Sakai: SDGs Future City, Environmental Model City

February 24, 2019
Sakai City Hall
Overview of Sakai

Sakai is located nearly in center of mega-consumption 20-million-resident Kansai area.
It has been an ordinance-designated city for 13 years since 2006.

Population: 833,544
Area: 149.82 km²
(As of Jan. 1, 2018)
Main industries of Sakai

Sakai is major foothold, covering approximately 70% of Kansai energy.

Clusters of industries characterized by waterfront and inland areas respectively

Waterfront area

- Heavy/chemical industries
- High-tech/environmental technology industries
- Large-scale distribution facilities
- Japan's largest liquefied hydrogen plant

Inland area

- Cutting tools, bicycles, incense sticks, and other traditional industries
- Metal product manufacturing industries
- Production equipment manufacturing industries

Sakai City Hall

Waterfront area

Inland area
Main industries of Sakai

■ Value of manufactured goods shipped per capita (compared among ordinance-designated cities)

Value of manufactured goods shipped per capita (4 or more employees)

No.1

3.89 million yen

Source: 2017 Census of Manufactures

Value of manufactured goods shipped: Total of "value of manufactured goods shipped," "processing fee income," "repair charge income," shipments of "scrap and waste from manufacturing processes," and other income for one year
Continuation of traditions: History and culture in Sakai

Mozu tombs

Sakai Plaza of Rikyu and Akiko (cultural tourism site in Sakai)

Site of Sen-no Rikyu's residence

Akiko Yosano literature monument
June 2018: Selection as SDGs Future City

"Founded on a spirit of freedom and autonomy, a city where anyone can be happy, healthy, and play an active role"

Vision for 2030

As represented by the Egoshu of Japan’s medieval period, the people of Sakai believe in governing themselves, maintaining peace, and using international exchange to build prosperity. This spirit of freedom and autonomy continues to this day.

Utilizing this spirit, enthusiastic business operators are actively engaging in energy and the environment, healthcare, and other growth industries and new fields, and are creating new businesses.

Thus, vibrant local industries are creating new employment and business opportunities, and everyone is playing an active role. Furthermore, coexistence with natural environment, and enhanced childcare and school environments, parents can give birth and raise their children with confidence and reassurance. At the same time, the city’s enhanced health and medical system is a comfort to older people and another reason why so many people settle here.

Sakai’s fascinating historical and cultural resources also draw in many people from both within and outside Japan. And with the city’s keenly autonomous residents actively engaged in community development efforts, Sakai is bustling and prosperous.

Sakai is a sustainably developing city: its bustle and prosperity attract people and business, which leads to further industry development.
2009: Selected as Environmental Model City

Formulation of Sakai Environmental Model City Action Plan

Formulation of Sakai Global Warming Countermeasure Implementation Plan (Area Measures Edition)

First plan period: 2009-2013
Second plan period: 2014-2018

Also, Environmental Model City Action Plan (Formulated in August 2017)

Greenhouse gas reduction target: 27% reduction by FY2030 (compared to FY2013)

- Industrial structure transformation (industry)
  - Achievement of both environmental conservation and economic growth
- Urban restructuring (transportation)
  - Formation of low-carbon urban structure
- Creation of environmental culture (consumer)
  - Creation of low-carbon lifestyle
**Low-carbon urban development strategies for Sakai** (prepared in March 2015)

Promote low-carbon initiatives via community development opportunities. Use energy efficiently via area energy networks.

- Improve energy use efficiency via reconstruction and upgrades.
- Promote use of exhaust heat and other nonutilized energy.
- Promote use of solar and other renewable energy.

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**Sakai Local Energy Policy** (revised in December 2018)

We will strive to improve the city's electricity self-sufficiency and create a sustainable low-carbon society.

- City electricity self-sufficiency in 2030: 26.5%
- Solar power introduced in 2030: 220 MW
Current greenhouse gas emissions in Sakai

Change in greenhouse gas emissions in Sakai

- Total emissions in 2015: 8.81 million tons of CO2
- In 2009, emissions temporarily decreased due to worsening economy related to impact of previous year's Lehman Shock.
- In 2011 to 2013, increased along with rise in electricity emission factor.

Features of Sakai

At about 60%, industrial sector's share of total emissions is large (national average: about 30%).

