Miyakojima City

Miyakojima City
Island-and-Islets Type Smart Community Verification Project
- Activities to Make Islands Sustainable -

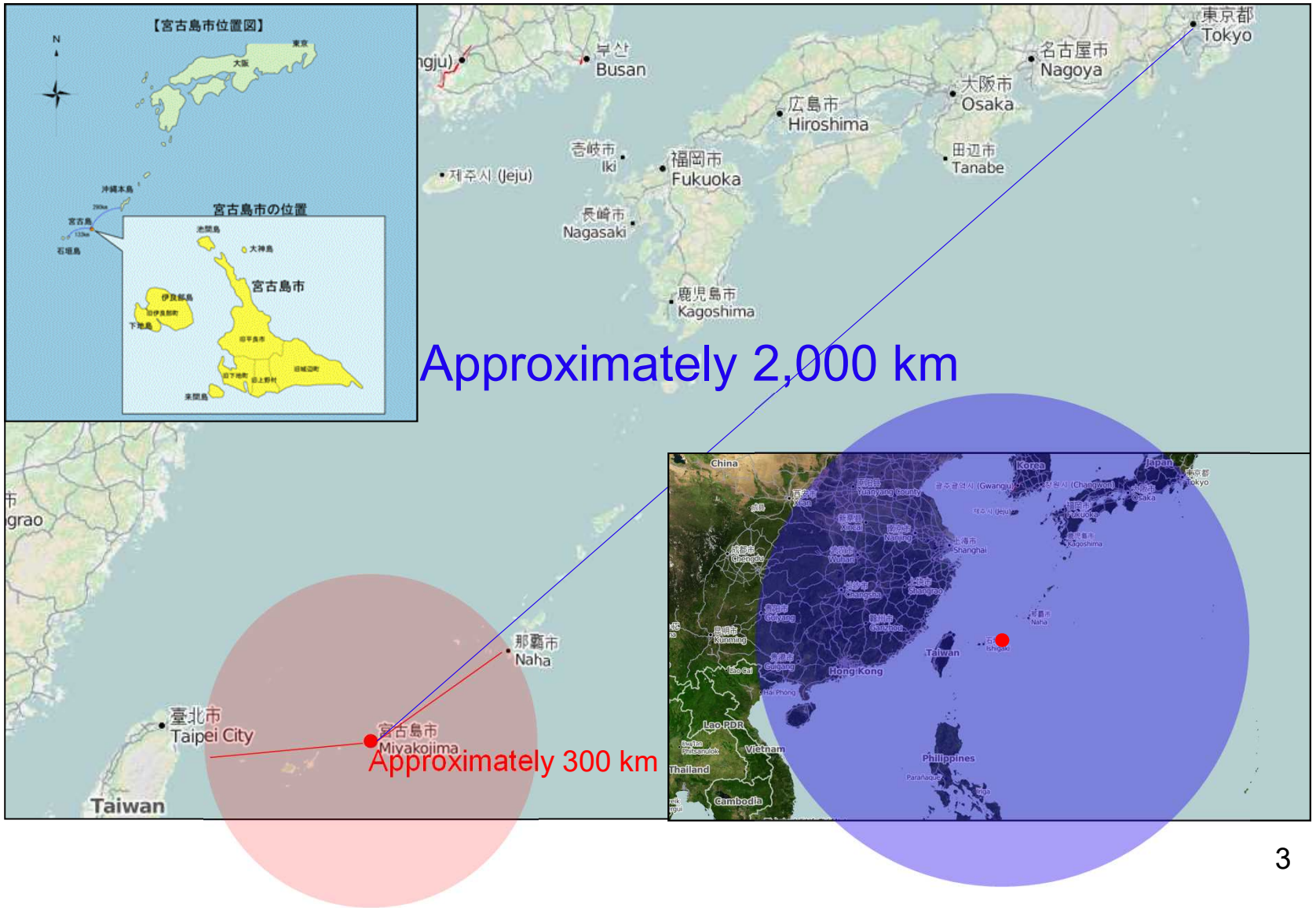
Eco-Island Promotion Section
Department of Planning and Policies
Miyakojima City

- **Overview of Miyakojima City**
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- Island-and-islets type smart community verification project
  - Overview
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - Future direction

General Situations of Miyakojima City

Miyakojima City

Miyakojima is an island approximately 2,000 km distant from Tokyo and approximately 300 km distant from Naha. It is located in the middle of Naha and Taiwan.



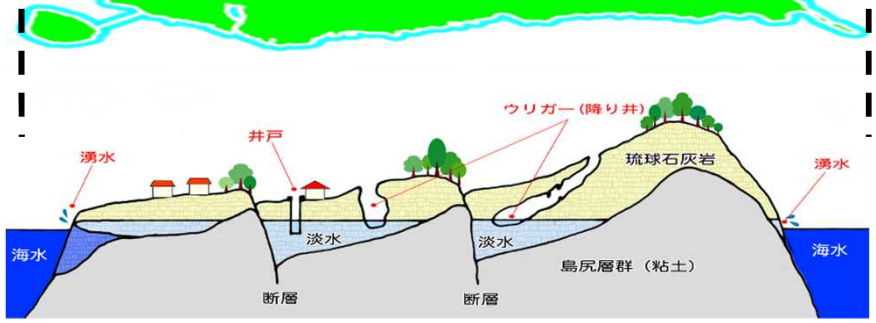
General Situations of Miyakojima City

Miyakojima City

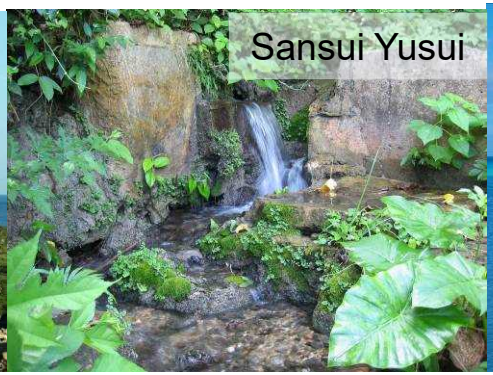
Miyakojima is a flat island that is surrounded by the sea and formed with raised coral reefs. It is in a severe natural environment without any large rivers and vulnerable to typhoons and droughts.

Population: Approximately 55,000
Area: Approximately 205 km^2
(Miyakojima accounts for 80% of this area.)
Climate: Subtropical climate
Annual average temperature: 23.3°C
Annual average precipitation: 2,000 mm
Annual average humidity: 79%

Profile of Miyakojima
(Overview)



Landscape of Miyakojima City

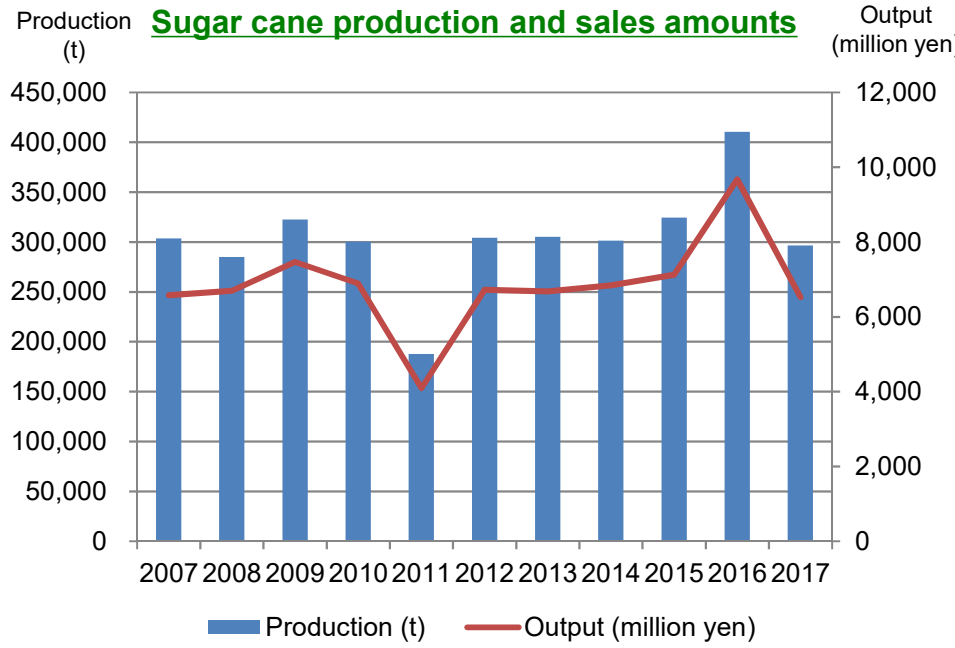


Industries of Miyakojima City (1)

Miyakojima City

Agriculture, forestry, fisheries, and tourism are Miyakojima's major industries. Agriculture in Miyakojima cultivates not only sugar canes, which are staple crops, but also leaf tobacco, mango and other fruit trees, and vegetables such as goya (bitter gourds), pumpkins, and wax gourds on a large scale. Miyakojima is one of the major producing areas of sugar canes and leaf tobacco in Japan.

Sugar cane production and sales amounts



	2012	2013	2014	2015	2016	2017
Production (t)	304,083	305,199	301,268	324,388	410,165	296,482
Output (million yen)	6,723	6,682	6,845	7,125	9,673	6,522

Source: Statistics on Miyakojima

* The poor harvest in 2011 was due to a lack of sunshine (February to March), typhoon (May), and drought trend.
* Prefecture total of 938,000 t (2016) includes 410,000 t (44%) from Miyakojima City

Agriculture in Miyakojima


Sugar cane


Brown sugar


Goya


Wax gourd


Mango, etc.


