

# Kansai International Airport Environmental Report

*2017*

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## About this Environmental Report

The “Environmental Report 2017” provides detailed data on the environmental initiatives conducted in fiscal 2016, and the categories of policy and measures described herein correspond to our Third Environmental Plan, adopted in April 2013.

### Environmental activities of the Kansai International Airport

At the Kansai International Airport we have been working to achieve thirty environmental targets to minimize impacts on the environment (air, water, etc.) for the entire airport island, based on the Kansai International Airport Environmental Plan adopted in June 2001.

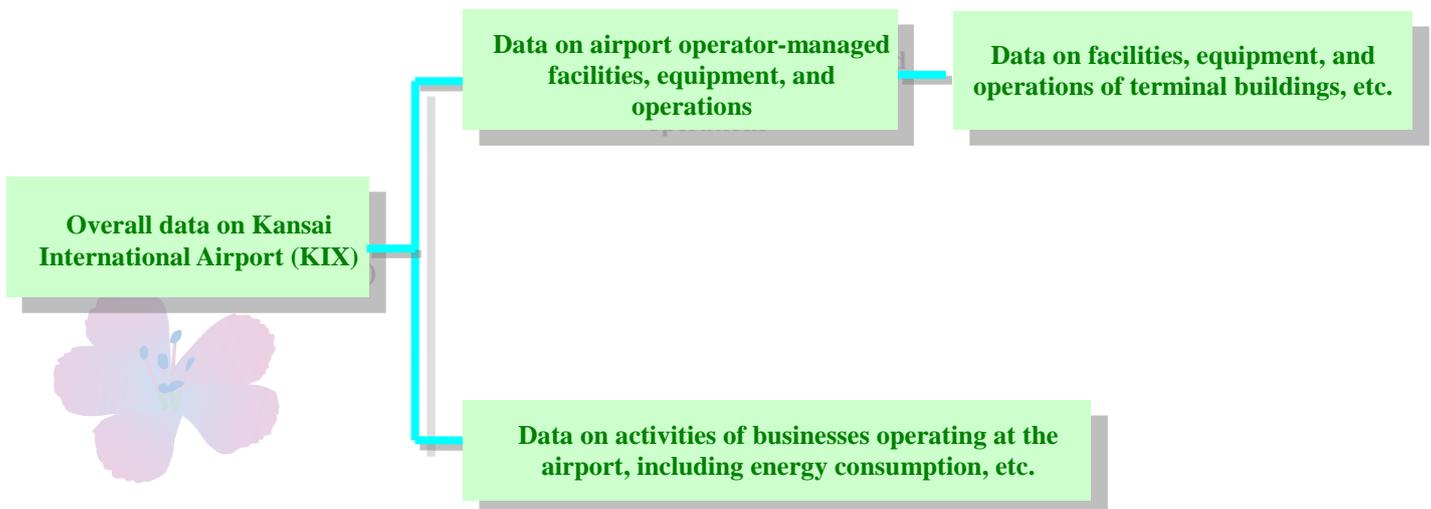
With the start of service of Runway B (August 2007), a new Environmental Plan (second edition) was adopted in March 2008, and we have been working since then to reduce environmental impacts from airport-related operations, and also to reduce impacts on the region around the airport.

The management of Kansai International Airport and Osaka International Airport was integrated in July 2012. The third edition of the Environmental Plan was adopted in April 2013 as a compilation of “smart” initiatives for a new environmentally friendly type of airport. Building upon our previous efforts, the latest edition aims to make this a “smart” airport—good for people and good for the planet—through initiatives such as the use of clean energy and better energy efficiency through the use of advanced information technologies.

In 2016, Kansai Airports began managing the airports and has been working to further reduce environmental impacts, as articulated in the Kansai Airports Environmental Declaration.

**Scope of report:** This report includes activities of businesses operating on the airport island that are members of the KIX Smart Island Council.

**Data presented:** Data in this report is compiled as shown below.



# CONTENTS

|  |           |
|--|-----------|
| <b>1. Environmental Plan</b>                                       | <b>1</b>  |
| <b>2. Environmental management structure and monitoring system</b> | <b>3</b>  |
| <b>3. Fiscal 2016 environmental data overview</b>                  | <b>4</b>  |
| <b>4. Major measures, targets, and achievements</b>                | <b>5</b>  |
| <b>5. Environmental initiatives</b>                                |           |
| (1) An airport that respects the local environment                 | 8         |
| (2) An airport that respects the global environment                | 12        |
| (3) An airport that recycles resources                             | 21        |
| (4) An airport that respects biodiversity                          | 24        |
| (5) An airport that respects the local community                   | 27        |
| <b>6. Environmental performance data</b>                           |           |
| (1) Environmental accounting                                       | 30        |
| (2) Environmental performance data                                 | 31        |
| <b>7. Chronology of environmental initiatives</b>                  | <b>32</b> |
| <b>□ Notes</b>   | <b>34</b> |

# 1. Environmental Plan

## ■ Key components

**1. Plan period:** Five fiscal years, from 2013 to 2017.

**2. Target activities and area:** The target area includes the entire area of Kansai International Airport, and in order to consider all environmental impacts associated with airport operations, the target activities include the activities of all users and all businesses/operators involved in airport operations. The airport operator is to take the lead on activities that are within its control, while actively seeking cooperation from airport business operators and users.

**3. Targets:** Targets are to be established, as quantitatively as possible, to promote and evaluate the level of achievement of the Plan, and the status of achievement is to be verified and published regularly. An effort shall be made to monitor progress with implementation of the Plan as well as other factors, such as international circumstances relating to climate change countermeasures. The targets are to be revised as appropriate.

**4. Organizational structure:** The airport operator is to advance and manage (review and improve) the Plan through the internal Environmental Management Committee, in cooperation with airport businesses and operators in the Smart Island Council, and others.

**5. Energy management:** Electricity consumption and generation on the airport island are to be managed in an integrated way, and energy conservation is to be promoted, including reducing electricity consumption during peak times.

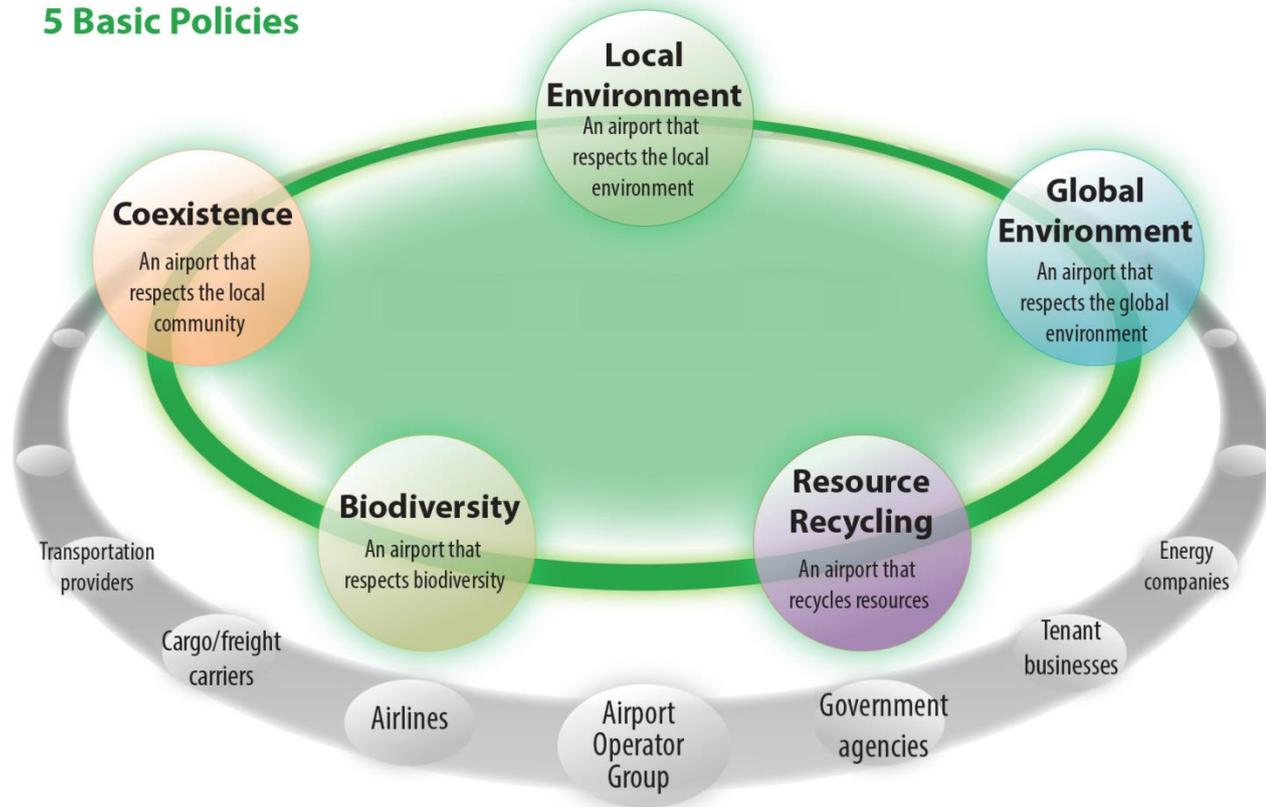
## ■ Basic Principles

Initiatives are promoted based on the concepts of “safety and security,” “improving customer satisfaction,” and “environmental measures.” With the expansion of area covered by the Kansai Innovation Comprehensive Special Zone for International Competitiveness Development we are engaged in initiatives toward the realization of the Smart Island Vision for an environmentally-advanced airport. This we do in cooperation with members of the KIX Smart Island Council, on the basic principles of “green innovation” (implementation of “smart community” model projects, etc.), “eco operations” (reduction of total energy use at the airport overall), and “eco relations” (reduction of impacts on the local environment as a pollution-free airport).