Change in greenhouse gas emissions

Breakdown of greenhouse gas emissions

- Industrial sector: 58.4%
- Transportation sector: 12.9%
- Consumer sector (business): 13.2%
- Consumer sector (residential): 10.5%
- Waste sector: 2.0%
- Other: 3.0%

8.81 million t–CO₂

*Of this, energy conversion sector share was 2.1%.
Industrial structure transformation efforts (1)

Sakai Solar Power Plant

Key point: Spread of renewable energy use

○ Extent: Approx. 21 ha at industrial waste disposal site = About 5 Koshien stadiums
○ Generation capacity: 10 MW = About 4,000 ordinary homes
○ Panels used: Thin-film solar cells manufactured by Sharp (approx. 74,000 panels)
○ Operation: Since September 2011
○ Managing entities: Kansai Electric Power Company, City of Sakai
Multistage use of recycled wastewater (Waterworks and Sewerage Bureau)

- **Multistage use within one facility**
- **Combined use** of recycled wastewater as heat and water source

**Key point: Use of nonutilized energy**

- First case nationally

Sambo Water Recycle Center
Recycled water supply capacity: 34,000 m³/day ➤ *One of Japan’s largest*

Aeon Mall Sakai Teppocho

- Hot water (Food court, etc.)
- Indoor air conditioning (cooling)

Water circulation

- Oasis "Seseragi"
- Toilet flush water

Seseragi Water Channel in Uchikawa Green Area

Urban restructuring
Content of support in 2018

- City business offices with high-voltage power reception contract for **less than 1,500 kL** in crude oil equivalent
- Reduction of target office's overall annual energy usage (1% or more) or greenhouse gas emissions (1 t-CO₂ or more) or peak demand electricity (1% or more)
- Maximum subsidy (subsidy rate: 1/3 or less): 2 million yen

### Equipment eligible for subsidy

1. Industrial heat pumps
2. Commercial water heaters
3. High-performance boilers
4. Low-carbon industrial furnaces
5. Transformers
6. Refrigerator-freezers (including refrigerators)
7. Industrial motors (inverter control-type air compressors, etc.)
8. EMSs (energy management systems)
9. Stationary storage batteries
10. Commercial fuel cells
11. Systems that use nonutilized energy (solar heating, geothermal heating, etc.)
Demand monitoring equipment:
For about 3 months in summer or winter, demand monitoring equipment is installed. Based on data obtained, advice is given by specialist.

Compressor:
Current and pressure are measured for 1 week, and compressor load factor is measured. Based on data obtained, advice is given by specialist. Also, if desired, compressor can be tuned, including adjustment of discharge pressure.

Boiler:
Current, pressure, etc., are measured for 1 week, and boiler operating efficiency and load factor are measured. Based on data obtained, advice is given by specialist.
**Sakai public transportation network**

- 6 railway lines, which run north-south.
- Fixed-route buses are centered on routes joining main train stations and surrounding urban areas.

![Sakai railway network and main train stations](image1)

![Main train stations and number of fixed-route bus runs (as of July 2012)](image2)

**Legend**

- 300 runs or more
Odekake Oen (Senior Discount) Program (Transportation Department)

- To promote use of public transportation and encourage older people to go on outings, this program allows Sakai residents 65 and older to ride buses and Hankai Tramway streetcars for 100 yen/ride with "Odekake Oen Card."

Share-ride taxi service (Transportation Department)

Purpose: To provide daily means of transport in area lacking public transportation.
- For city areas far from bus stops and train stations, offers 9 routes to/from train stations.
- 5 runs/day. Advance reservation required for service.

➢ Due to share-ride taxi service, public transportation population coverage = 98%
Effect verification *Targets bus users.

Due to availability of Odekake Oen Bus, 52.4% of people are using bus more.

Due to availability of Odekake Oen Bus, a number of bus services used in a year increased by approximately 2.26 million. (Annual bus use increased by about 16 trips per Odekake Oen Card holder.)

Many users avoid work/school commuting peak hours and thus contribute to more efficient bus service and routes.