Miyako beef

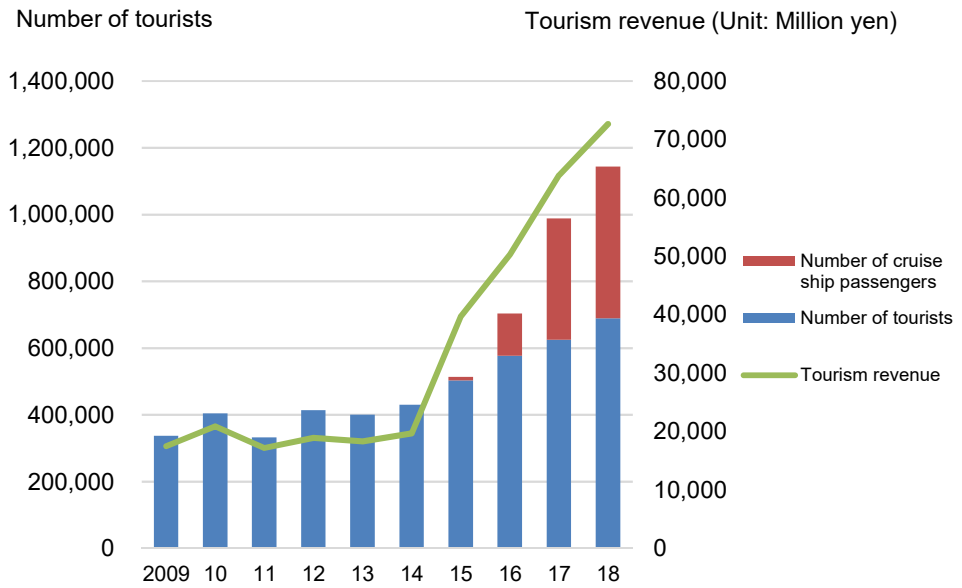
Industries of Miyakojima City (2)

Miyakojima City

Miyakojima is rich in natural landscape resources for tourism, such as the beautiful coral reefs in the surrounding ocean and the cape of Higashihennazaki. Also, various sporting events associated with the "Sport Island Miyakojima" concept, music events, and other events held on the island account for an increasing number of tourists visiting the city.
Following the opening of the Irabu Great Bridge, the start of new direct flights to the mainland, and increased port calls by cruise ships in recent years, about 1.14 million tourists visit Miyakojima annually. The berth development currently in progress at Hirara Port and the opening of the Shimojishima Airport Terminal in March 2019 are expected to spark further increases in the number of tourists.

Changes in the number of tourists to Miyakojima City

Yearly changes in the number of arriving tourists and tourism revenue



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of tourists	337,356	404,144	332,473	413,654	400,391	430,550	513,602	703,054	988,343	1,143,031
Number of cruise ship passengers							10,984	125,786	363,968	454,157
Tourism revenue	17,489	20,900	17,206	18,940	18,333	19,714	39,717	50,312	63,876	72,658

Created by Miyakojima City

Major tourist events, etc.

All Japan Triathlon Miyakojima

Tourism in Yabiji

Rock Festival

Irabu Great Bridge

Shimojishima Airport

Underground-Dam Irrigation Development Project

Miyakojima City

In a harsh natural environment, Miyakojima has suffered from heavy damage due to droughts, etc. To break away from waterless agriculture by using abundant groundwater, Miyakojima City developed a water resource by constructing an underground core-wall storage dam in highly water permeable Ryukyu limestone rock.
(Project period: FY 1987 to FY 2000. Total project cost: 64 billion yen. Storage capacity: Sunagawa, 9.5 million m^2; Fukuzato, 10.5 million m^2)


Pinfudake FP

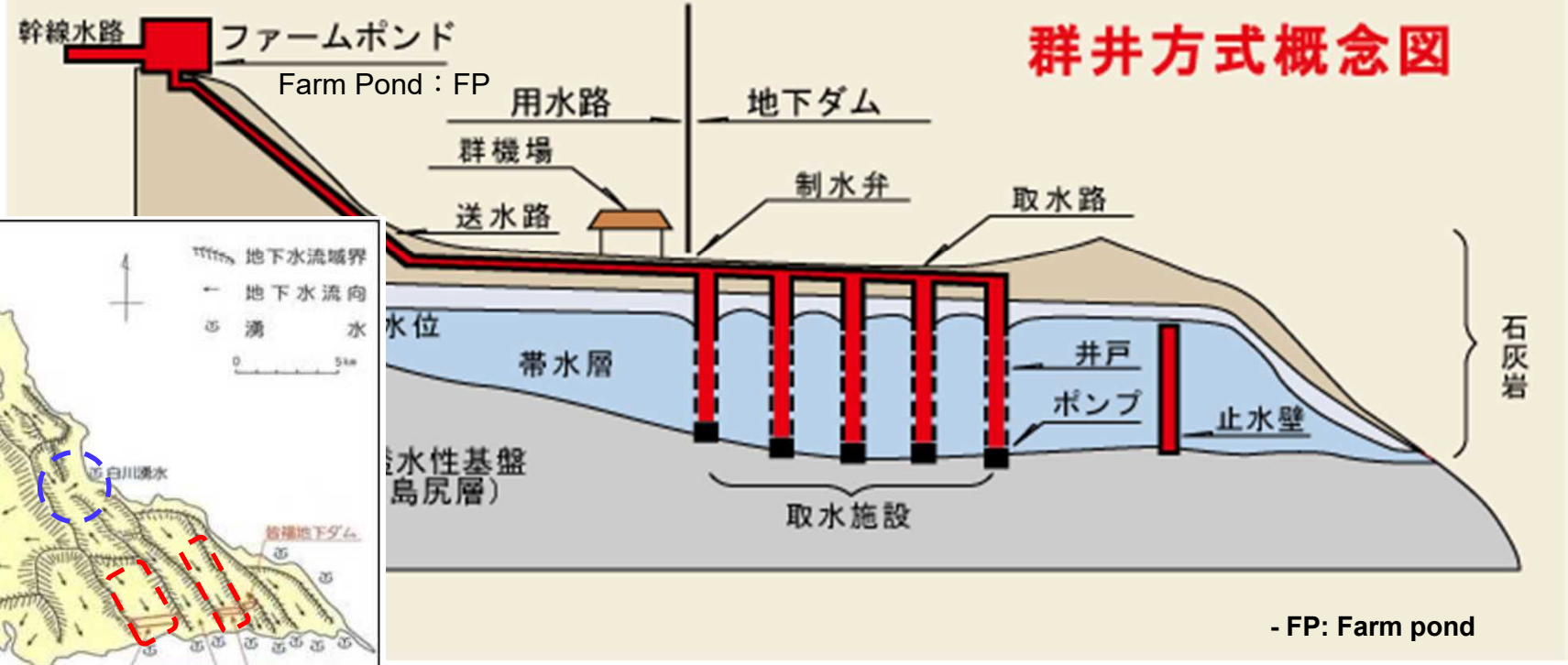

Milk-mine FP


Nakaomine FP


Agariyama FP


Nobarudake FP


Kurimajima FP



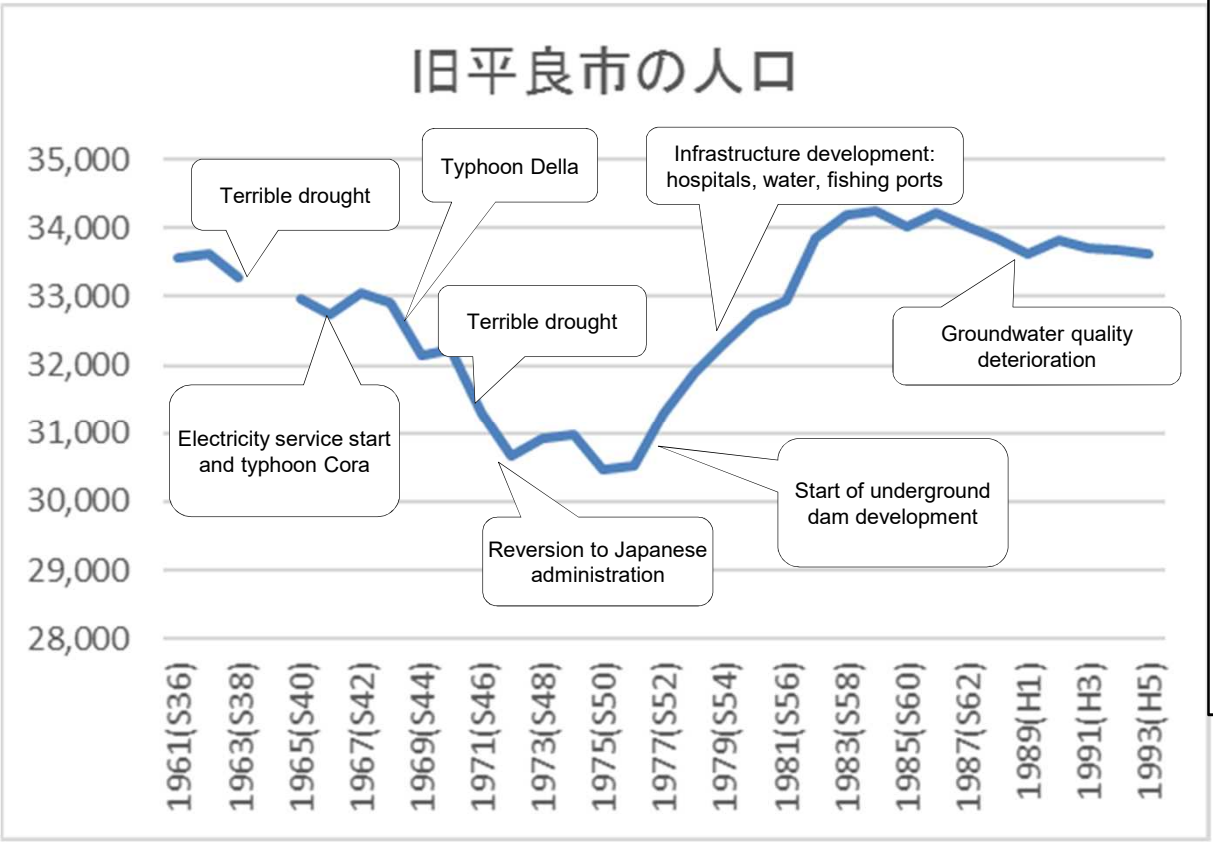
- FP: Farm pond

- Overview of Miyakojima City
- **Policy background**
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- Island-and-islets type smart community verification project
  - Overview
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - Future direction

Events Related to Sustainability of the Islands

Miyakojima City

1963: Terrible drought
1966: Typhoon Cora, start of electricity service to all Miyakojima islands
1968: Typhoon Della
1971: Terrible drought
1989: Elevated nitrate nitrogen concentration
(from 1.92 mg/L in 1963 to 8.9 mg/L)



<Key issues related to sustainability>
[Issue (1)]
✓ In the past, the population decreased due to large-scale disasters, droughts, etc.
=> Infrastructure development and countermeasures have curbed the impact of disasters and droughts on population decreases.

[Issue (2)]
✓ As the population increased, groundwater quality deteriorated to a critical condition.
=> The quality is presently stable due to a groundwater conservation ordinance and countermeasures by the agriculture and livestock industries.

What barriers to sustainability will arise in the future?