■ **Basic Policies**

**5 Basic Policies**

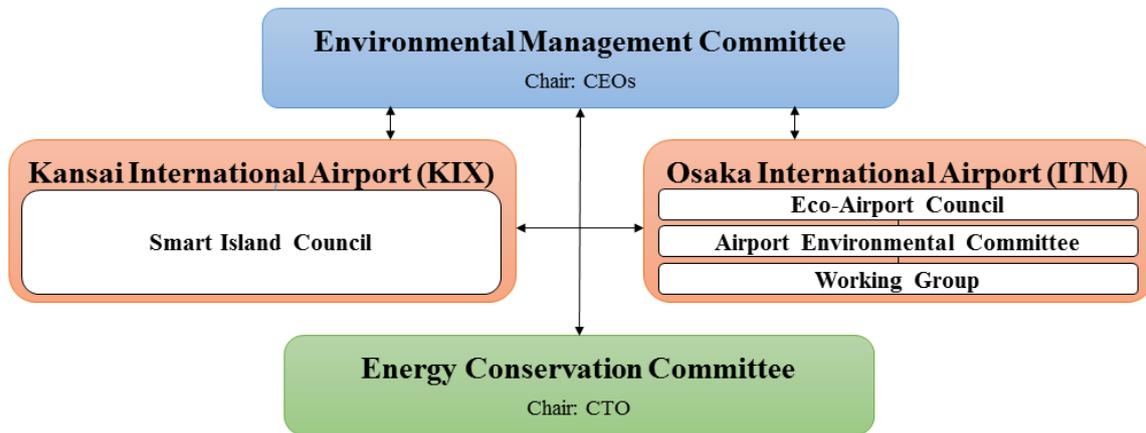


- |  |  |
|--|--|
| <p><b>1. An airport that respects the local environment</b></p>  | <p>Continue to comply with environmental standards for aircraft noise and work to further reduce noise levels. Work to protect the environment by not only meeting government regulations for air and water quality, but also by setting our own voluntary standards that are even more stringent.</p>   |
| <p><b>2. An airport that respects the global environment</b></p> | <p>Cooperate with the relevant contractors and businesses to show leadership in reducing greenhouse gas emissions arising from activities. Also, promote the introduction of clean energy through the use of renewable energy such as photovoltaics and hydrogen.</p>  |
| <p><b>3. An airport that recycles resources</b></p>              | <p>Continue with efforts to reduce the amount of waste generated and to make efficient use of the waste that does get generated, in order to make this an airport that recycles resources. Also, work to ensure that water recycling systems make efficient use of water resources, such as through efforts to promote the use of reclaimed water.</p> |
| <p><b>4. An airport that respects biodiversity</b></p>           | <p>Create seaweed habitat around the airport seawalls and maintain them as habitat for a diversity of flora and fauna. Also, increase the amount of greenery on airport grounds, and improve the surroundings to give airport users a sense of comfort and relaxation.</p>   |
| <p><b>5. An airport that respects the local community</b></p>    | <p>Aim for good communication with the local community and airport users, provide information to domestic and international users about environmental monitoring and our environmental activities, and provide diverse opportunities to promote an understanding of airport activities.</p>  |

## 2. Environmental management structure and monitoring system

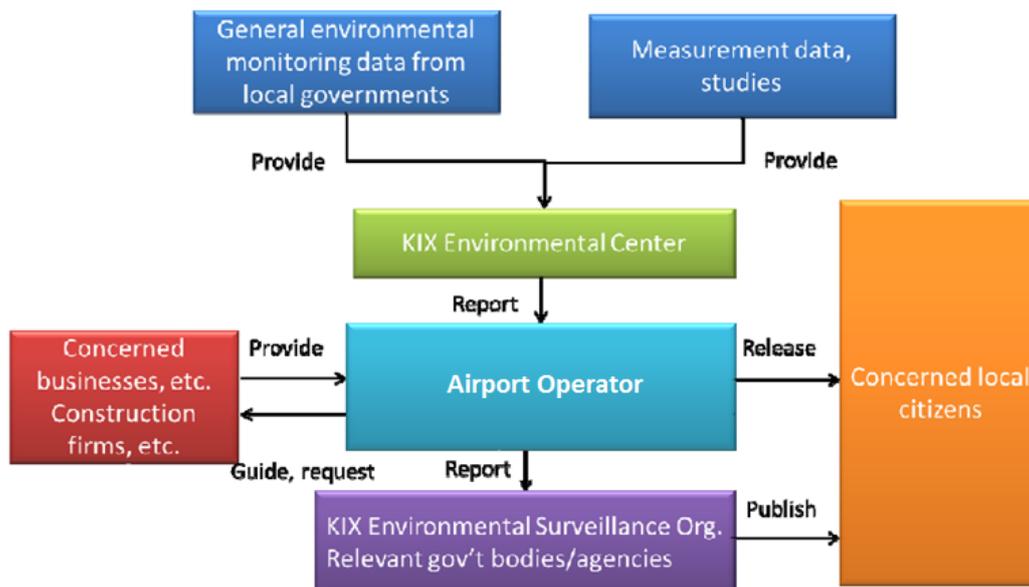
### ■ Organizational structure

The airport operator advances and manages (reviews and improves) the Plan through the internal Environmental Management Committee, in cooperation with airport business operators in the Smart Island Council, and others. Efforts are also made to share information with the Energy Conservation Committee.

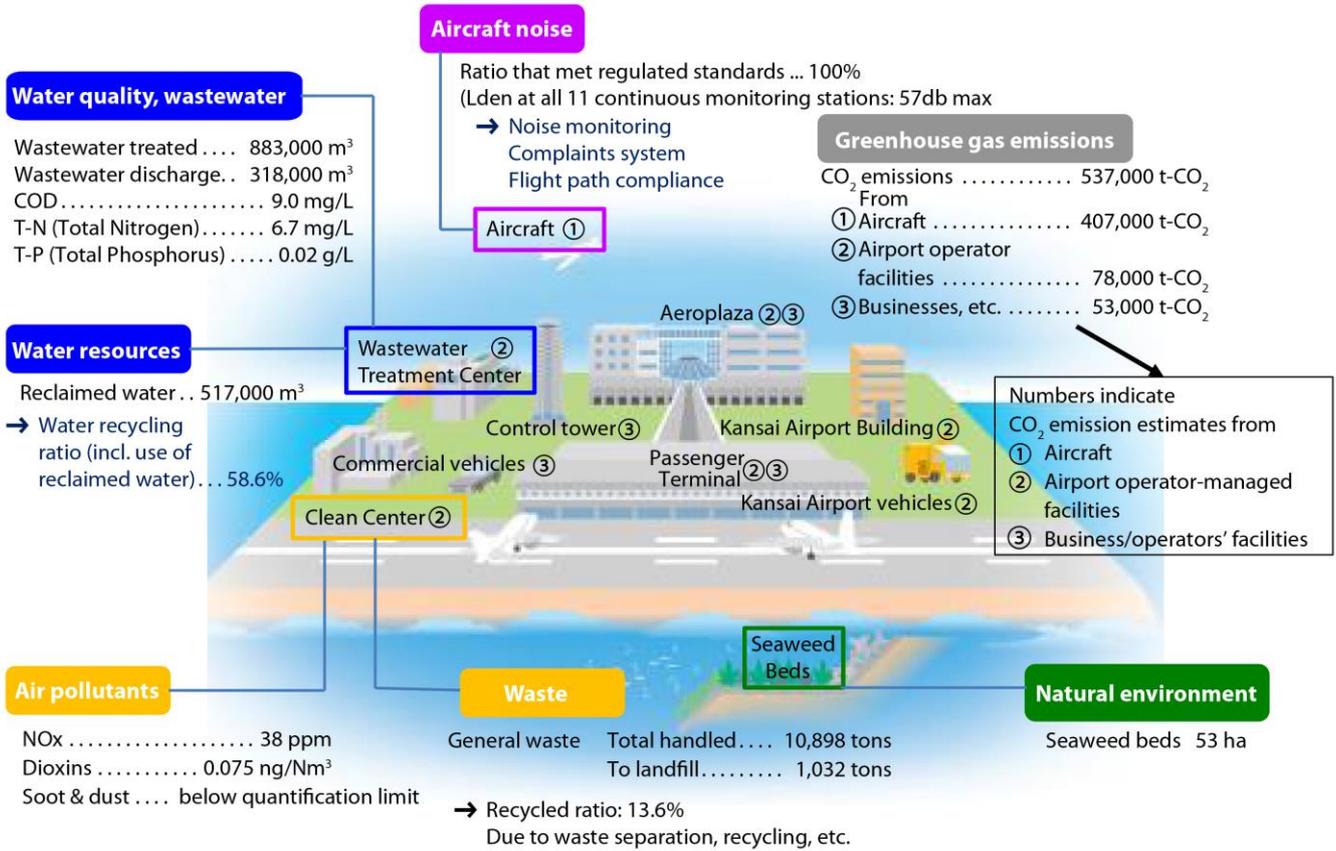


### ■ Environmental monitoring system

The environmental conditions around KIX are monitored in order to track the impacts of airport-related operations, construction, and so on. An environmental monitoring plan has been developed under the guidance and direction of the Kansai International Airport Environmental Surveillance Organization (members include the governor of Osaka Prefecture and mayors of nine cities and four towns in the nearby Senshu District). Aircraft noise, air quality, water quality, aquatic life and other environmental parameters are checked regularly. The results of monitoring are reported to the relevant governmental organizations in the form of monthly and annual reports, and are also available at the Kansai International Airport Environmental Center.