Odekake Oen Bus peak usage: 10 a.m. - 12 noon

Economic ripple effect (approx. 5.57 billion yen) of about 8.8 times the cost (approx. 630 million yen)

Annual economic ripple effect of Odekake Oen Bus's total user base: Approx. 12.98 billion yen

Annual economic ripple effect of increased user base due to availability of Odekake Oen Bus: Approx. 5.57 billion yen
Urban restructuring efforts (4)

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<th>Industrial structure transformation</th>
<th>Urban restructuring</th>
<th>Creation of environmental culture</th>
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### Bicycle City Sakai

When Nintoku-ryo Tumulus was constructed, a cluster of skilled iron manufacturers existed in Sakai.

- **Development as major gun producer**
- **Start of tobacco knife manufacture**
- **Bicycle repair using gunsmithing techniques**
- **Domestic production of bicycles**

- **Bicycle City Sakai**
  - Tour of Japan venue
  - Sakai's domestic share of bicycle and parts manufacturing (value of goods shipped): high level

- **Burial Mound era**
- **Sengoku period (Period of Warring States)** ⇔ Introduction of tobacco
- **Meiji era** ⇔ Introduction of bicycles
Adopted measure (example): Community Cycle Project

Cycle ports (dedicated bicycle parking areas) containing shared-use bicycles are set up in 8 locations in Sakai. Community Cycles can be borrowed at and returned to any cycle port. As of end of March 2018, 770 shared-use bicycles were available not only for work and school commutes but broad range of uses, including sightseeing and business.

Adopted measure (example): Bicycle Traveling Environment Improvement Project

Plans are moving forward to improve bicycle traveling environment by creating network that boosts navigability and comfort.

As of end of March 2018, total length of improvements had reached 41.4 km.
Sansou (Bicycle sightseeing)
The purpose is not to "ride a bicycle" but to "use a bicycle" slowly and leisurely, as if walking, in a new, enjoyable way to experience history and culture, enjoy good food, etc.

- Concept © Link attractive spots scattered about Sakai via "Sansou (bicycle sightseeing)."
- Improve city's navigability and link that to increased vitality.
- Link people with other people.
Urban restructuring efforts (6)

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**Introduction of next-generation automobile**

**Key point: Reduction of CO₂ emissions from automobiles**

**Introducing fuel cell vehicle (FCV) as official car**

- Provide vehicle body with wrapping showing simple explanation of FCV mechanism, and have employees drive it in and out of town as (shared) pool car to broaden publicity.
- On weekends and holidays, publicly promote by displaying with panel at events.

- Toyota MIRAI
  - 5-year maintenance lease
  - General competitive bidding (3 participants)
  - Provided with wrapping concisely showing mechanism: "Driven by electricity generated from hydrogen and oxygen."

- Hydrogen energy experiential event!
  (Oct 21-22, 2017, Aeon Mall Sakai Kitahanada)

- Minami-ku Fureai Festival
  (Nov. 12, 2017)

FCV: Vehicle whose motor runs on electricity generated from chemical reaction between hydrogen in fuel and oxygen in air.
### Environmental culture creation efforts (1)

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<tr>
<th>Industrial structure transformation</th>
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<tbody>
<tr>
<td>Solar power generation in the city (at elementary, junior high schools, etc.)</td>
<td>Key point: Spread of renewable energy use throughout city</td>
<td></td>
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</tbody>
</table>
Environmental culture creation efforts (2)

Project to Create Harumidai Eco-Model Town

Community development efforts

- Facility layout plan that also considers passive design aspects, such as area's prevailing wind direction
- Self-sustaining energy for common-use spaces via solar power system and multiple energy storage devices
- Equipment that can supply power to meeting facilities even if power is interrupted due to disaster or accident
- City resident sharing of electric vehicles owned by Housing Complex Management Union Corporation

Housing efforts

- Achieving net zero energy for each housing unit via energy-saving equipment and energy-generating equipment
- Contributing to shift in energy demand peak due to lithium-ion battery use
- Real-time visualization of energy status with HEMS. Equipping of history displays, energy conservation advice, and remote control of air conditioners

Wind direction/speed analysis (2.5 m above ground)  ■ Shared solar power generation system

■ Wind direction/speed analysis (2.5 m above ground)  ■ Shared solar power generation system

■ EV owned by Housing Complex Management Union Corporation  ■ Pump and rainwater tank at meeting facility

■ ENE-FARM (some residences)  ■ Solar power generation system

■ Insulation spec improvements  ■ Lithium-ion battery

ZEH ratio: **Approx. 118%**!  City's overall ZET ratio: **Approx. 122%**
**Environmental culture creation efforts (3)**

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**Smart House Support Project**

**Key point: Spread of renewable energy use throughout city**

<table>
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<tr>
<th>Equipment eligible for subsidy</th>
<th>Solar power generation system</th>
<th>HEMS</th>
<th>ENE-FARM</th>
<th>Battery system or V2H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number subsidized</td>
<td>9,373</td>
<td>1,779</td>
<td>1,171</td>
<td>370</td>
</tr>
</tbody>
</table>

*Up to March 2017, subsidy required introduction of solar power generation system and HEMS, but in addition it was possible to apply for ENE-FARM, etc.