Requirements for making "islands where people can continue living" a reality

- Lifestyle changes and active industrial and economic activities have placed an increased burden on the natural environment, which provides life-supporting water and resources for tourism. Preservation of the natural environment is needed.
  => Preservation of water for life
  => Toward sustainable tourism by enhancing the value of the islands through nature preservation
- Okinawa is a prefecture with remote islands. The Miyakojima islands in Okinawa are isolated and depend on food and energy resources supplied from the outside. Resource circulation based on local production for local consumption is needed.
  => Local economic circulation (Suppression of outflow from the region)
  => Mitigation of the effect of external factors (Security)
- Local communities are on the decline due to population decreases. Job creation by promoting local industries is needed.
  => Attractive jobs

"Eco Island Miyakojima" means:

Affluent islands where people can indefinitely continue to live = Making islands sustainable

Declaration of Eco Island Miyakojima 2.0

Miyakojima City

Declaration of Eco Island Miyakojima 2.0

- Toward the Future 1,000 Years From Now -

Ten years have passed since the Declaration of Eco Island Miyakojima in March 2008.
The Declaration of Eco Island Miyakojima 2.0 was announced to redefine "eco island" and clarify the vision.

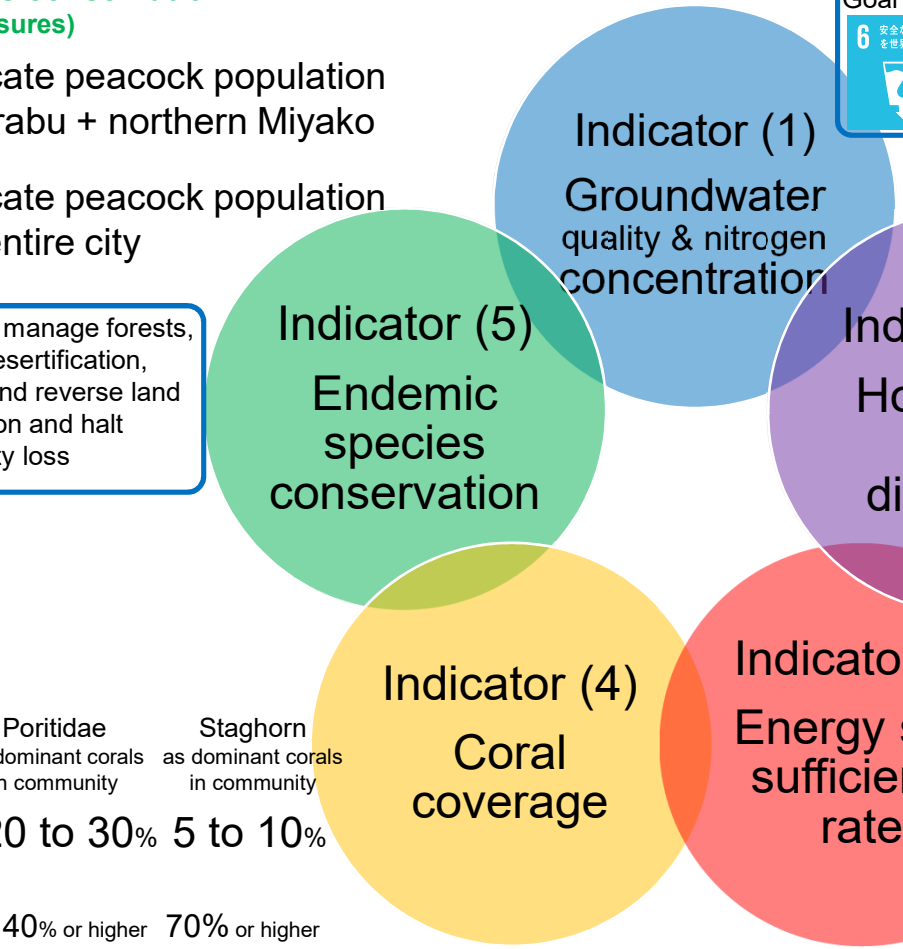
- The slogan "Toward the Future 1,000 Years From Now" was devised (in March 2018).
- Five goals that should be achieved by 2030 and 2050 were set (in March 2019).

The Declaration of Eco Island Miyakojima is positioned as Miyakojima City's version of SDGs, and the city has a policy to add related measures to the eco island promotion plan in the future.

● Declaration of Eco Island Miyakojima (March 30, 2018)

- As residents of the city, we will protect our precious groundwater which supports the island's life.
- As residents of the city, we will protect our beautiful coral reefs and the sea.
- As residents of the city, we will conserve our limited resources and energy by using our wisdom and creativity.
- As residents of the city, we will act individually, aiming to make Miyakojima beautiful, tidy, and earth-friendly.
- As residents of the city, we will protect our forests, sea, and air and act to make an environment in which all living things can co-exist.
- As residents of the city, we think and act together with the peoples of the world to preserve and protect our environment and pass it on to future generations.

- Toward the Future 1,000 Years From Now -
Five Goals of Eco Island Miyakojima



Endemic species conservation (Alien species measures)

2030	Eradicate peacock population from Irabu + northern Miyako
2050	Eradicate peacock population from entire city

Goal 15: Sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Groundwater quality & nitrogen concentration (Tap water sources)

Goal 6: Ensure access to water and sanitation for all

2016 (present)	5.05 mg/L
2030	4.64 mg/L
2050	2.17 mg/L

Daily per capita household waste discharge

2016 (present)	542 g
2030	488 g
2050	434 g

Goal 11: Make cities inclusive, safe, resilient and sustainable

Coral coverage

	Poritidae as dominant corals in community	Staghorn as dominant corals in community
2016 (present)	20 to 30%	5 to 10%
2030	40% or higher	70% or higher
2050		

Goal 14: Conserve and sustainably use the oceans, seas and marine resources

Goal 13: Take urgent action to combat climate change and its impacts

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy

Energy self-sufficiency rate

2016 (present)	2.9%
2030	22.1%
2050	48.9%

Overall Picture of Eco Island Miyakojima

Miyakojima City

- Toward the Future 1,000 Years From Now -

Declaration of Eco Island Miyakojima 2.0

Vision

- Indicator (1) Groundwater quality & nitrogen concentration
- Indicator (2) Waste discharge
- Indicator (3) Energy self-sufficiency rate
- Indicator (4) Coral coverage
- Indicator (5) Endemic species conservation

Eco Island Miyakojima promotion plan

[Environmental preservation]

- Groundwater conservation
  - Water quality and water conservation measures
    - Sewage measures
      - Sewerage connection
      - Septic tank installation
    - Chemical fertilizer reduction
      - Compost (soil fertility)
      - Organic fertilizer
      - Delayed release fertilizer
    - Livestock waste countermeasures — Compost
- Waste measures
  - Waste reduction
  - Illegal dumping countermeasures
  - Cleanup activities

- Coral reef conservation in oceans
  - Red soil runoff
    - Agricultural land measures
    - Forest conservation
  - Establishing rules of ocean use
  - Global warming countermeasures — Energy conservation/renewable energy
  - Groundwater quality conservation measures
- Biodiversity
  - Habitat conservation
    - Alien species measures
    - Forest conservation

[Resource circulation]

- Energy self-sufficiency rate/CO2/energy cost measures
  - Energy-saving measures
    - Citizen actions
    - Widespread use of electric vehicles
  - Expansion of energy conservation — Smart community
  - Locally produced energy — Natural gas resource utilization
- Local food production for local consumption

[Industrial promotion]

- Sustainable tourism
  - Tourism protecting and harnessing nature
  - Provision of local farm and marine products, etc.

Environmental model city action plan

CO2 emission reduction

Establishment of the Eco Island Miyakojima brand

- Resident-led promotion of activities
  - Sparking awareness/action, and running communication platforms
    - ✓ Website: Eco activity publication and information exchange
    - ✓ Yukuriba (a place for chatting about ecology): Small group communication
    - ✓ Eco Island Contest: Participation in eco activities
    - ✓ Eco festival: Making new friends
    - ✓ Virtual currency: Promoting citizen actions
    - ✓ Corporate version of an eco certification institution

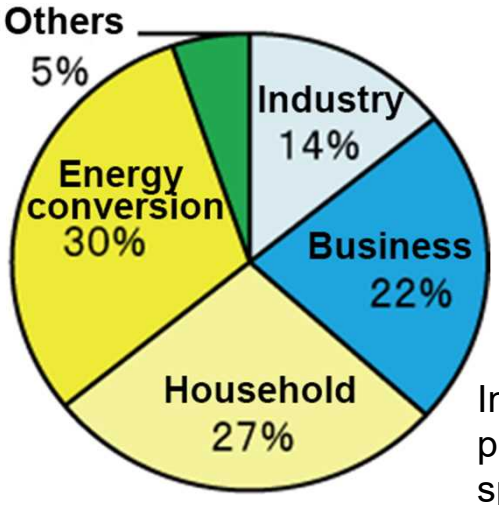
- Acceptance of inspection tours

- Human resource development (learning and education)
  - Delivery of courses (elementary/middle school)
  - Summer eco tours (elementary/middle school)
  - Staff training, etc.
  - Courses, etc. for residents
  - High school student WS (JSAP Energy System Group)
  - Tokai University environmental classes

Activities as an "Environmental Model City"
(Designated by the Prime Minister in January 2009)

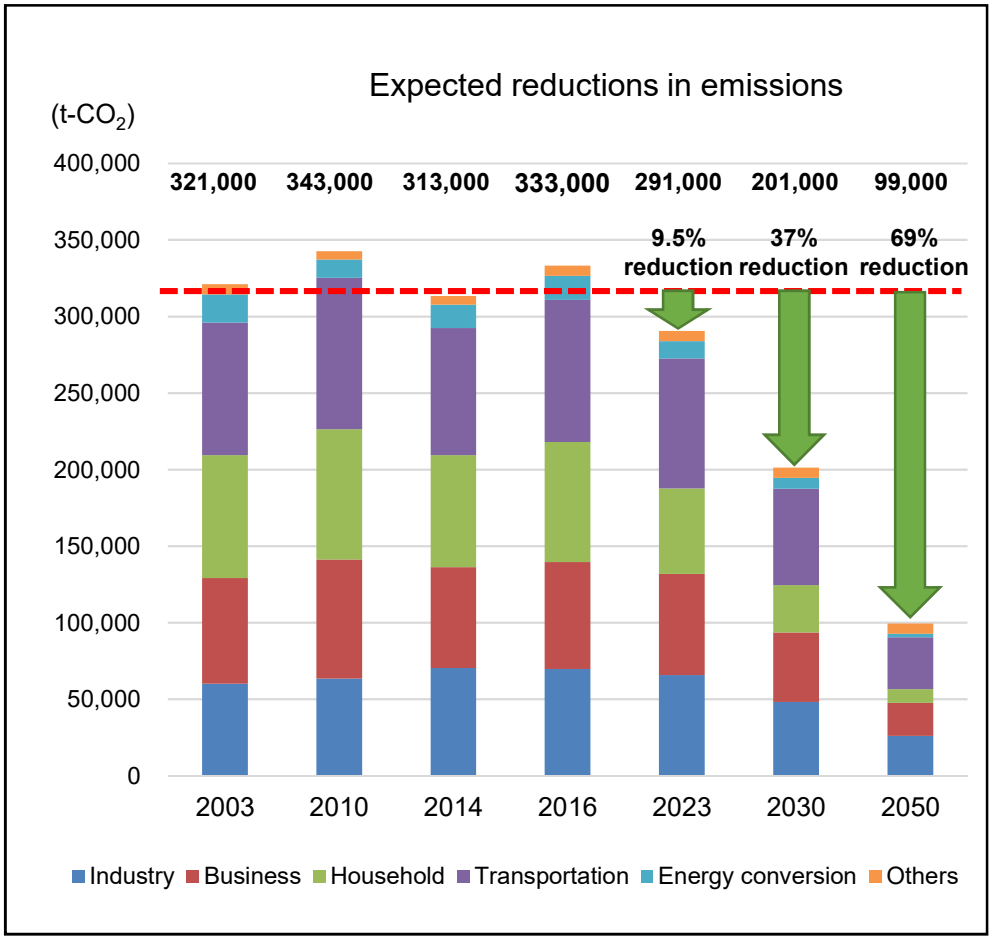
Miyakojima City

Miyakojima City has been designated as Japan's only island-and-islets type environmental model city by the government of Japan, setting the following CO_2 reduction targets in its environmental model city action plan.