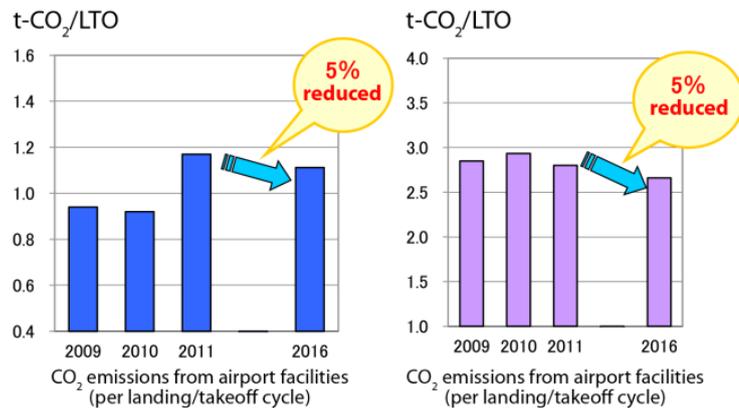
### 3. Fiscal 2016 environmental data overview



#### Quantitative targets

We establish targets in order to evaluate progress on efforts articulated in the Plan. Where possible, we establish quantitative targets (e.g., air quality, water quality, energy usage, greenhouse gas emissions, recycling rates) for quantifiable categories. For categories where quantitative targets are more difficult to establish, we still make our best effort to quantify the status of our initiatives.

#### Examples of quantitative targets



## 4. Major measures, targets, and achievements

| Item  |   | Objective  | FY2016 achievements   | Description   | Rated | Page |  |
|---|---|--|---|---|-------|------|--|
| <b>(1) An airport that respects the local environment</b>           | Aircraft noise  |  |   |   |       |      |  |
|   | Reduce aircraft noise, introduce low-noise aircraft   | Maintain 100% achievement of environmental standards   | • Continued to achieve 100% (Lden 57 or less)   | • Continued environmental monitoring.   | ---   | 8    |  |
|   | Ensure compliance with proper flight paths  |  |   | • Encouraged related parties to introduce low-noise aircraft.   |       |      |  |
|   | Consider runway operations, make requests to concerned organizations  |  |   | • Contacted concerned local governments by fax, etc., regarding any deviation from flight path due to weather conditions, etc.  |       |      |  |
|   |   |  |   | • Requested KIX Airline Operations Council (AOC), etc., to observe proper flight paths.   |       |      |  |
|   | Air quality protection  |  |   |   |       |      |  |
|   | Encourage the introduction of aircraft with low emissions of air pollutants   | Appeal/request, best effort.   | • Requested efforts by KIX Airline Operations Council (AOC).  |   | 😊     |      |  |
|   | Emission reduction measures at incineration plant (Clean Center)  | Voluntary target of 70 ppm or lower concentration of NOx emissions (Government standard is 187 ppm)                              | • 38 ppm (average)  | • Maintained efforts to ensure that actual nitrogen oxide emissions from incineration plant were well below regulated standards.  | 😊     | 10   |  |
|   | Improve fuel quality of jet fuel tanker trucks  | 100% is good quality Bunker A fuel or better   | • 100% good quality fuel is being used  | • Requested related parties to improve quality of tanker truck fuel.  | 😊     |      |  |
|   | Water quality protection  |  |   |   |       |      |  |
| Reduce impacts of water discharge from wastewater treatment plant   | COD level of treated wastewater discharge: Daily average 10 mg/L or lower<br>Daily COD load never to exceed 30 kg/day (1/6th the level predicted by environmental impact assessments) | • COD daily average 9.0 mg/L<br>• Daily COD load 6.9 kg/day  | • Established targets to maintain quality of treated water discharge at levels much better than regulated standards, and conducted extensive upkeep/maintenance of facilities.<br>• Reused some discharge from wastewater treatment plant as reclaimed water. (See "An airport that recycles resources" section for reclaimed water targets.) | 😊   | 11    |      |  |
| <b>(2) An airport with minimal impact on the global environment</b> | Energy conservation measures  |  |   |   |       |      |  |
|   | Introduce energy-efficient equipment  | For new construction or upgrades, use only LED lighting for buildings/facilities and all airport lighting.                       | • Conversion to LED lighting in terminal buildings, Observation Hall, etc.<br>• Install LED lighting in Terminal 2 (international flights zone)   | • Implemented various energy saving efforts, including LED installation in terminal buildings and Observation Hall, converting to higher efficiency luggage delivery motors and electrical distribution equipment for airport lighting, and installation of 37 kW intake fan inverter at incineration center (Clean Center), etc.<br>• In Terminal 2 (international flights), converted to LED lighting and light sensors, installed efficient air conditioning, and improved thermal insulation with double-paned glass. | 😊     | 12   |  |
|   | Promote energy-efficient operations   | 1% average annual reduction in energy intensity of operations managed by the airport operator                                    | • Average 3.7% annual reduction for past 5 years<br>• Monitoring changes in reference values in target buildings  |   | ---   |      |  |
|   | Reducing greenhouse gas emissions   |  |   |   |       |      |  |
|   | Promote the use of more fuel-efficient aircraft   | Reduce greenhouse gas emissions (per aircraft landing-takeoff cycle) by 5% compared to FY 2011                                   | • 18.6% reduction (reduced from 2.80 tons in FY2011 to 2.28 tons per LTO cycle)   | • Increased ratio of fuel-efficient aircraft (ratio of smaller aircraft is increasing).   | 😊     | 13   |  |
|   | Reduce the use of auxiliary power units (APU)   | Reduce APU use to 10% or less (equiv. to GPU usage of 90%)   | • GPU usage ratio of 78.9%  | • Changes made to parts of Aeronautical Information Publications (AIP) since Jan. 2010, reduced time aircraft can use auxiliary power unit (APU) (was 30 minutes before scheduled departure, now 15 min.), boosting use of GPU (ground power units), which have a lower CO <sub>2</sub> emission load.  | 😞     | 14   |  |
|   | Idling prevention awareness campaigns   | Appeal/request, best effort.   | • Smart Island Council conducted an idling prevention campaign on June 3, 2016, and handed out information flyers and hand-held fans to drivers of trucks, limousine buses, taxis, and cars that use the airport  |   | 😊     | 15   |  |
|   | Promote public transportation   | Appeal/request, best effort.   | • Appealed to public transport users  | • Conducted outreach by Smart Island Council.   | 😊     |      |  |
| Reduce greenhouse gas emissions from airport facilities             | Reduce GHG emissions (per landing-takeoff cycle) from airport facilities (excluding aircraft) by 5% compared to FY2011  | • Reduced 37.6% (reduced from 1.17 tons/LTO in FY2011 to 0.73 tons/LTO)<br>• Acquired Airport Carbon Accreditation (ACA) Level 2 |   | 😊   | 13    |      |  |
|   | Reduce plastics content 10% or less   | • Plastics content dropped to 16.5% of garbage brought to airport island incineration facility.                                  |   | 😞   |       |      |  |

Fully achieved target (100% or greater)
 Generally achieved target (90% to 100%)
 More effort needed next year (achieved below 90%)

Note: Targets to be achieved by end of FY2017.