*Numbers indicate totals to end of March 2018 from 2009 for solar power generation system, from 2014 for HEMS and battery/V2H, and from 2012 for fuel cell.

HEMS includes number introduced to multifamily apartment buildings (329 households).

Project to Create Harumidai Eco-Model Town (area energy network)

Smart House Support Project

Solar power generation ratio in detached residences: No. 4 among ordinance-designated cities
Environmental culture creation efforts (4)

| Industrial structure transformation | Urban restructuring | Creation of environmental culture |

**Spread of net zero energy house (ZEH) use**

Key point: Spread of ZEH use

ZEH is a dwelling that, while maintaining a comfortable indoor environment, achieves net annual energy consumption of nearly zero (or less), made possible by generating energy via solar power, etc., and by maximum efforts to conserve energy through home insulation improvements and high-efficiency equipment.

**Net annual energy consumed by dwelling: roughly zero or less**

 Require as little energy as possible

(Dwelling that is cool in summer and warm in winter)

Use energy skillfully

Create energy

Source: Definition of ZEH and future measures proposed by the ZEH Roadmap Examination Committee (December 2015, Energy Efficiency and Conservation Division, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry)

ZEH addition in Sakai

| Fixed amount: 100,000 yen | Initial: 70 houses |

Smart house conversion 270,000 yen + ZEH addition 100,000 yen = Maximum 370,000 yen
Environmental education and learning project launched in 2010 and implemented via collaboration between City of Sakai and various individuals and organizations. *It is not a "university" prescribed in the School Education Law.

**Sakai Eco College**

**Key point: Better environmental awareness, human resources development**

Environmental education and learning project launched in 2010 and implemented via collaboration between City of Sakai and various individuals and organizations. *It is not a "university" prescribed in the School Education Law.

**Basic principles of Sakai Eco College**

- All city residents will seek to create a city (Sakai) that independently engages in environmental actions.
- Various entities from industrial, educational, private, and public sectors will cooperate in solving environmental problems.
- Through individual actions and mutual cooperation, we will create a low-carbon "Cool City Sakai" and lead the way as a sustainable society.

**Project content**

<table>
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<tr>
<th>(1) General course</th>
<th>From children up to adults, course covers range of topics for purpose of &quot;promoting environmental education and learning.&quot;</th>
</tr>
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<tbody>
<tr>
<td>(2) Advanced course (Ended FY2017)</td>
<td>More advanced, specialized course for those with interest in environment gained from general course, etc.</td>
</tr>
<tr>
<td>(3) Eco College Supporter</td>
<td>For those who have completed advanced course and wish to be registered. Cooperation is requested in hosted courses, booth exhibits, etc.</td>
</tr>
<tr>
<td>(4) Eco College Partner</td>
<td>Individuals and organizations who agree with the principles and actively wish to participate will be certified.</td>
</tr>
<tr>
<td>(5) Local collaboration</td>
<td>Courses are implemented in collaboration with sister cities Higashiyoshino-mura and Tanabe.</td>
</tr>
</tbody>
</table>
### Sakai Environmental City Promotion Council

**Key point:** Cooperation with residents and businesses

System of collaboration between city residents, business operators, university research institutes, related organizations, government, etc. (Currently, 45 organizations participate.)

⇒ Collects opinions on city policies. Considers and implements resident- and business-centered efforts.

#### Specific efforts

- Issue of "Case Examples of Environmental Activities," which summarizes environmental efforts taken by business offices, factories, and others in the city
- Formulation of Sakai Global Warming Countermeasure Implementation Plan (Area Measures Edition)
- Implementation of home eco-diagnoses at business offices
- Public promotion of Cool Choices
- Other, such as providing information via e-mail newsletter
Thank you for your kind attention.