Smart City Planning by NSRI

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Shinji Yamamura
Nikken Sekkei Research Institute (NSRI)
yamamura@nikken.jp
Nikken Sekkei Research Institute (NSRI)

Founded as Consulting firm of Nikken Sekkei Group in 2006

Over 70 experts globally engages in urban and environmental projects.

[SERVICES]
- 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)
1. Background for Smart globally

Global Energy Crisis caused by Economic Growth in Asia

- Primary energy consumption in APEC is 61% of the world
- Energy consumption in China is twice and catching up by India
- The lack of Fossil energy source is coming near (coal :122 years, Oil :42 years, natural gas :60 years ( from a research point of view )

【出典】IEA World Energy Outlook 2013
## 2. Planning Strategy for Smart City

Firstly, Form the balanced comprehensive Smart Target and Concept from the Urban planning standpoint!

<table>
<thead>
<tr>
<th>Urban Structure</th>
<th>Red: Environment, Energy</th>
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</thead>
<tbody>
<tr>
<td>Compact urban design, TOD</td>
<td>Blue: Quality of Life (QOL)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Low Carbon Building</th>
<th>Green: Both red and Blue</th>
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<tbody>
<tr>
<td>Aiming nZEB</td>
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<tr>
<td>Higher priority on Energy efficiency in a Community</td>
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<table>
<thead>
<tr>
<th>Low Carbon Transportation</th>
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<tbody>
<tr>
<td>LRT, BRT</td>
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<td>EV, PHEV</td>
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<table>
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<th>ICT Infrastructure</th>
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<tr>
<td>Security, Safety</td>
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<tr>
<td>QOL (Quality of Life)</td>
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<table>
<thead>
<tr>
<th>Renewable and Untapped Energy</th>
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<tr>
<th>Area Management</th>
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<tr>
<td>Area Energy Management (AEMS)</td>
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<th>Resources &amp; Waste Management</th>
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<td>3R, Thermal use</td>
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<thead>
<tr>
<th>Urban Natural Environment</th>
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<tbody>
<tr>
<td>Environmental Friendly by Greenery</td>
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TOD: Transit Oriented Development, LRT: Light Railway Transfer, BRT: Bus Rapid transit, QOL: Quality of Life
3. Example in EU  From the urban Planning standpoint

Enhancing the QOL (Quality of Life) is the key factor for Smart in EU

＜Retro Fitting＞

Amsterdam Smart City, Netherlands
市内の各所において様々な取組。気候ストリートにおいては、商店主がスマートメーター設置

＜Brand-new Development＞

＜"Smart" oriented concept＞

Lyon Confluence, France
再開発エリアにおいて、省エネビル、エネルギー管理、EV等の実証実験（NEDO協力）

＜"Eco" oriented concept＞

Cuxhaven City, Hamburg, Germany
港湾部における都市再生。建物レベルの環境配慮、歩行者にとって快適な街づくりを展開

＜Smart” oriented concept＞

Royal Seaport, Stockholm
スマートライフをコンセプトとして、ハマルビー・モデルにスマートグリッドを付加

＜Eco” oriented concept＞

Hammarby Shostad, Stockholm
ブラウンフィールドにおける都市再生。ハマルビーモデルと呼ばれる資源循環モデルを実践

Malaga Smart City, Spain
海岸沿いエリアにおいてスマートグリッド、EV、風力・太陽光発電等の実証実験。（NEDO協力）
4. Kashiwanoha Smart City

- Site: Kashiwanoha Campus area (Total 2.73 million m²)
- Planned population: 26,000 persons
- 25km from Mid Tokyo, 25 minutes by Tsukuba EX

Founded in 2014

Kashiwa-no-ha Park

“Gate City”
Site area: 23,344 m²
Total floor: 53,277 m²
Office, Commercial, Hotel, Rental residence
Founded, 2014

University of Tokyo

Park City Kashiwa-no-ha Campus “2nd Town”
119,000 m² (880 units)
Founded, 2012

Kashiwa-no-ha Campus Railway Station

Chiba University

Kashiwanoha Shopping mall
from 2006
144,500 m²
(180 tenants)
Founded, 2006

Tsukuba EX

[Reference] Mitsui Fudosan Co. Ltd.

From 2009
144,000 m² (997 units)
Founded, 2009

From 2009
144,000 m² (997 units)
Founded, 2009

Park City Kashiwa-no-ha Campus “1st Town”

[Reference] Mitsui Fudosan Co. Ltd.

From 2009
144,000 m² (997 units)
Founded, 2009
4. Kashiwanoha Smart City

Comprehensive **Smart** vision of Kashiwa-no-ha Smart City

**Environmental-friendly City**
- Centralizing regional energy management
- Saving, creating, and storing energy
- Encouraging sustainable localization in food and energy
- Low-carbon urban transportation
- Maintaining lifelines during disasters

**City of Health and Longevity**
- Engaging in regional collaboration for disease prevention and preventive care
- Ensuring full social participation of the elderly population
- Using information and communication technology for inter-generational interaction

**City of New Industry Creation**
- Supporting local start-ups that utilize cutting-edge Japanese technology
- Fostering new industries that can provide a solid foundation for a green economy
- Creating a world-leading community of innovative start-ups

**Safe, secure, and sustainable Smart City**
- The Central Business District occupies 4km² with a total construction area of 9,500,000m².
- Planned daytime population is 500,000 and 50,000 in nighttime.
- Construction is ongoing in some part of precedent development area.
Compact and TOD (Transportation Oriented Development)