| Item  |  | Objective   | FY2016 achievements  | Description   | Rated | Page |
|---|--|---|--|---|-------|------|
| <b>(2) An airport with minimal impact on global environment</b> | Promote introduction of eco-cars   |   |  |   |       |      |
|   | Promote introduction of eco-cars   | Eco-car introduction ratio 100% (EV, FCV, CNG, HV, PHV, ultra-fuel-efficient vehicles) for Kansai Airports car sharing vehicles   | • Fleet ratio 56.3% (9/16 vehicles)  | • Introduce eco-cars when replacing Kansai Airports car-sharing vehicles.   | 😊     | 16   |
|   |  | Eco-car ratio 80% (commercial vehicles used on island)  | • Fleet ratio 22.4% (402/1,791 vehicles)   | • Encourage businesses operating on island to introduce eco-friendly vehicles.  |       |      |
|   |  | Trial use of hydrogen fuel cell vehicles, as appropriate.   | • As part of demonstration trial selected by Ministry of Environment in February 2015, launched the first-ever trial operation of a fuel cell-powered forklift at an Asian airport.<br>• Introduced 1 commercial car model to the fleet in 2016.<br>• In January 2016, installed large hydrogen fueling station on Phase 2 airport island, as part of hydrogen grid project. | 😊   |       |      |
|   | Implement in cooperation with related parties  | • In cooperation with interested parties (Ministry of Land, Infrastructure, Transport and Tourism, businesses/operators) discussed more use of CNG low-emission vehicles (trucks, limousine buses, shuttle buses)<br>• Now conducting trial operation of hydrogen-powered vehicles, using hydrogen fueling stations (installed May 2007, January 2016) on airport island. |  |   |       |      |
|   | Expand the use of clean energy   |   |  |   |       |      |
|   | Expand the installation of hydrogen fueling stations   | Best effort   | • Using hydrogen filling stations, added 2 hydrogen engine cars to the fleet.<br>• Hydrogen grid project began on May 20, 2014.  | 😊   | 16    |      |
| Install CNG fueling stations                                    | Consider   | • In cooperation with interested parties (Ministry of Land, Infrastructure, Transport and Tourism, gas suppliers/operators), discussed construction of CNG fueling stations.  | 😊  |   |       |      |
| Install electric vehicle charging stations                      | Best effort  | • Installed four more regular chargers in parkades (P1 and P2) in April 2016, bringing the total to 10 chargers on the airport island.  | 😊  | 17  |       |      |
| Implement solar power projects                                  | Locally-generated energy accounting for equivalent of 10% of electricity consumption on airport island | • Reached equivalent of 9.7% generated  | • Launched operation of KIX Megasolar in Feb. 2014, and launched operation of new megasolar installation in September 2015.<br>• In March 2016 started operation of solar power generation on roof of Nankai Bus Co. building in international freight zone.   | 😊   | 18    |      |
| Use clean energy  |  |   | • Installed small wind turbine in Sora Park on Phase 2 island in September 2014, and two units in February 2016, bringing the total to 3 units.  |   |       |      |
| <b>(3) An airport that recycles resources</b>                   | Achieve zero emissions   |   |  |   |       |      |
|   | Reduce general waste volume. Recycle resources.  | 13% recycling rate for general waste  | • Recycling ratio 13.6%  | • Issued rules for waste separation in "Regulations Governing the Use of Waste Processing Facilities."<br>• Introduced separated waste collection by airline companies for garbage from aircraft. | 😊     | 19   |
|   | Reduce industrial waste volume. Recycle resources.   | Appeal to businesses/operators on airport island  | • Requested efforts: proper disposal of industrial waste, waste prevention, reuse of waste plastic from packaging, etc.  | 😊   |       |      |
|   | Effective use of construction byproducts   | 100% recycling of soil/sand from projects on island   | • Recycling ratio 100%   | • Recycled/utilized in construction related to new terminal (T3), seawall, etc.   | 😊     |      |
|   | Green purchasing   | Continue efforts  | • Selected green options as much as possible when purchasing products.   | 😊   |       |      |
|   | Water conservation, water recycling  |   |  |   |       |      |
|   | Promote water conservation actions   | Reduce clean water consumption by 5% from FY2011 levels (per landing/takeoff cycle)   | • Reduced by about 44% (from 7.5 to 4.2 m <sup>3</sup> /LTO)   | • Encouraged relevant parties to save water, with use of automatic taps, water-conserving devices.  | 😊     | 20   |
| Use reclaimed water   | 55% usage rate (percentage of wastewater reclaimed/recycled)   | • Water recycling ratio: 59%  | • Encouraged the use of reclaimed/recycled water.  |   |       |      |

 Fully achieved target (100% or greater)
  Generally achieved target (90% to 100%)
  More effort needed next year (achieved below 90%)

Note: Targets to be achieved by end of FY2017.

| Item   |  | Objective   | FY2016 achievements  | Description | Rated | Page     |
|--|--|---|--|-------------|-------|----------|
| <b>(4) An airport that respects biodiversity</b>       | Natural environment  |   |  |             |       |          |
|  | Protect/grow seaweed beds, coastal vegetation  | Maintain seaweed beds. Aim for 20% increase above FY2010 (was 47 ha).   | <ul style="list-style-type: none"> <li>Seaweed habitat, area: 53 ha (studied Mar. 2016), 13% increase over FY2010.</li> <li>Implementing transplantation to grow and maintain healthy seaweed beds.</li> </ul>   |             | 😊     | 21       |
|  | Expand greenery on airport island  | Expand greenery on airport island by 20%  | <ul style="list-style-type: none"> <li>Continued with greening efforts on airport island.</li> </ul>   |             | 😊     | 22       |
|  | Scenic views   |   |  |             |       |          |
|  | Protect landscape/views on airport island  | Continue efforts  | <ul style="list-style-type: none"> <li>Worked to protect scenic views: KIX Sora Park; KIX Sora Farm; water features along inner water between airport islands; terminals; etc.</li> </ul>  |             | 😊     | 23       |
| Create spaces for resting and relaxation               | <ul style="list-style-type: none"> <li>Created spaces for resting/relaxation by using inter-island water area, KIX Sora Park.</li> </ul> |   |  |             |       |          |
| <b>(5) An airport coexisting with the local region</b> | Information provision  |   |  |             |       |          |
|  | Publish environmental monitoring data  | Ongoing release of monitoring data. Prepare Environmental Report each fiscal year.  | <ul style="list-style-type: none"> <li>Published environmental monitoring data (aircraft noise, air quality, water quality, etc.), environmental reports on website, etc.</li> <li>Installed monitors showing electrical generation of solar panels (KIX Megasolar), visually displaying environmental information</li> <li>Added Airport Island Phase 2 tour to Waku Waku Airport Explorer Tours.</li> </ul>  |             | 😊     | 24       |
|  | Dialogue with the local community  |   |  |             |       |          |
|  | Provide environmental information  | Provide website, reports, pamphlets   | <ul style="list-style-type: none"> <li>Included environmental management plans, Smart Island Reports, environmental monitoring data, etc., on company website.</li> </ul>  |             | 😊     | 24       |
|  | Provide opportunities for environmental education, etc.  | Continue efforts  | <ul style="list-style-type: none"> <li>Provided environmental information materials at Kansai Airport Environmental Center at the Observation Hall.</li> <li>KIX Family Eco-Classes: Hydrogen/Magnesium Air Fuel Cells, hands-on learning for primary school kids (middle and higher years)</li> <li>Provided guest speakers and airport tours for primary school students (11 schools in FY2016).</li> <li>Brought local primary school kids to the KIX Sora Farm (eco farm that grows with pesticide-free fertilizer made from grass clippings from Osaka International Airport. Organized potato harvesting events.</li> <li>Presented an airport booth at the 2016 EcoPro International Exhibition on Environment and Energy at the Tokyo Big Site (3 days, starting December 8, 2016).</li> </ul> |             | 😊     | 26<br>27 |
|  | Cooperation with airport-related businesses  |   |  |             |       |          |
|  | Coordinate Smart Island Promotion Council  | Continue efforts  | <ul style="list-style-type: none"> <li>In partnership with businesses/operators on airport island, promoted environmental protection, environmental education, etc.</li> </ul>   |             | 😊     | 27<br>28 |
| Collaborate with other airports in Japan and overseas  | Continue efforts   | <ul style="list-style-type: none"> <li>In March 2017, we welcomed trainees from Asia as part of a course being offered by the Overseas Human Resources and Industry Development Association (HIDA) and introduced KIX environmental initiatives, visited the incineration plant (Clean Center).</li> <li>Kansai Airports is a member of Airports Council International (ACI), which represents 623 organizations that manage 1,940 airports in 176 countries and regions around the world (as of January 2017), and participated as a member of the ACI Asia-Pacific Regional Environment Committee.</li> <li>The 7th meeting of the committee was held in Dubai, UAE, in October 2016 to discuss airport environmental actions.</li> </ul> |  |             |       |          |

 Fully achieved target (100% or greater)
  Generally achieved target (90% to 100%)
  More effort needed next year (achieved below 90%)

Note: Targets to be achieved by end of FY2017.

## 5. Environmental initiatives:

### (1) An airport that respects the local environment

KIX was built five kilometers off the coast of the Senshu District in order to minimize the impacts of aircraft noise. Measurements of aircraft noise have shown that environmental standards are being met at all monitoring sites. For emissions from our incineration plant and wastewater discharged from our wastewater treatment plant, we have voluntarily set standards that are more stringent than required by regulations, in an effort to minimize our impacts on the environment.

#### ■ Efforts to minimize the impacts of aircraft noise

Environmental assessments based on flight paths and flight procedures established to minimize aircraft noise found that only areas over water were affected by noise levels exceeding environmental quality standards.

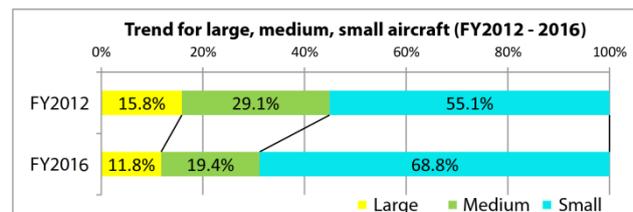
KIX conducts both continuous and periodic monitoring of aircraft noise, and publishes the findings. For fiscal 2016, as in the prior year, noise levels complied with environmental standards (maximum Lden 57 dB, see Note 1) at all land-based continuous monitoring stations and periodic monitoring sites.

FY2016 Aircraft noise monitoring results (continuous monitoring stations)



#### Efforts to minimize the impacts of aircraft noise

- Measures at noise sources
  - Use quieter aircraft (Note 2)
- Flight paths and aircraft operation
  - Aircraft are expected to fly over land only after gaining sufficient altitude over Osaka Bay after takeoff from the runway.
  - Aircraft arriving or departing late at night or in early morning are restricted to flight paths in airspace over Akashi Strait and Kitan Strait.
  - Flight procedures have been adopted to minimize noise from aircraft approaching the airport from Kitan Strait (Note 3).
  - Continuous descent flight procedures have been adopted (Note 4).
- Our initiatives
  - Continue monitoring for compliance with established flight paths and altitudes.
  - Communicate with KIX Airline Operations Council to request that members observe established flight paths and give due consideration to the need to minimize noise, etc.