Proportion of emissions by sector

Implement a reduction plan that mainly specifies energy policies targeted at the transportation and household sectors, which are relatively high in the proportion of emissions



- Overview of Miyakojima City
- Policy background
- **Sustainability and local energy policy**
  - **- Views toward energy policies**
  - - Examples of activities
- Island-and-islets type smart community verification project
  - - Overview
  - - Structure of energy costs on isolated islands
  - - Characteristics of renewable energy and electricity
  - - Securing an inexpensive adjustment capability
  - - Future direction

Basic Energy-Related Issues

Miyakojima City

[Basic views]

Issues along the way to creating a framework for sustainable energy use

(1) High costs

(Cause)
- Transportation costs
- Inefficient due to small scale of demand

(Problem)
- Burden on life

→ Energy saving / Load leveling

(2) Outflow from local economy

(Cause)
- About 97% dependence on on energy from outside of island

(Problem)
- Outflow from local economy

→ Locally produced energy / Energy saving

(3) Future risks

(Cause)
- About 97% dependence on energy from outside of island
- Preferential treatment of remote islands *

(Problem)
- Fossil fuel prices may rise steeply
- Costs may increase due to institutional changes

→ Locally produced energy / Energy saving

Energy self-sufficiency rates Primary energy basis
* Estimates by Miyakojima City

	Miyakojima City	Japan (Source: ANRE webpage)
2010	1.5%	20.2%
2016	2.9%	8.3%
2030	22.1%	24.3%

* Preferential treatment of remote islands
The price of energy used on remote islands is cheaper than the actual price because they get assistance for gasoline, etc.) and electricity is a universal service.
The measure may change due to institutional reforms, such as electric utility deregulation.

Vision of the Ideal Energy Supply for Miyakojima City

Miyakojima City

[Energy supply vision: Environment model city = CO2 reduction]
To make islands sustainable, the city seeks to provide a **more stable** and **more continuous** supply of energy at a **lower cost**.

- For local communities, energy supply is the foundation that supports civic life and business activities.
- Through economic circulation within the islands, the city seeks to improve the energy self-sufficiency rate by producing and consuming energy locally. In turn, this makes a robust social system that is not susceptible to the effects of external factors.
- However, it is assumed that social costs will not increase.

[Measures to realize the vision]
- The energy self-sufficiency rate is about 3% at present.
- Power-saving measures and expanded renewable energy adoption are essential.
- Local business operators will drive the renewable energy business.

(Continuous)
- Promotion of power-saving actions by residents
- Very widespread use of electric vehicles

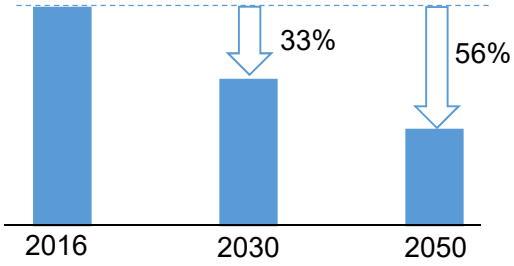
(In about 5 years, for the time being)
- Significant expansion in photovoltaic power generation adoption, leading to prices dropping at a rapid pace
- Technical issues with balancing electricity supply and demand
  => Securing an inexpensive adjustment capability

(5 years or later)
- Examination of wind power generation, biomass, etc.

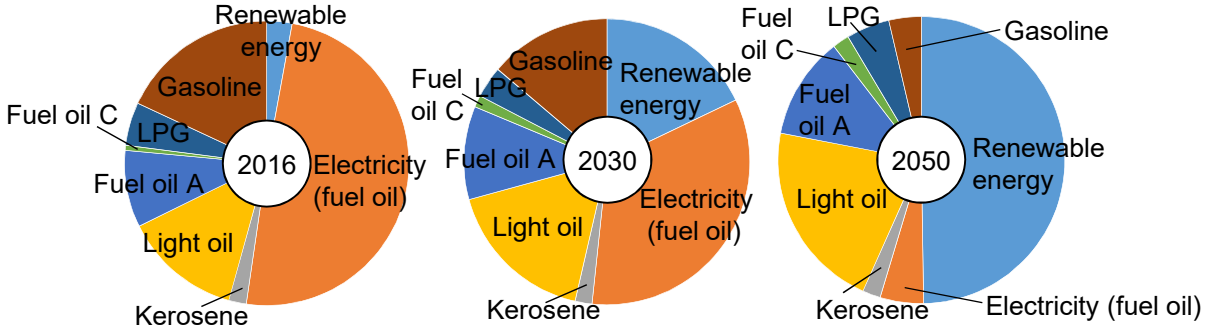
	2016	2030	2050
Power savings (electricity) (%)	-	20.6	24.0
Power savings (fuel) (%)	-	17.5	20.8
EV (10,000 vehicles)	0	1.3	3.0
Photovoltaic power (MW)	22	128	208
Wind power (MW)	4.8	6.9	36.9

	2016	2030	2050
CO2 emission (10,000 t-CO2)	33.3	20.1	9.9
CO2 reduction rate (%) *	-	37.3%	69.1%
Renewable energy electricity rate (%)	12.0%	55.1%	91.9%
Energy self-sufficiency rate (%)	2.9%	22.1%	48.9%

<Amount of primary energy>



<Proportion of primary energy>



- Overview of Miyakojima City
- Policy background
- **Sustainability and local energy policy**
  - Views toward energy policies
  - **Examples of activities**
- Island-and-islets type smart community verification project
  - Overview
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - Future direction

Project to Promote Widespread Use of Electric Vehicles

Energy saving | Locally produced energy

● Project overview

The city has problems such as CO_2 emissions from the transportation sector, high vehicle fuel costs, and power outages due to typhoons and other disasters. Since the use of electric vehicles (EVs) is an effective measure against these problems, the city promotes widespread use of EVs.
The challenges include promoting a greater understanding of EVs, clarifying cost-effectiveness and developing measures for improvement, developing charging facilities and establishing effective ways to operate them, and building an EV maintenance system.

● Implemented items

- ➢Trial use (2W): To promote a correct understanding
- ➢ Dissemination activities: Events, brochures, etc.
- ➢ Charging facilities: Development and effectiveness verification
- ➢ Quick billing: To reduce congestion
- ➢ Expansion of normal charging: To improve convenience
- ➢ Examination of measures for apartment homes
- ➢ Maintenance system
- ➢ Installation assistance: Initial cost measures

[Conceptual image of the project]

Problems specific to remote islands in Okinawa
- ➢CO_2 emissions from the transportation sector
- ➢High vehicle fuel costs
- ➢High risk of power outages due to typhoons, etc.

Use in disasters

Utilize as power-source vehicle

- Efficient use of renewable energy through EV operation
- Maximization of the utility value of electric vehicles

Reduced living costs
- Reduced running costs
- Reduced electricity consumption costs

Living a safe and rich life
- Prepared for power outages
- Relief from concerns about steep rises in gasoline prices

● Expected effects

- Reduced living costs
- Improved QOL (security and safety)
- New lifestyle established
- Low-carbon society realized
- Eco Island Miyakojima brand established

Project to Raise Eco House Awareness and Popularity

Energy saving

● Project overview

The project provides opportunities to visit and trial stay at eco houses in hot and humid regions where environmental technologies, such as solar heating and heat barrier paint, are combined with traditional housing techniques born from the climate and natural features of Okinawa.
Widespread use of architectural technologies introduced in model houses to promote energy conservation in individual houses can make lives more comfortable with minimum use of energy.

● Characteristics

Points about energy saving in Okinawa

- ➢Heat insulation: To block direct sunlight and prevent the entry of heat, use breeze blocks and heat barrier paint.
- ➢Ventilation: To ensure good ventilation, install windows at floor level.
- ➢Humidity control: To reduce humidity, which increases discomfort, use wood.

Houses in Okinawa need to take in a lot of natural ventilation at normal times and serve the role of shelter during typhoons.

[Conceptual image of the project]

[Urban type]

[Suburban type]

● Expected effects

- Technologies developed for use in eco houses
- Energy savings in individual houses
- Reduced living costs
- Low-carbon society realized

Project to Promote Utilization of Natural Gas

Locally produced energy

● Project overview

Natural gas drilling exploration by the prefecture has found natural gas and the accompanying water (hot spring water) in underground pockets at Miyakojima. The city conducted component analysis, production tests, environmental impact studies, etc., and formulated utilization and implementation plans.

Based on these activities, the city is doing other work, including feasibility studies and marketing research, to establish businesses that use natural gas and the accompanying water (hot spring water) as part of Miyakojima's underground resources.

