center (UDCK)**
  - Hub of organizing smart city with public, private and school

- **Kashiwa-no-ha Eco-club and nature kid’s club**
  - Hub for activity of eco-friendly life style

- **Kashiwa-no-ha Future village (KFV)**
  - Hub for eco-friendly activity by local people

- **Marche couleur**
  - Station market for local production and consumption

- **Kashi-hana (flower) project**
  - Planting activity at the station by residents

- **Low carbon transportation sharing**
  - Provide eco-friendly transportation

- **Regional economic activities**
  - Eco-point for eco-activity

Authorized by UDCK
Visualization of Residential Energy and Eco-points program

HEMS will be installed into 2,500 households around the Kashiwa-no-ha campus station and now got to start eco-points

- Monitor the usage of electricity, gas and water at home
- Ranking is displayed on the monitor

Promoted activities of Eco Club” to raise residents’ environmental awareness

Kashiwa-no-ha Machi Eco Suishin Kyougikai (a local council)

CO2 emission reduction effect achieved by “CO2 visualization project"

15-20% reduction achieved

Local companies
IV. Safe, Secure and Sustainable City (Business & Life Continuity Plan after the Great East Japan Earthquake "3.11")
Smart Grid System  Domestic Micro Grid

- Park City 2nd Town
  - Residence
  - EV&Robby
- Emergency Power Line

- Electric Power Company
  - Gas Co-Generator System
  - Li Storage Battery
  - Solar Panels

- Power Distribution System
  - 148th Block (Complex Building)
    - Commercial Office Building
    - Hotel & Residential Building
  - Normally & Emergency Power Line
  - 148th Block (Complex Building)
    - Smart Center
      - Electric Power Accommodating System (1000kW)
      - Storage Battery (500kW)
    - Generator System
      - Solar Power System (216kW)
- Electric Power Accommodating System

- Emergency Power Line
  - Electric Power Company
    - Solar Panels
    - NAS Storage Battery

- LaLaport Kashiwa-no-ha
  - NAS Storage Battery (1800kW)
  - Solar Power System (500kW)
Smart Grid System

ICT Network (AEMS)

- Park City 2nd Town
- Smart Meters
- BAS
- LaLaport Kashiwa-no-ha
- BAS
- Smart Meters
- Park City 1st Town
- 148th Block (Complex Building)
- AEMS Network
- BAS
- BEMS
- HEMS

148th Block (Gate Square) Smart Center

Area Energy Management system (AEMS)

Smart meter/HEMS

BEMS • BAS
Concept of Power Interchanging (Energy Sharing)

Highly independent energy system utilizing renewable energy, untapped energy, city gas and electric power storage technology, etc.,

(Electric Power Company) Power System

【148th Block "Gate Square"】
- Office
- Retail
- Residence
- Hotel

Heat Source for Hot Water
- Solar Heat
- CH₄ Gas Fuel Generator (16.8kW)
- Bio-gas Power Generator (20kW)
- PV Power Generation (200kW)
- Gas Fuel Co-generation (153.6kW)
- Gas Fuel Generator (2000kW)

Independent Power Resource: Approx. 60%

【Shopping Mall "LaLaport"】
- Retail

Mutual Electricity Power Interchanging

Heat Utilization

Heavy Oil
City Gas
Stored Energy
Renewable / Untapped Energy

Multi Energy Source under Diseases

NaS Storage Battery (1800kW)
PV Power Generation (500kW)
Wind Power Generation (3kW)
BLCP Concept

**Usual**

- **85% Eco-friendly Life**

**Regional blackout**

- Limiting energy supply from energy power company

- **85% Eco-friendly life**
  - Saving Electricity
  - 50% Energy Saving Life
  - Rolling Blackout

**In case of disaster**

- **85% Eco-friendly life**
  - Saving Electricity
  - 20% (*) secure & safe life
  - Regional Blackout

**Day 1**

- 15% Energy Saving Life

**Day 2**

- 85% Eco-friendly life
  - Rolling Blackout

**Day 3**

- 85% Eco-friendly Life
  - Energy supply from Independent power system
  - Cutting 50% (*) of energy consumption
  - “Energy Saving Life”

**“Eco-friendly Life”**

- Cutting 15% of energy consumption

**Energy supply from Independent power system**

- Supply energy to a minimum of life support load and maintain “Secure & safe life”

* Ratio to Eco-friendly Life
VI. Encouraging Quality of Life and Business
Social Experiment for Health Visualization Services

Analyze and Visualize Health Data ⇒ Health improvement and Prevention

**Obtain health data**
- Wristband activity meter
- Obtain exercise and sleep data 24/7 with acceleration sensor
- Fitness scale equipped with wireless data communications

**Telecommunications infrastructure**

**Analyze big data**
- Healthcare analytics server
- Analyze exercise, sleep and fitness data

**Obtain exercise, sleep and fitness data**
- Smart phones and PCs
- Fitness scale equipped with wireless data communications
- Medical institutions database (medical checkup data & electronic treatment records)
- ICT-based data integration

**Telecommunications infrastructure**

**Visualize health information**
- Smart phones and PCs
- Visualize health information

**Exercise frequency**
**Calorie consumption**
**Hours of sleep**
**Exercise intensity (METs value)**
**Number of steps taken**
**Lifestyle pattern**
**Weight**
**Body mass index**
**Body fat percentage**
**Base metabolic rate**
Kashiwa-no-ha Open Innovation Laboratory (KOIL)

Completed in spring 2014

Key Issues

- 1-minute walk from station
- Hands-on support by TEP
- Latest information and active people interaction
- Free use of meeting rooms for residents
- Enriched common facilities such as kitchen and cafe
- Flexible usage of office space

KOIL Park

KOIL Laboratory
Nikken Sekkei has founded in 1900, Over 20000 projects have been designed and planned

Around 2,000 experts globally engage in architecture, engineering, urban planning, civil engineering and consulting.

[SERVICES of Research Institute]
- Policy making, Planning, Supporting the Implementation for Smart City, Sustainable City
- Urban Environment and Energy Design and Operation Support
- Analysis, Simulation for environment and Energy
- Consulting Business Scheme (PPP,PFI)
View of Kashiwa-no-ha Campus City in 2030

Thank you for your attention
Annex