For Notes 1 to 4, please see page 34.

## ■ Complaints, inquiries, and responses

### Aircraft noise

The annual number of complaints and inquiries peaked at 263 in fiscal 1998 when new flight paths were introduced in airspace over the Osaka Prefecture region, and since then have been on a declining trend. The majority of complaints and inquiries were about individual aircraft being too loud or flying too low, or queries about whether aircraft were staying on their regular flight paths. In response, we study these issues in cooperation with the Civil Aviation Bureau (under the Japanese Ministry of Land, Infrastructure, Transport and Tourism) and publish our findings. We will continue to respond appropriately to complaints and inquiries.

#### ◆ Inquiries

Kansai Airports

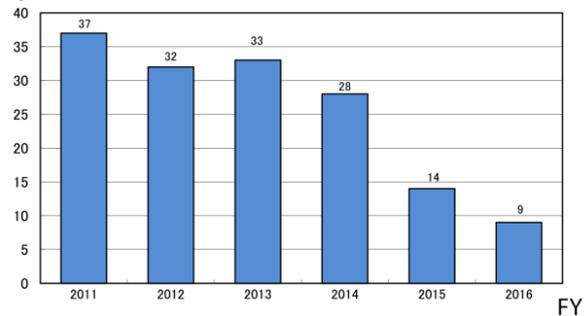
Technical Department, Smart Island Group

Tel: 072-455-2177 (weekdays 9:00 am to 6:00 pm)

KIX Airport Information Center

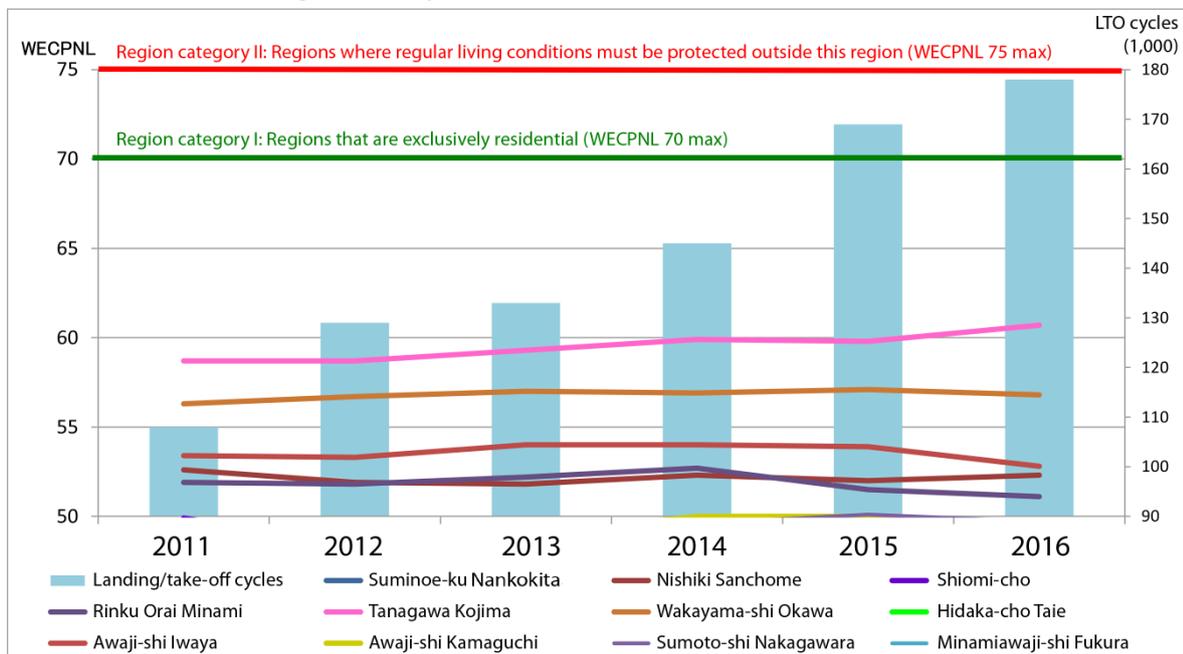
Tel: 072-455-2500 (nights and holidays)

Complaints



### Trends in aircraft landing/takeoff cycles and noise measurements (WECPNL, see notes)

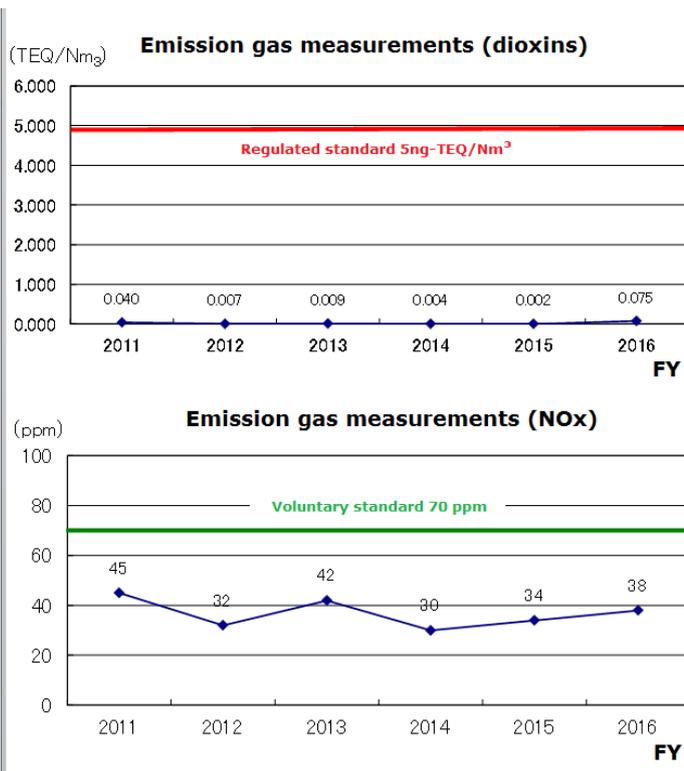
Trends in aircraft landing/takeoff cycles and noise measurements (WECPNL) (See notes)



#### Notes:

1. WECPNL was used until FY2012 as an environmental standard measure of aircraft noise, replaced by Lden starting in FY2013.
2. Noise measurements were WECPNL 50 or less at Suminoe-ku Nankokita.
3. WECPNL 50 or less: Shiomi-cho (2009-2010, 2012-2015), Awaji-shi Iwaya (1994-1996, 1998-2003), Awaji-shi Kamaguchi (1998-2013), Sumoto-shi Nakagawara (2008-2013), Minamiawaji-shi Fukura (1994, 1998-2015), Hidaka-cho Taie (2001-2015) (all fiscal years)
4. Nishiki and Fukura (1994-97 scheduled monitoring), Iwaya (1994-96 scheduled monitoring), Nakagawara (started continuous monitoring in 1997), Nankokita (same: 1998), Kamaguchi (same: 1998)

## ■ Measures to reduce emissions from incineration plant (Clean Center)



General waste from the airport island is separated into combustibles and recyclables, and combustible waste is then incinerated at our incineration plant. Emissions from incineration go through a filter-type precipitator. The installation of a garbage shredder has significantly improved the furnace's incineration efficiency; air pollutant levels such as nitrogen oxides are below regulated emission standards. Dioxin emissions are also well below regulated standards. Waste heat from incineration is being used as a source of heat for the incinerator, and for hot water and air conditioning at the incineration plant.

### Incineration plant (Clean Center)

#### Plant description

This plant is designed with a fluidized bed furnace. It also uses a filter-type precipitator that uses catalysts to remove nitrogen oxides, as well as humidity-regulated fly ash stabilizing equipment. The plant was designed with careful consideration of the local environment.

#### Exhaust gas flow

Emissions at about 850°C from the incinerator's furnace are directed into a cooling chamber, through heat exchangers designed with heaters to prevent white smoke (Note 5, page 34), and then to a reactor. Dust and hazardous gases are then removed by a filter-type precipitator, and exhaust gases are released into the atmosphere via an induced-draft fan and an exhaust stack. We operate with strict voluntary standards at the stack outlets for dust, sulfur oxides, hydrogen chlorides, and nitrogen oxides, with maximums of 0.02 g/Nm<sup>3</sup>, 20 ppm, 30 ppm and 70 ppm, respectively.