- Sky garden on mid floor in building
- Sunken Garden (Wellhole space) connecting subway station with lower level of building (Closed type)
- Natural daylight introduced into underground level through wellholes
- Urban vegetable plant factory
- Subgrid for DHC piping and electrical, IT cables
- Subway station
- Greenery design for mitigating Heat island (creating Window path)
- Building Fasade with integrated PV panel
- Greenery on the roof
- PV on the roof
- Sunken Garden (Wellhole space) connecting subway station with lower level of building (Semi-open type)
- Natural daylight from Lighting Duct
- Natural daylight from PV on the roof
- Urban vegetable plant factory groomed by waste urban energy
- Parking and charging site for EV
5. Tianjin Yujiapu APEC LCMT Phase1, Tianjin, China

Prepare appropriate plan of Area Energy Network and AEMS by Mid-term and by Long-term

Local Smart Grid by 2020 - 2030

Heat Supply Network by 2014 - 2020

AEMS by 2014 - 2016
Justify the choice of Smart Measures by comparing the performance of costs and energy efficiency.

Example of cost performance plot:

- Bike sharing
- Load Pricing
- BRT
- Building energy conservation
- DHC
- Transportation-related measures
- Building/energy related measures

Business planning for:
- Technical specification
- Business profitability
- Recruitment requirements

Technologies:
- DHC + Cogen
- Smart Grid (Cogen + PV + biomass)
- AEMS+ Ubiquitous Network
- Transportation measures

Example of cost performance plot:

<table>
<thead>
<tr>
<th>CO2 reduction (t-CO2/year)</th>
<th>Cost (yuan)</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1,000</td>
<td>100,000</td>
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<tr>
<td>2,000</td>
<td>200,000</td>
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<tr>
<td>3,000</td>
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<td>8,000</td>
<td>800,000</td>
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<tr>
<td>9,000</td>
<td>900,000</td>
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For local transport route planning
For establishing design and management guidelines for developers
6. Samui Island APEC LCMT Phase2, Thailand

Aim to become the first Smart Resort Island in Asia

- Island area: 228km²
- Population: 53,000 persons
- Tourists: 900,000 persons/year
- 1 hour flight from Bangkok

SAMUI’S SMART GRID MODEL

- Smart Grid & energy self-reliance
- Building renovation (and new construction) guidelines for resort hotels
- Eco-lifestyle (including eco-tourism)
- Biodiversity and smart use of local natural resources (e.g., coconut)
6. Samui Island APEC LCMT Phase2, Thailand

Aiming the implementation of “Island Grid”

SAMUI’S SMART GRID

Supply side
- Small hydro power
- Wind power
- Biomass power

Smart Grid

AEMS Center

Demand side
- Hotel
- Office
- Commercial
- Residential

AEMS: Monitoring and Control on both Demand side and Supply side

Candidate site: Chaweng area

Electricity power supply

PV
CGS
EV
7. K-City, Krasnoyarsk City, Russia

- K-City project is the development of residential area in Krasnoyarsk City.
- This project is now on going for construction as the first Smart residence in Russia.
- Advanced low energy and Smart life supported by ICT are the characteristic point of view.
Aiming Advanced High Efficient Low Energy Households

30% energy reduction is achievable by installing high performance windows and reducing the outside air load.

- Intake Outdoor air of -50 degree
- Cold
- Warm
- Air-conditioner (for summer)
- Super type window
- Vacuum glass
- Low-E glass
- Coefficient of overall heat transmission
  - Super type window: 0.8W/m²
  - Double-glazed glass: 1.8W/m²
  - Normal glass: 6.0W/m²

- Sensible heat exchanger with pre-heating coil (in the depot)
- Air-conditioner (for summer)
- Convecter
- Warm
- Convector
- Cold
- From DH duct and pipe (in the wall)
7. K-City, Krasnoyarsuk, Russia

Securing House Energy Management, Safety and Security in residence

Comprehensive ICT Network for Security

Face Collation System guards suspicious person.

maintain the security of by carrying out a patrol

Kids hold RFID tag

Sensing receiver catch who is passing

Kids hold RFID tag

Email will be sent to their family automatically and make attention

[Reference] Products of NEC, Hitachi, Toshiba, etc
Annex
Gate Square can cover 60% when temporary power down and 20% when black out in diseases. 3 day’s power supply will be ensured in Kashiwanoha area.
Background

ますます“都市化”が進む

2/3 of world population will live in cities

By 2030;
- 25% of GDP will be from top 10 cities in the world
- 2/3 CO2 emission from Cities
Demand Side

Supply Side

Management

Business as Usual

Urban Structure (with Environmental Planning)

Low Carbon Building

Area Energy

Untapped Energy

Renewable Energy

Transportation

Area Energy Management System

CO2 emission

Intensive urban development

CO2 Mitigation Effects

Hot Water

HVAC

Façade Design

High efficient DHC

River water usage

PV, Wind power, Biomass

BRT, LRT

Innovation in Future (20XX)

Setting Integrated Low Carbon Target both Comprehensive and Subcategories
まちをスマート化するとは？ 空間のサイズとスマート化

Smart technologies in each scale of Urban

- **施設系インフラ**
  - 各用途建物（建物省エネ）

- **エネルギー系インフラ**
  - CGS, DHC, PV, 未利用エネなど

- **交通系インフラ**
  - 公共交通、自動車（EV, HEV）など

- **排水再利用、資源再利用、廃熱利用**

- **ICT系インフラ**
  - コミュニケーション系：モバイル、SNS、ソフトサービス系
  - マネジメント系：AEMS, 交通, 安全
Consider both Direct benefit and Indirect benefit!

NEB (Non-Energy Benefit) を考慮した場合の評価結果例

スマートシティ「実現」のために重要なこと

・QOL向上
・安全確保
・防災性能向上
・環境会計を企業会計に組込み促進