● Implementation scheme

Budget: Okinawa promotion special promotion delivered fund (municipalities)

Government agency concerned: Cabinet Office

Project period: FY 2016 to FY 2019

● Expected effects

- Energy security ensured through resource development
- Industries and tourism developed through the use of natural gas and the accompanying water
- Other

● Project in FY 2019

Verification related to the utilization of natural gas resources

Improvement of the utilization plan

Acquisition of a mining license and agricultural verification (leaf lettuce)

[Conceptual image of the project]

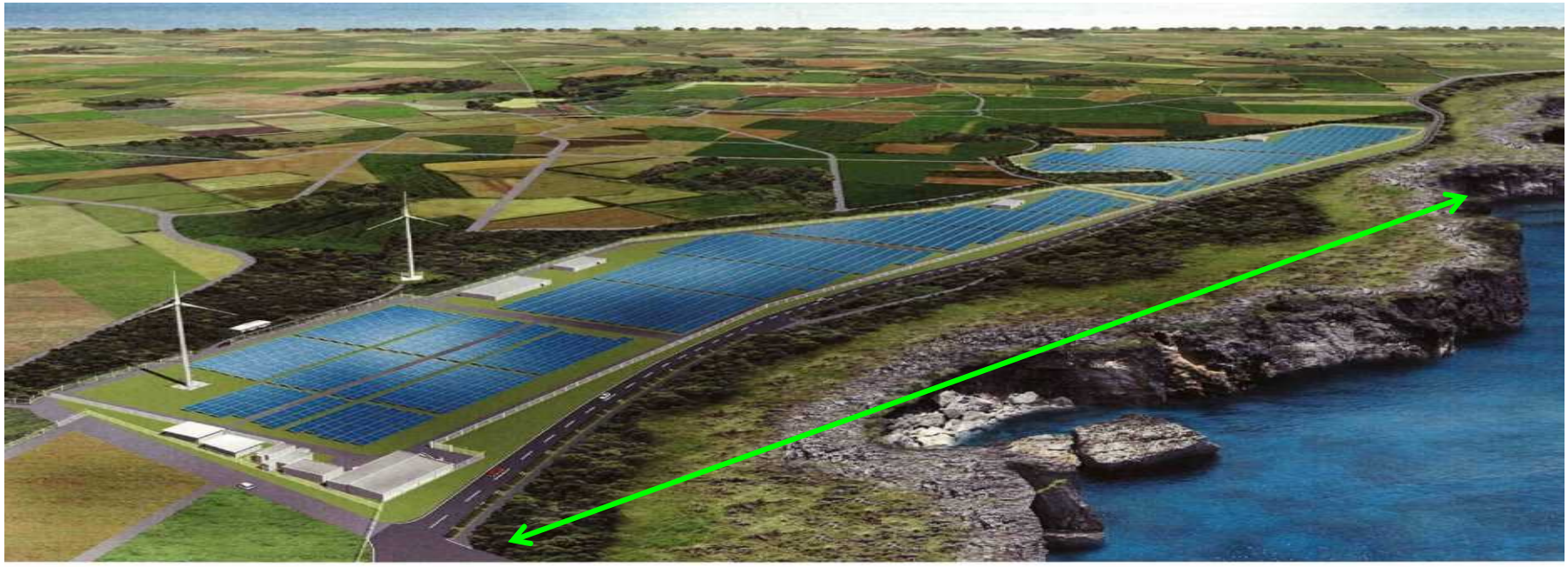
Verification Project on the Microgrid System for Isolated Islands

Locally produced energy

Stabilizing measures against fluctuations in renewable energy were verified at a 4-MW photovoltaic power plant installed with 4-MW batteries by the Okinawa Electric Power Company.

Verification Project on the Microgrid System for Isolated Islands

Accumulating knowledge of the necessary system-stabilizing measures by grasping and analyzing the influence of photovoltaic generation facilities, etc. introduced on a large scale into the independent system of an island



- Transmitting information on technologies of the independent-type low-carbon society system within and outside the island
- Vitalizing the tourism industry by providing eco-tours using the verification and study facilities

Source: Okinawa Electric Power Company website

Project to Promote Eco Island Miyakojima Branding

Miyakojima city

● Project overview

The eco island-related activities by the city are becoming better known within and outside the islands as features of the city, but they have not yet become widespread activities in the local economy. To connect the Eco Island Miyakojima activities to local economic revitalization, the city seeks to establish them as a brand to achieve high added value for tourism and other related industries.

● udget, etc.

- Budget: Okinawa promotion special promotion delivered fund (municipalities)
- Government agency concerned: Cabinet Office
- Project period: FY 2016 to FY 2019

● Project schedule

FY 2016: Research for branding
Action plan development
FY 2017: Communication platform (Web, events, etc.) construction
FY 2018: Website and event administration
Trial implementation of a virtual currency system, etc.
FY 2019: Verification for running the platform continuously, and more

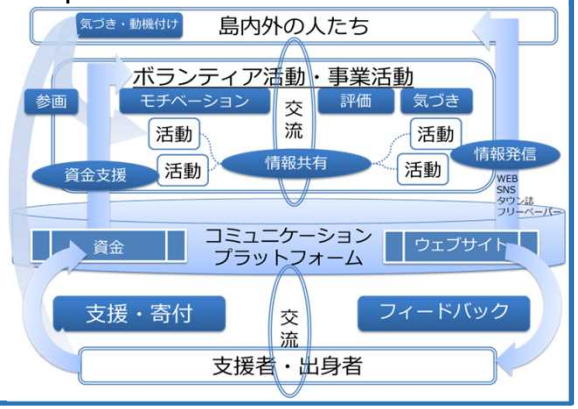
[Conceptual image of the project]

[Industrial tourism]
= Services with high satisfaction
-> Economic and employment effects

- ✓ Transmission of information to list candidate locations (targets and means)
- ✓ Simplified approach (simple procedures)
- ✓ Grasp of wants (purpose and service level)
- ✓ Acceptance system

[General tourism]
= Branding within the islands
-> Empathy -> Repeat business and support

- ✓ Common understanding and recognition
- ✓ Awareness and participation
- ✓ Motivation
- ✓ Network
- ✓ Financial support



● Expected effects

- Increase in inspection visitors
- Increase in fans, repeaters, and supporters
- Revitalization of the local economy
and more

- Overview of Miyakojima City
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- **Island-and-islets type smart community verification project**
  - **Overview**
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - Future direction

Island-and-Islets Type Smart Community Verification Project

Energy saving | Locally produced energy | Load leveling

[Project overview]
To form a smart community in Miyakojima City, the city is taking advantage of IT technologies in a massive renewable energy installation, seeking to optimize power supply and demand on the islands, improve the energy self-sufficiency rate, and implement a new energy supply and demand system as a social system. With these aims, the city is committed to local economy revitalization and job creation by implementing the projects shown below.

Budget scheme: Okinawa Prefecture => (outsourcing) => Miyakojima City

Project period: FY 2011 to FY 2020

<100% self-support verification of Kurimajima's RE> Until 2016

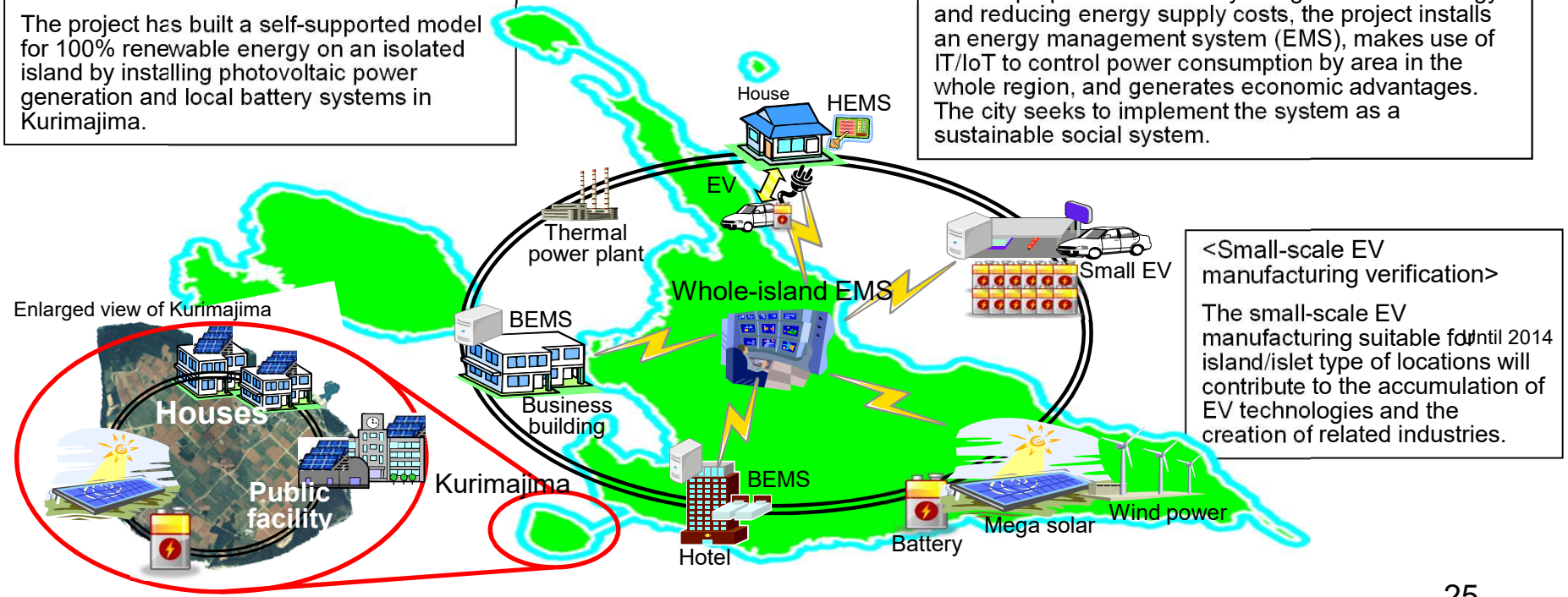
The project has built a self-supported model for 100% renewable energy on an isolated island by installing photovoltaic power generation and local battery systems in Kurimajima.

<Miyakojima City's whole-island EMS verification> Until 2020

For the purpose of effectively using renewable energy and reducing energy supply costs, the project installs an energy management system (EMS), makes use of IT/IoT to control power consumption by area in the whole region, and generates economic advantages. The city seeks to implement the system as a sustainable social system.

<Small-scale EV manufacturing verification>

The small-scale EV manufacturing suitable for island/islet type of locations will contribute to the accumulation of EV technologies and the creation of related industries. Until 2014



What is a Smart Community in the First Place?