Note: Operational information about the KIX Clean Center is published online on the following website (in Japanese): <http://www.kansai-airports.co.jp/efforts/environment/kix/monitoring/clean.html>



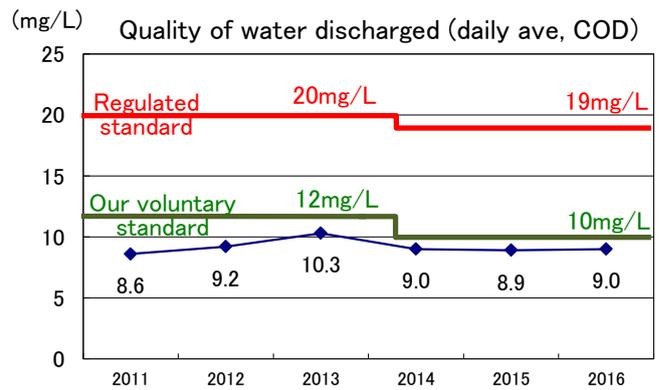
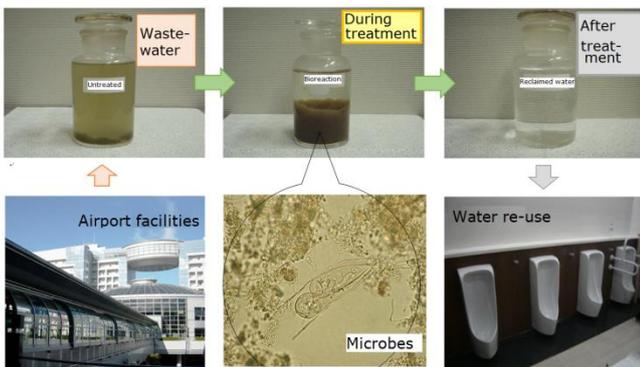
Incineration plant (Clean Center)



Central control room

## ■ Advanced treatment of general wastewater

General wastewater from airport-related facilities is directed to a wastewater treatment plant for advanced treatment before being discharged. The treated water being discharged is significantly cleaner than legally-required standards, based on our own more stringent voluntary standards (e.g., COD daily average 12 mg/L, and further tightened to 10 mg/L starting in fiscal 2014). Our laboratory is equipped with a variety of testing equipment, which ensures rigorous control of water quality until the point treated water is discharged into Osaka Bay. We also strive to maximize the effective use of water resources and to consider the local environment, such as by using some of the advanced-treatment water for flush toilets and the watering of plants.



### Wastewater treatment plant

Wastewater from the passenger terminal buildings and other airport facilities is considered to be general wastewater, and undergoes advanced treatment such as activated-sludge circulation nitrification/denitrification, chemical clarification (coagulation/sedimentation), and rapid sand filtration. Special wastewater from industrial sources first undergoes onsite pre-processing to remove hazardous substances, and then undergoes advanced treatment at the wastewater treatment plant, through chemical coagulation/sedimentation and rapid sand filtration processes, etc. After advanced treatment, the treated water is reused as reclaimed water for airport flush toilets, watering plants, etc., and any surplus amount is discharged into the sea.

|                    |   |
|--------------------|---|
| Treatment capacity | General wastewater 10,050 m <sup>3</sup> /day<br>Special wastewater 3,300 m <sup>3</sup> /day |
|--------------------|---|

In fiscal 2016, average processed volumes were 2,194 m<sup>3</sup>/day of general wastewater, and 225 m<sup>3</sup>/day of special wastewater.



## (2) An airport that respects the global environment

Kansai International Airport promotes energy conservation measures through the Energy Conservation Committee. In internal operations we are putting efforts into green purchasing, energy conservation, and going paperless. In December 2016, our efforts to reduce CO<sub>2</sub> emissions were recognized by the Airports Council International (ACI) when we received Airport Carbon Accreditation (ACA) Level 2. We will continue our efforts in collaboration with airport businesses to reduce CO<sub>2</sub> emissions.

\* Airport Carbon Accreditation is an international evaluation and accreditation program/system to manage and reduce CO<sub>2</sub> emissions from airports. It is the only environmental accreditation program designed specifically for airports. ACA has four levels for carbon management: Mapping (Level 1), Reduction (Level 2), Optimisation (Level 3), and Neutrality (Level 3+).

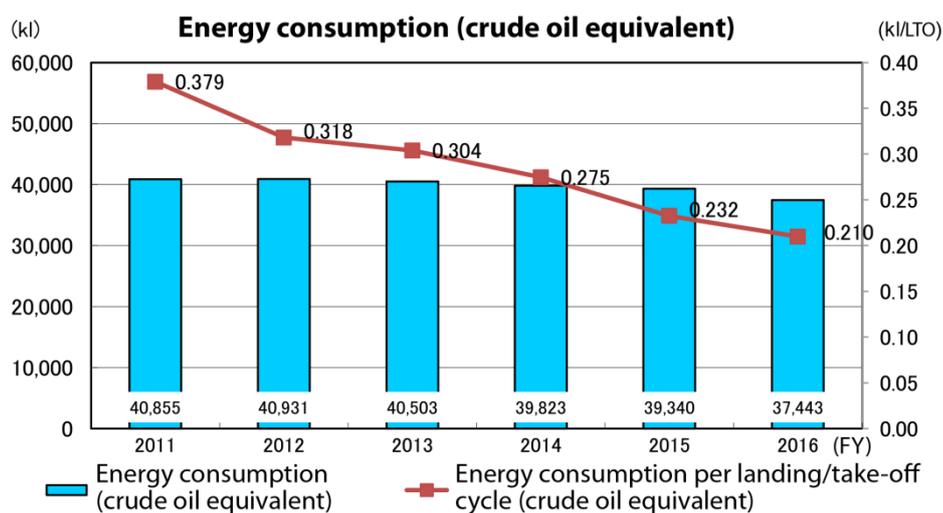


## ■ Promoting energy conservation

We are working to reduce CO<sub>2</sub> emissions (and conserve energy) by developing a carbon management plan that integrates all of our ongoing initiatives. It includes the creation of an organizational structure, reduction targets, and medium and long term plans to limit CO<sub>2</sub> emissions. Examples of our energy conservation measures at facilities include boosting the efficiency of equipment and plants and improving the thermal insulation performance of buildings. We are also undertaking efforts to optimize airport operations and visualize and analyze energy usage.

In fiscal 2016 we reduced annual CO<sub>2</sub> emissions by approximately 320 tons through actions that included conversion to LED lighting in terminal buildings and the Observation Hall (1820 units), upgrading to more efficient baggage conveyor motors (22 units), improving the efficiency of power distribution units for airport lighting systems, and conversion to inverters for 37 kilowatts incineration center (Clean Center) intake fans. Meanwhile for construction in Terminal 2 (international flights) which started operations on January 28, 2017, we aimed for energy conservation in the entire building, including the use of LED lighting and light sensor controls, the installation of high-efficiency air conditioning equipment, and improved thermal efficiency of multi-paned glass windows.

We will continue to work toward making further improvements in energy efficiency and a reduction in energy consumption for the entire airport.



Note regarding fiscal 2016 energy consumption:

Facilities covered have changed due to the change to new management under Kansai Airports.

Thermal conversion coefficients for heating and cooling is from actual numbers by the Kansai International Airport Heating and Cooling Supply Co.



LED lighting at Observation Hall



High-efficiency transformers are used in power distribution units for airport lighting systems



Inverters for incineration center fans boost efficiency

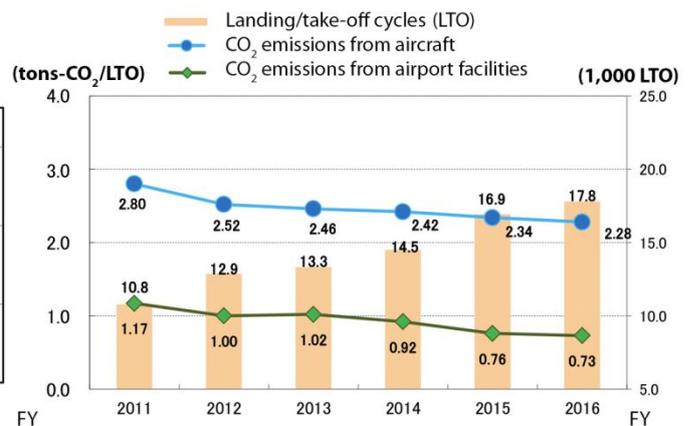
## ■ Reducing greenhouse gas emissions

CO<sub>2</sub> emissions from activities at this airport came to 537,000 tons in fiscal 2016, an increase of approximately 2.0% from the previous year. Total CO<sub>2</sub> emissions from aircraft increased, but the CO<sub>2</sub> emissions per landing and takeoff cycle decreased due to an increase in the number of aircraft landing and takeoff cycles and an increase in the ratio of small aircraft. Meanwhile, CO<sub>2</sub> emissions per landing and takeoff cycle decreased for airport facilities managed by Kansai Airports, and for airport facilities managed by airport businesses. This decrease is due in part to emission-reduction efforts, including the pursuit of energy conservation. The largest share of CO<sub>2</sub> emissions is from aircraft, at 75.7% of the total, followed by 14.4% from passenger terminals and other airport facilities.

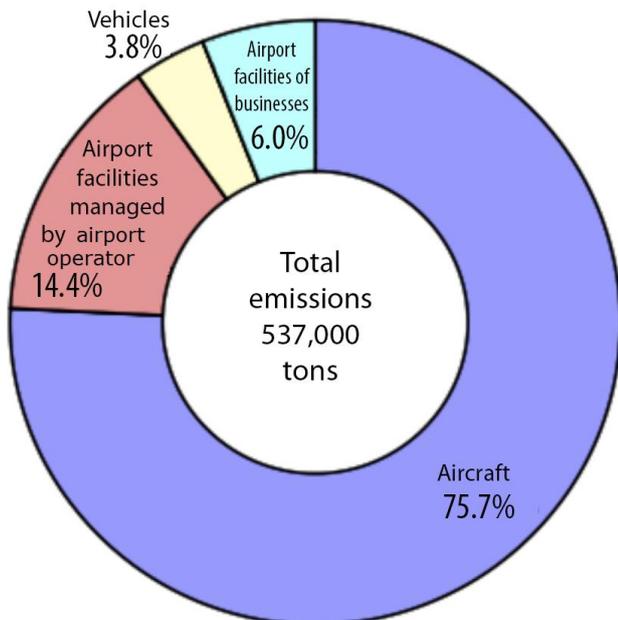
### Airport CO<sub>2</sub> emissions (total)



### Airport's total CO<sub>2</sub> emissions (per landing/take-off cycle)



### Breakdown of CO<sub>2</sub> emissions (2016)



Notes for graphs:

CO<sub>2</sub> emission factors for procured electricity are calculated from Kansai Electric Power Co. coefficients for each year. For fiscal 2016 the thermal conversion coefficient for heating and cooling is from actual numbers from the Kansai International Airport Heating and Cooling Supply Co.

Note also that when the environmental plan was adopted, the intention was to use 2006 emission factors each fiscal year, but it was later decided to use specific emission factors for each year in order to more closely reflect actual conditions.

#### Emission calculations:

- Emissions from aircraft are calculated to include the airport-related portion of the aircraft landing/takeoff (LTO) cycle as defined by the International Civil Aviation Organization (ICAO) (i.e., movement of the aircraft between an altitude of 3,000 feet and the ground for both landing and take-off).
- Emissions from vehicles are from vehicles operating within the airport's restricted areas, and exclude trains, ships, and vehicles travelling to and from the airport.

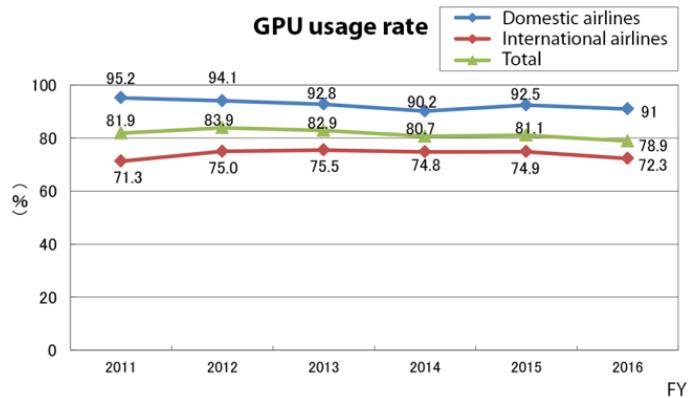
■ Promoting the use of ground power units (GPUs) (Note 6, p. 34)

The electricity required by stationary aircraft to run air conditioning and other systems is usually provided by an onboard auxiliary power unit (APU).

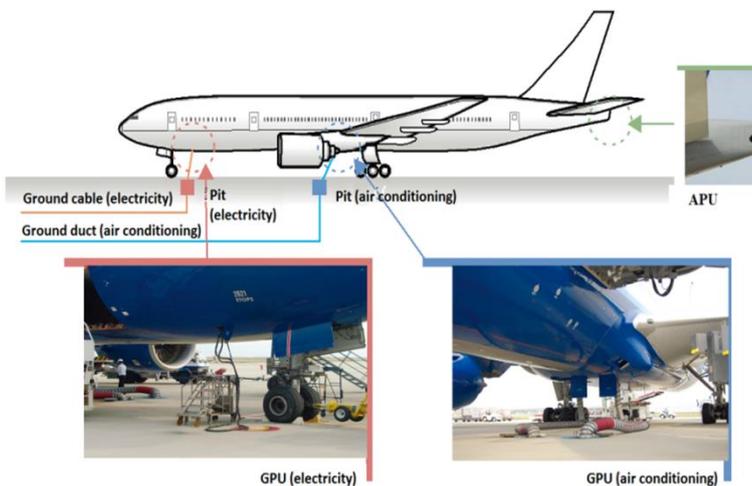
To reduce air pollution from APUs, we have installed ground power units (GPUs) to provide electricity and air conditioning to aircraft parking spots and ask airlines at KIX to use them.

KIX was the first in Japan to have changes made to the Aeronautical Information Publications (Note 7, p. 34) pertaining to GPU usage starting in January 2010, reducing the period of time an aircraft can use its APU—from 30 minutes prior to scheduled departure, to just 15 minutes.

In fiscal 2016 the overall ratio of GPU usage (including mobile units) was 78.9%.



Note: Graph indicates the ratio of actual number of times (flights) GPUs were provided compared to number of opportunities (flights). The calculations for 2012 onward exclude low-cost carrier (LCC) airlines, which have shorter aircraft parking times.



**Benefits of ground power units at KIX**

CO<sub>2</sub> emissions reduced (FY2016) by GPUs:

**47,000 tons**

Note: Reduction is calculated as the difference between CO<sub>2</sub> emissions from GPU use and the emissions that would have occurred if only APUs were used.

**Airlines with 100% GPU usage in fiscal 2016**  
(including the use of other companies' mobile GPUs)

The following four airlines had a GPU usage ratio of 100% in fiscal 2016 (used GPU for all 12 months of the fiscal year): Air France, Emirates, Hawaiian Airlines, Xiamen Airlines.

## ■ Idling prevention awareness campaigns

The Smart Island Council conducts an idling prevention campaign in June each year during national Environment Month, designated by the Ministry of the Environment. This is an annual activity to raise environmental awareness of airport users and businesses and encourage them to help protect the environment. The campaign (conducted June 3, 2016) involves handing out flyers and traditional Japanese fans (*uchiwa*) with messages urging drivers of trucks, limousine buses, taxis and passenger cars who use the airport to cooperate in idling prevention. A reduction of ten minutes of idling per trip by large vehicles (trucks, buses, etc.) arriving at the airport could reduce CO<sub>2</sub> emissions by approximately 570 tons annually (equivalent to the CO<sub>2</sub> absorbed by 65,000 40-year-old cedar trees). At the end of the campaign each year, volunteers also do a cleanup activity of loading and parking areas at the airport.

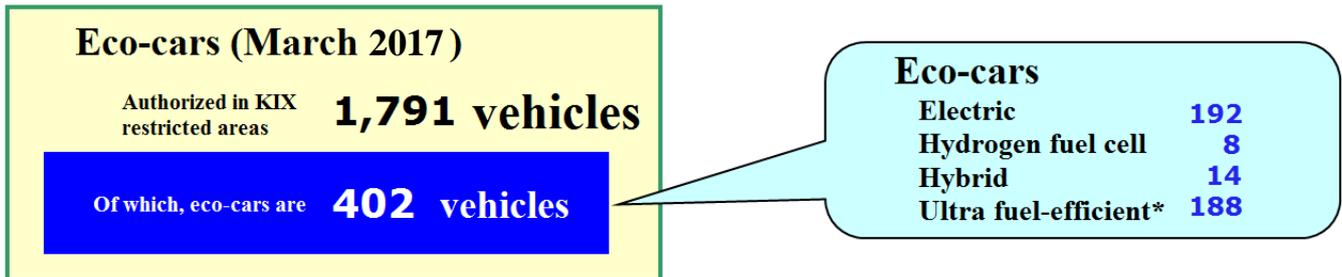


Scenes of the idling prevention campaign asking drivers to cooperate



## ■ Introduction of eco-cars

We are making an effort to gradually introduce eco-cars (electric, fuel cell, compressed natural gas, hybrid, plug-in hybrid, and ultra-fuel-efficient vehicles) when vehicles are being replaced and other opportunities arise. We are also encouraging businesses and operators on the airport island to make the shift to eco-cars. Eco-cars account for 402 of the vehicles authorized to operate inside the restricted areas (Note 8, page 34) at the KIX airport; 192 of them are electric vehicles. (Eco-cars are 22.4% of total fleet.)



Note: Ultra-fuel-efficient vehicles meet the following emission and fuel efficiency standards.

1. Gasoline vehicles

Emissions: 75% below Japan's 2005 standards

Fuel efficiency: Meet/exceed 2015 standards or 25% of 2010 standards

2. Diesel vehicles

Emissions: Meet post new long-term standards

Fuel efficiency: Meet/exceed 2015 standards

### ● Electric vehicle charging stations

Two rapid charging stations have been installed for electric vehicles (EVs) at the Observation Hall parking lot and Parking Lot 5 at Terminal 2 (P5). Parkades P1 and P2 have regular chargers (plug-in type), with installations in April 2016 bringing the total in parking lots to 8 stations. Combined with others at that Kansai International Airport the total is now 10 EV charging stations, making it easier for users to come by electric vehicle to the airport with confidence of being able to get a charge. (Available in Observation Hall parkade 8 am to 10 pm, elsewhere 24 hours a day.)