Energy saving | Locally produced energy | Load leveling

Concept of sustainable energy

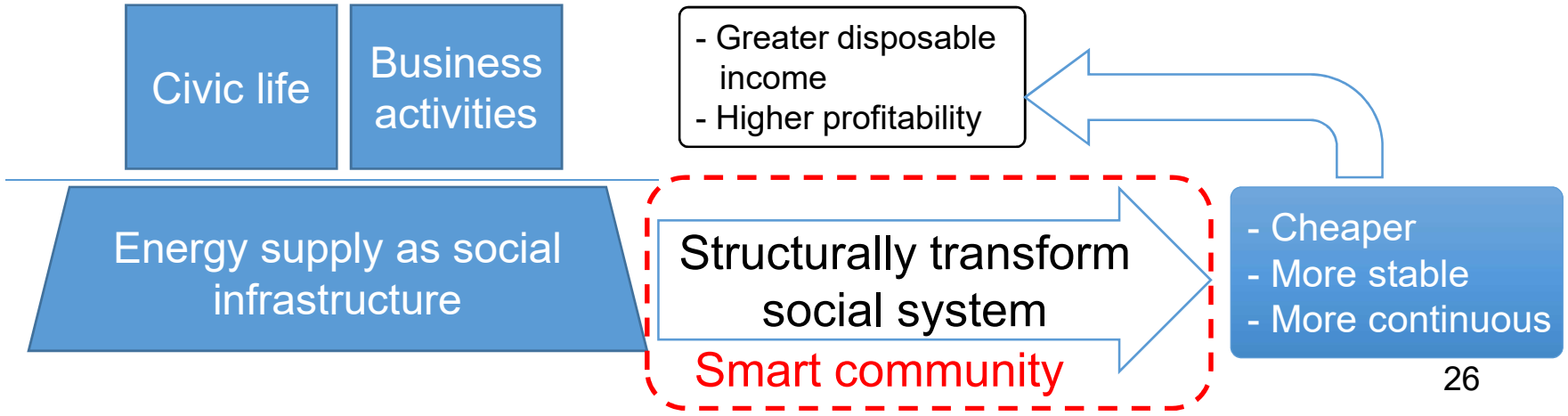
[Low cost]

=> Since energy costs are structurally high in isolated islands, a mechanism that structurally reduces costs has to be prepared.

[Continuous and stable]

=> Since fossil resources are limited, a mechanism to introduce renewable energy has to be prepared.

=> A smart community is a social system that makes use of IT technologies to successfully increase use of renewable energy and reduce energy supply costs. Social infrastructure cost reductions can stabilize civic life and business activities, and lead to increased profitability and revitalization of the regional economy.



- Overview of Miyakojima City
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- **Island-and-islets type smart community verification project**
  - Overview
  - **Structure of energy costs on isolated islands**
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - Future direction

Structure of Energy Costs on Isolated Islands

Energy saving | Load leveling

Gasoline	Approximately 140 yen/L x 50 L/month	=> 7,000 yen
LP gas	Approximately 1,700 yen + approximately 570 yen/m^3 x 10 m^3/month	=> 7,400 yen
Electricity	Approximately 26 yen/kWh x 300 kWh/month	=> 7,800 yen
Total	Monthly utility cost:	22,000 yen

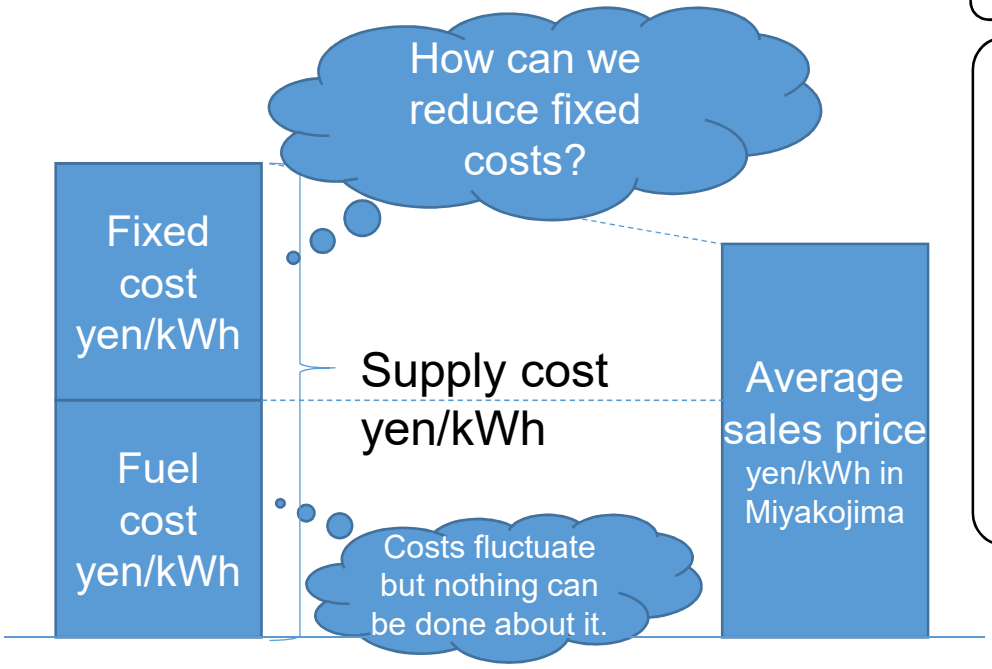
[Living costs]

Energy saving

Reducing energy costs through energy savings

[Structure of social costs for electricity]

- The sales price of electricity is the same as on the Okinawa main island, but supply costs are higher.



All 11 systems on the isolated islands are in the red (7 billion yen/year), accounting for about 4% of sales of the Okinawa Electric Power Company.
If these deficits on the islands are eliminated, the electricity rate may decrease by 4%.

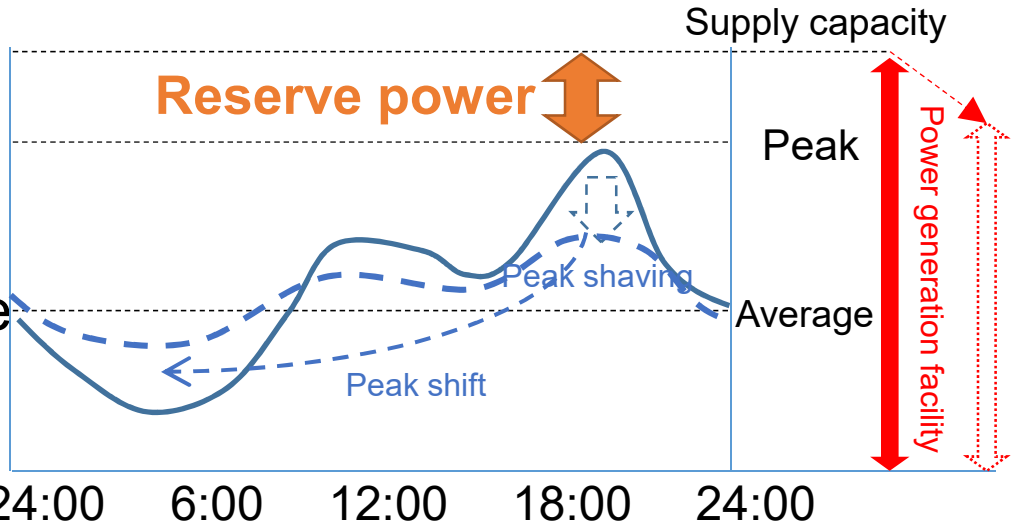
Electric power companies are obligated under the Electricity Business Act to supply electricity at the same rate*.
Despite the increasing relaxation of regulations in response to Japan's deregulation policy, the above regulation will continue exceptionally for the isolated islands until 2020. No policy has been seen for the years after 2020.
If the regulation is eliminated, the electricity rate may possibly rise to 1.5 times today's rate or higher, which would have a significant impact on residents' lives and business activities.

* Universal service

Structure of power supply facility costs

[Reserve power]

- Small-scale demand
- Large fluctuations
- Difficult to predict peaks
- **Reserve power** gets large



[Without load leveling]

- The supply facilities are large for a small amount of electricity use.
  (Height) (Area)
- The cost to produce one unit of electricity is high.
  => Load leveling can reduce the cost.

Capability for load leveling = **Adjustment capability**

[Reference] Electricity Situation of Miyakojima City

[Situation of demand (as of June 2018)]
- Peak of electric power demand: Approximately 60 MW (Summer)
- Peak of electric power demand (daytime): Approximately 22 MW (Winter)
  * 30-day rule applied -> 25.6 MW
- Annual total electric power consumption: 262,419 MWh (in 2011)

* Reached a peak at about 10 o'clock at night (Consumer demand)

[Situation of power generating facilities (as of June 2018)]
- DEG power generation (Fuel oil C): 60.5 MW (7 units)
- GT power generation (Fuel oil A): 15 MW (3 units)

- Total thermal power generated: 75.5 MW

- Wind power generation: 4.2 MW
- Photovoltaic generation: 4 MW (Mega solar power plant)
- Demand-side photovoltaic generation: 24.1 MW (tentative)

- Total power generated by renewable energy facilities: Approximately 32.3 MW

- ✓ [Miyakojima electricity and climate summary]
- ✓ Demand peaks in summer and bottoms out in winter.
- ✓ Summer has many fine days and mild winds (excluding typhoon days).
- ✓ Winter has many cloudy days and strong winds.

Estimation of the RE ratio

* Estimate based on only the typical utilization factor

[Photovoltaic generation: 12%]

28.1 x 8,760 h x 12%

= Approximately 29,500 MWh

[Wind power generation: 25%]

4.8 x 8,760 x 25%

= Approximately 9,200 MWh

[Bagasse]

10,000 MWh

[Total of RE]/[Total consumption]

Approximately 48,700/ approximately 272,500 MWh

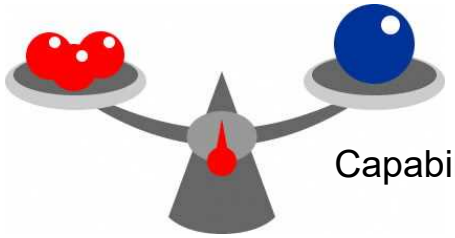
[RE ratio] 17.9%

- Overview of Miyakojima City
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- **Island-and-islets type smart community verification project**
  - Overview
  - Structure of energy costs on isolated islands
  - **Characteristics of renewable energy and electricity**
  - Securing an inexpensive adjustment capability
  - Future direction

Characteristics of electricity

Supply and demand must match at all times.

Consumption 50 MW	>	Supply 45 MW	=>	Power outage
Consumption 50 MW	<	Supply 55 MW	=>	Power outage
Consumption 50 MW	=	Supply 50 MW	=>	Supplied



Capability to always keep supply and demand balanced like a scale = **Adjustment capability**

Restrictions of photovoltaic generation installations

- Winter = Less electricity demand

↓

- Sunny during the day = Increased photovoltaic generation

↓

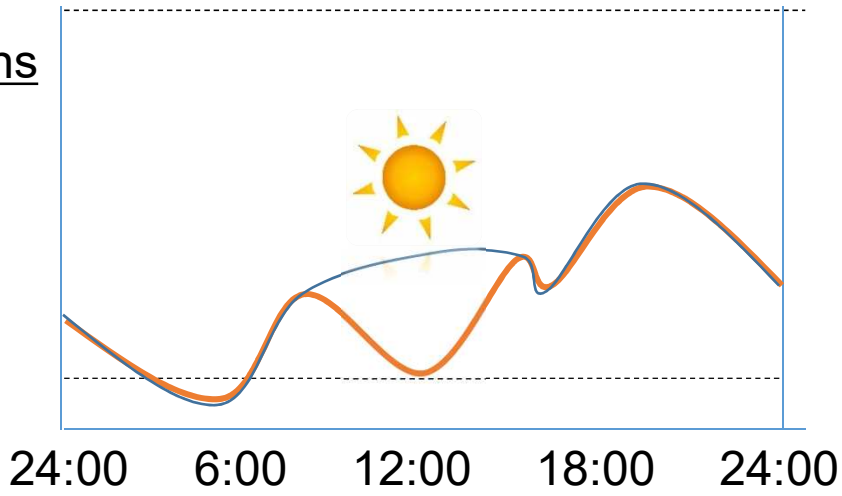
- Narrow output from the thermal power generator to maintain a balance

↓

- Cannot stop the generator because thermal output must increase if it suddenly becomes cloudy

↓

- Excessive photovoltaic generation may lead to too much power generated, causing power outages on all the islands



If demand can be adjusted according to the weather, even more photovoltaic generation installations are feasible.

Adjustment capability

[Low cost]

=> Mechanism that structurally reduces costs

[Continuous and stable]

=> Mechanism for adding renewable energy

Inexpensive adjustment capability

Energy mechanism required for making islands sustainable

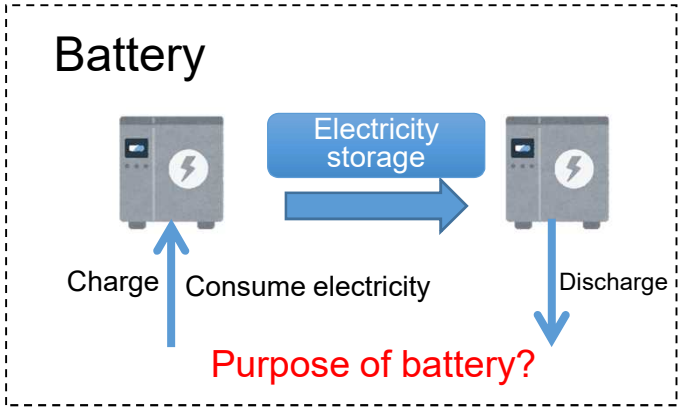
- Overview of Miyakojima City
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- **Island-and-islets type smart community verification project**
  - Overview
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - **Securing an inexpensive adjustment capability**
  - Future direction

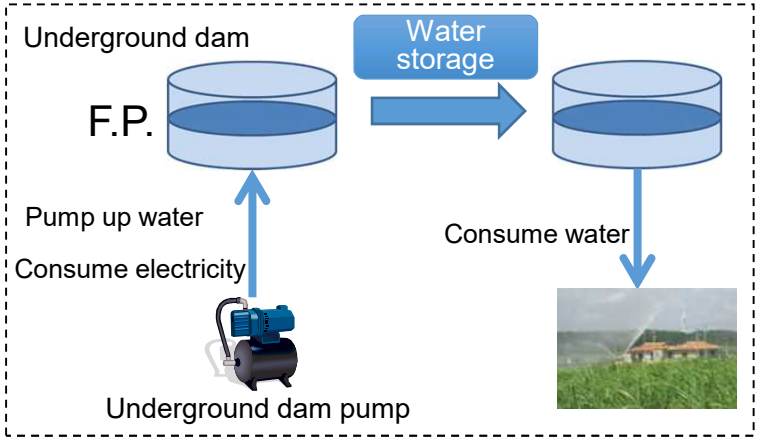
Securing an Inexpensive Adjustment Capability (Making Use of Energy Storage Facilities)

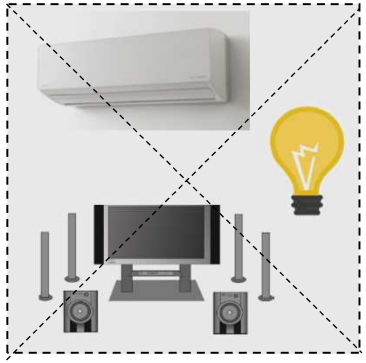
Miyakojima City

Points to securing an adjustment capability

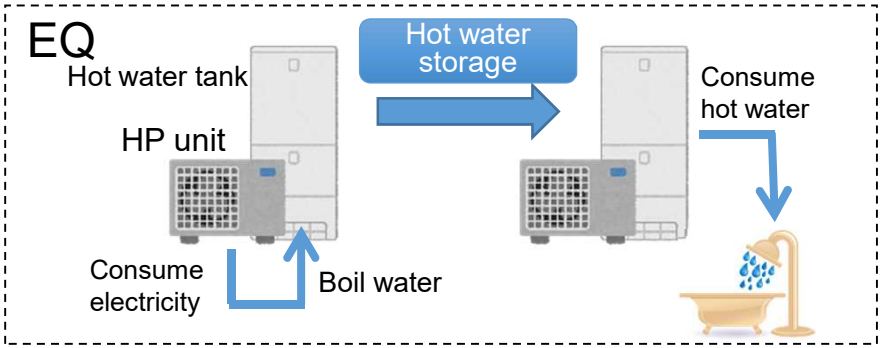
- ✓ Guaranteed certainty of adjustment => Human intervention eliminated (Past verification results)
- ✓ Secured amount of adjustment => Time slot of electricity use is adjusted (shifted) without affecting lives
- ✓ Target facilities can store energy (energy that will be used at some point in the future)

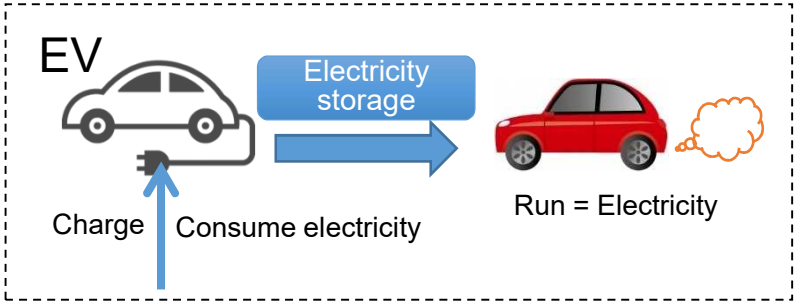






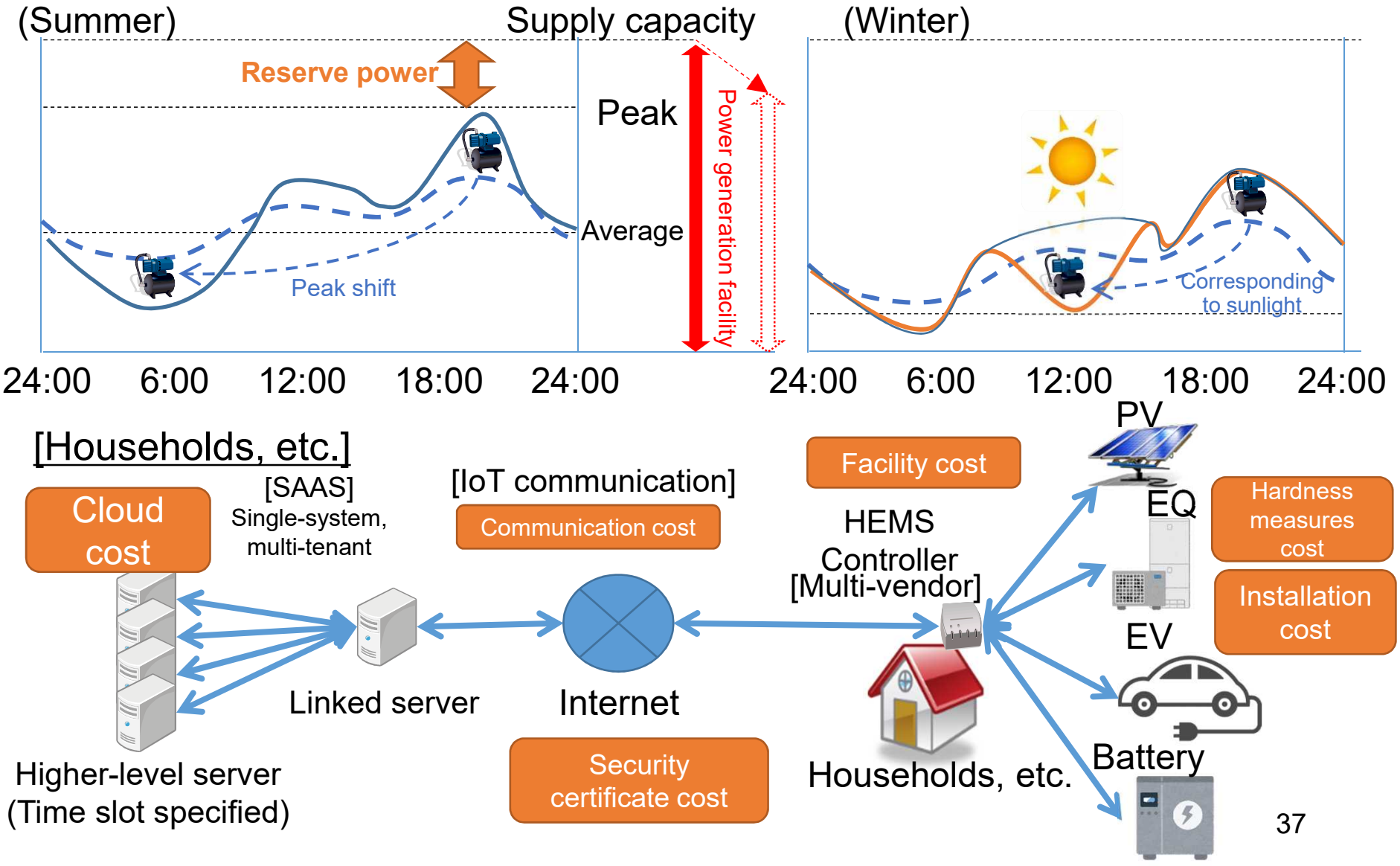
Cannot store



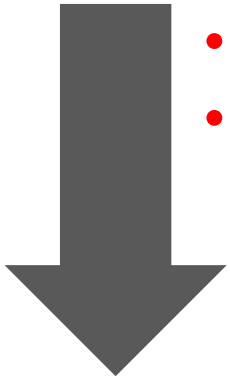


Point for inexpensiveness: "dual purpose"

How is energy adjusted?



Traditionally, electric power companies:
- supply electricity in tune with consumer demand, and
- are responsible for adjusting the supply-demand balance.



- **High cost structure**
- **Inadequate adjustment capability**

By adjusting how they use electricity, electricity consumers will:
- incorporate renewable energy in their usage while
- employing a continuous, low-cost mechanism.

- Overview of Miyakojima City
- Policy background
- Sustainability and local energy policy
  - Views toward energy policies
  - Examples of activities
- **Island-and-islets type smart community verification project**
  - Overview
  - Structure of energy costs on isolated islands
  - Characteristics of renewable energy and electricity
  - Securing an inexpensive adjustment capability
  - **Future direction**

1. Outcomes and challenges in social implementation

[Adjustment capability verification]

- Technically, adjustments can be made through IoT. This would require verification of certainty, examination of operational issues, and more.

[Cost simulation]

- Devices, construction, communication, etc. are now sufficiently inexpensive, which makes it possible to secure an adjustment capability while producing benefits for residents. However, this would require widespread use of the devices, communication, etc.

[Effect simulation]

- If an inexpensive adjustment capability is secured, it is possible to expand renewable energy installations and reduce social costs. However, this has been shown only in a simulation, so it is necessary to actually prove the effect in the field.

[Market providing an adjustment capability]

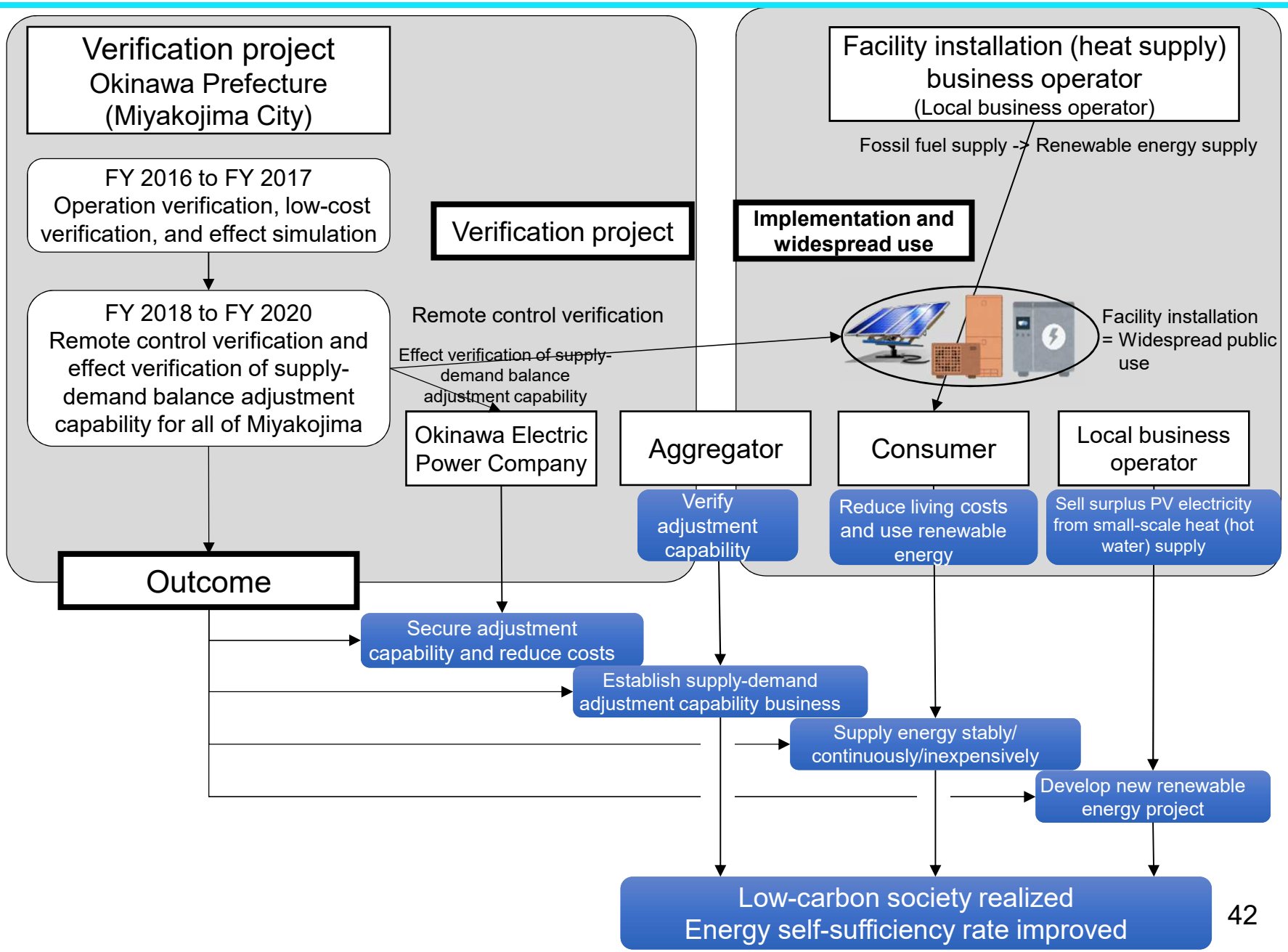
- A market with electric power companies as a system is at the examination stage as part of the reform of the electrical power system. It is important to show the actual effects.

2. Approach to solving issues

- There is a chicken-and-egg relationship between the ability to attract more users and cost reductions.
- To get widespread use, first consider a scheme that maximizes benefits for residents.
- In addition, the amount of widespread use is important to reducing device costs. The city seeks cooperation with other regions by using a successful case example as a model that is widely applicable to similar cases across Japan.
- In terms of institutions too, cooperation with other regions is also important for sharing and grouping issues with business operators in other regions in order to plan and propose solutions.
- For wider use of renewable energy, move forward with preparations to advance activities to form a single region.

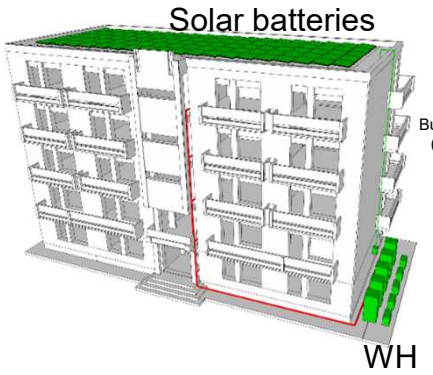
Stakeholder Relationships

Miyakojima City

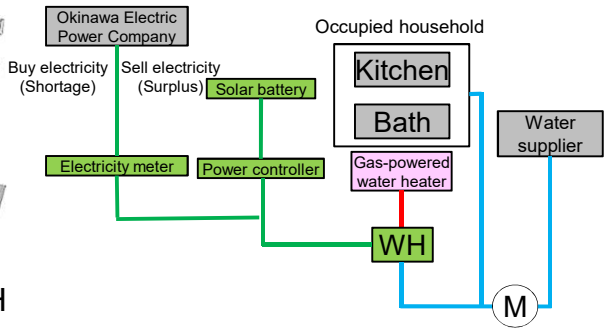


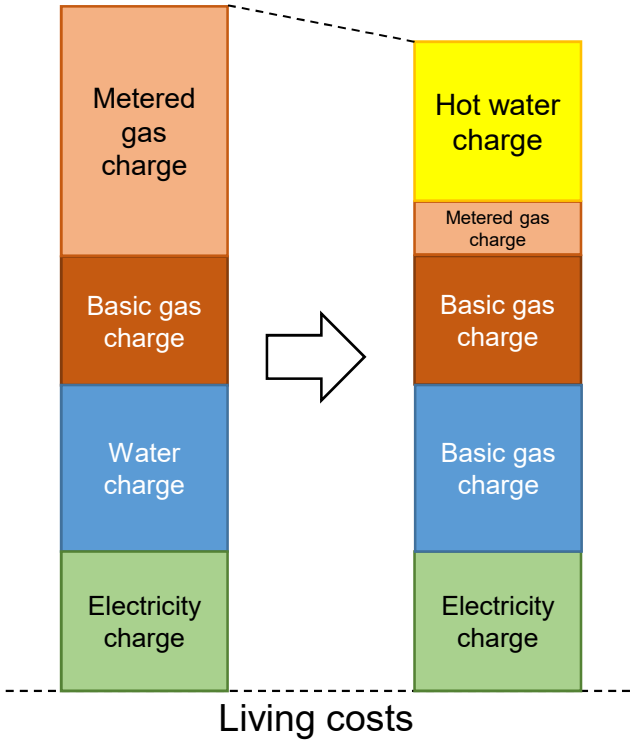
Apartment home

* WH = HP or electric water heater

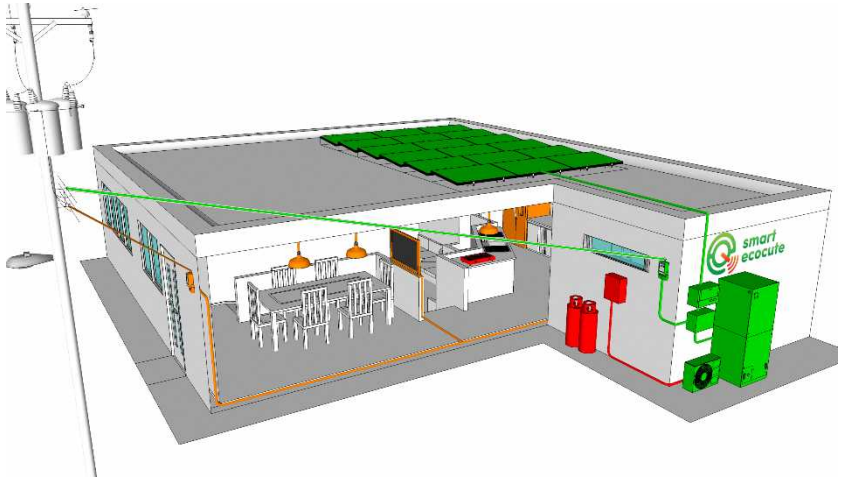


1EQ: 1 household





Detached home



[Characteristics of third-party ownership model]
- Consumers reduce living costs without incurring costs (risks).
- Business operators achieve low costs through massive bulk procurement.
- The failure risk is distributed.
- Profitability is secured through collaboration with a gas supplier.
- B-to-B facilitates demand control.

3. Vision of the future

- In the future, fossil resource reserves will certainly decrease and extraction will become impossible at some point (before which prices will surge).
- Energy supply from renewable energy sources will become mainstream.
- Renewable energy (photovoltaic, wind, ocean waves, etc.) is unlimited but dependent on nature. Therefore, the challenge is how to maintain a balance between supply and demand.
- In the future, nature will generate electricity, and adjustments will be made on the consumer side.
- Now, such a smart community will soon be realized. The city will share the vision and philosophy with the parties concerned in the region and move ahead with making a locally rooted social system.

Thank you very much for your attention.

千年先の、未来へ。
ECO-ISLAND
MIYAKOJIMA