EV regular charger in parkade

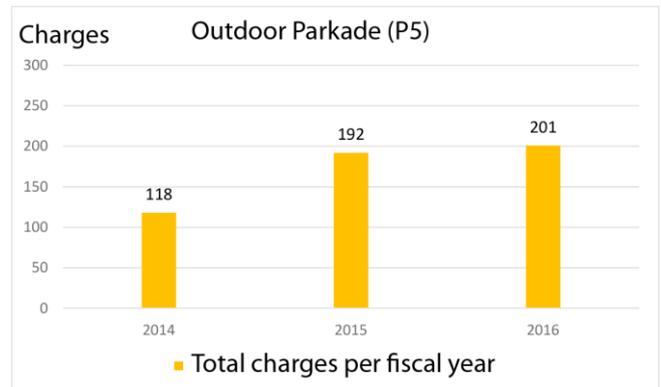
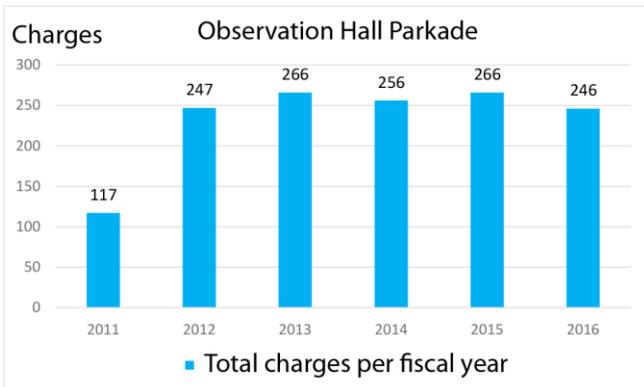


EV rapid charger at Observation Hall



EV rapid charging station, 24 hours a day  
(Terminal 2 parking lot)

## Usage of electric vehicle chargers



Note: Total charges in fiscal 2014 are counted from June that year when the EV rapid chargers were installed.

### ● Kansai International Airport Taxi Operators Council

The taxi industry is also making an effort to switch to eco-friendly vehicles to realize a low-carbon society. The Kansai International Airport Taxi Operators Council has introduced 22 hybrid cars, or about 39% of the total fleet of 56 vehicles.



Hybrid taxis

## ■ Expanding the use of clean energy

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### ● Solar power

The KIX Megasolar system began generating electricity in February 2014 from photovoltaic panels installed on the ground on the Phase 2 airport island and on freight building roofs, and a new megasolar system also started operating in the Phase 1 international freight zone in September 2015. In March 2016, Nankai Bus Co. also started operation of photovoltaic panels installed on the roof of its building in the domestic freight zone. All of this clean power generation produced the equivalent of about 9.7% of the total electricity consumed at Kansai Airport. The system generated about 17.66 million kilowatt-hours of electricity in fiscal 2016, reducing CO<sub>2</sub> emissions by about 8,707 tons.



Solar panels on roof of Nankai Bus building



KIX Megasolar



### ● Wind power

Since fiscal 2013 KIX Sora Park has had three outdoor street lights powered by wind turbines and solar panels. In fiscal 2016 they generated about 150 kilowatt-hours of electricity, contributing to energy conservation.

Also, a 5-kilowatt small wind turbine that was installed as a symbol of the KIX Smart Island Vision and started trial operation in September 2014 as a model case, the first of its kind at an airport in Japan. Two additional turbines of the same size started operating in February 2015, bringing the total to three. In fiscal 2016 annual output of these units was about 5,300 kilowatt-hours of electricity. The power generated is being used to power streetlights in the Sora Park.



Small wind turbines

## ●Hydrogen energy

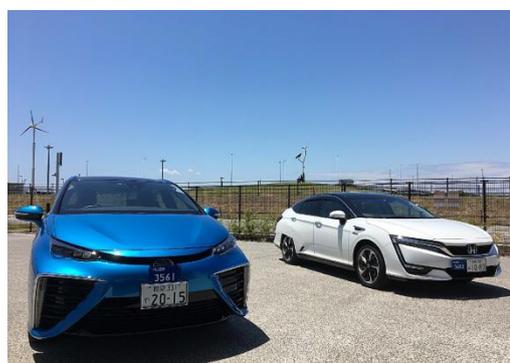
### Trial use of hydrogen fuel cell vehicles

Hydrogen is the ultimate clean energy, with water as its only product of combustion, and it is valued for its potential in preventing climate change. A hydrogen fueling station was installed at KIX in May 2007, fueling commercial vehicles running on hydrogen-powered engines. Between October 2012 and March 2014, buses powered by hydrogen fuel cells were in trial operation as shuttle buses between the Aero plaza and Terminal 2. Meanwhile, we added the Toyota Mirai to our vehicle fleet in April 2016, the world's first commercially-available hydrogen fuel cell vehicle (FCV), and we added the Honda Clarity fuel cell vehicle in December 2016.

In January 2016, a large hydrogen fueling station was installed on the Phase 2 airport island as part of our Hydrogen Grid Project. This was the first commercial hydrogen fueling station at any airport in Japan, and is also one of the largest. Besides providing refueling for FCVs, this station also will be able to serve fuel cell buses such as those that operate as limousine buses from Osaka International Airport, and as shuttle buses at Kansai International Airport.



Large hydrogen station (on Phase 2 Island)



Hydrogen fuel cell vehicles (Toyota Mirai and Honda Clarity)

### Trial operation of fuel cell forklift and hydrogen infrastructure: A first among Asian airports

On May 20, 2014, we made the full launch of the Hydrogen Grid Project, and in February 2015 we started trial operation of fuel cell-powered forklifts in the international freight zone of the airport, all a part of the Fuel Cell Forklift Practical Application and Development/Testing of Optimal Hydrogen Infrastructure Improvements Project, selected by the Ministry of the Environment for implementation. This is the first forklift of its kind to be used at any airport in Asia. In April 2017, construction of tanks and high pressure piping for liquid hydrogen was completed in the international freight zone as part of Japan's first hydrogen infrastructure installation for industrial vehicles, and the country's largest trial operations were launched for fuel cell forklifts and hydrogen infrastructure. The introduction of fuel cell forklifts to handle air freight 24 hours a day can reduce CO<sub>2</sub> emissions compared to forklifts powered by fossil fuels and electricity. Also, the ability to refill hydrogen in under three minutes eliminates the work of charging and battery exchanges and makes it possible to work with fewer interruptions, with benefits for work efficiency and scope of work.



Opening ceremony for industrial vehicle hydrogen infrastructure initiative



Hydrogen fuel cell powered forklifts

### (3) An airport that recycles resources

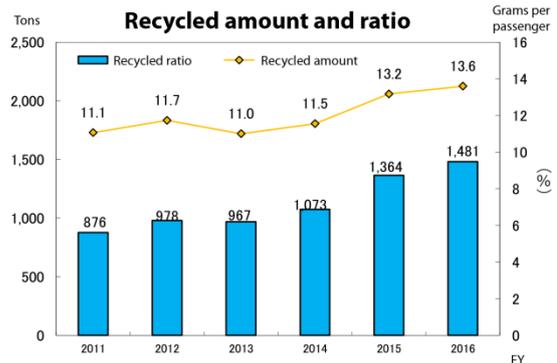
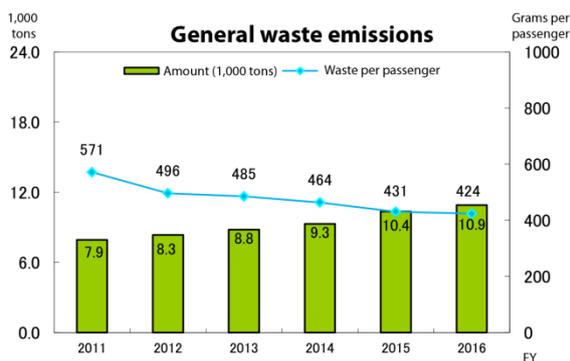
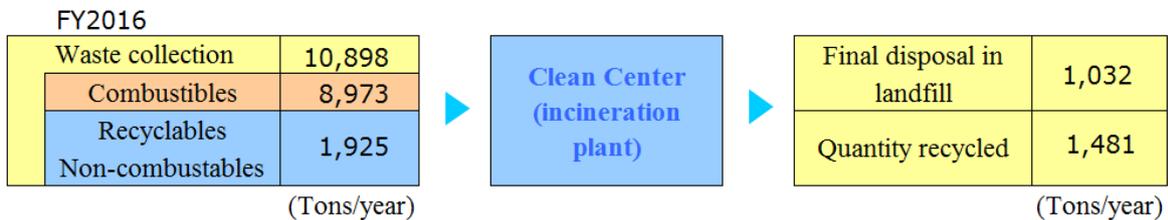
We are working to ensure proper management of waste generated on the airport island, including efforts through recycling and the reduction of waste volume. By using reclaimed water, we are also promoting the efficient use of water resources.

#### ■ Waste reduction and recycling

The more than approximately 11,000 tons of general waste generated at KIX each year come mainly from sources such as aircraft, airline catering plants, and passenger terminal buildings. In order to recycle and reduce this volume of general waste, we have written rules for waste separation in “Regulations Governing the Use of Waste Processing Facilities” and have reached out to businesses operating at the airport, urging them to sort their waste. The result is a slight increase of waste generated at the airport in fiscal 2016, but the amount per passenger has declined, and the recycling ratio was 13.6% for general waste (an increase of 0.4% over the previous year).

| Waste category          | Description   |
|-------------------------|---|
| Combustibles            | Kitchen waste, wood waste, non-recyclable paper, rags, other      |
| Recyclables             | Cans: Steel, aluminium  |
|                         | Glass bottles: Bottles (unbroken)                                 |
|                         | PET bottles   |
|                         | Waste paper: Newspaper (excluding advertising), magazines         |
|                         | High-quality used paper: Copy paper, office paper                 |
|                         | Documents (excluding confidential materials)                      |
| Non-combustibles        | Cardboard   |
|                         | Glass dishes, ceramic dishes, glass bottles (broken), metal waste |
| Large combustible items | Wood waste, cloth, briefcases, grass clippings, wooden products   |

As for industrial waste, we have been encouraging businesses operating at the airport to make efforts to manage waste properly, avoid creating waste, and recycle.

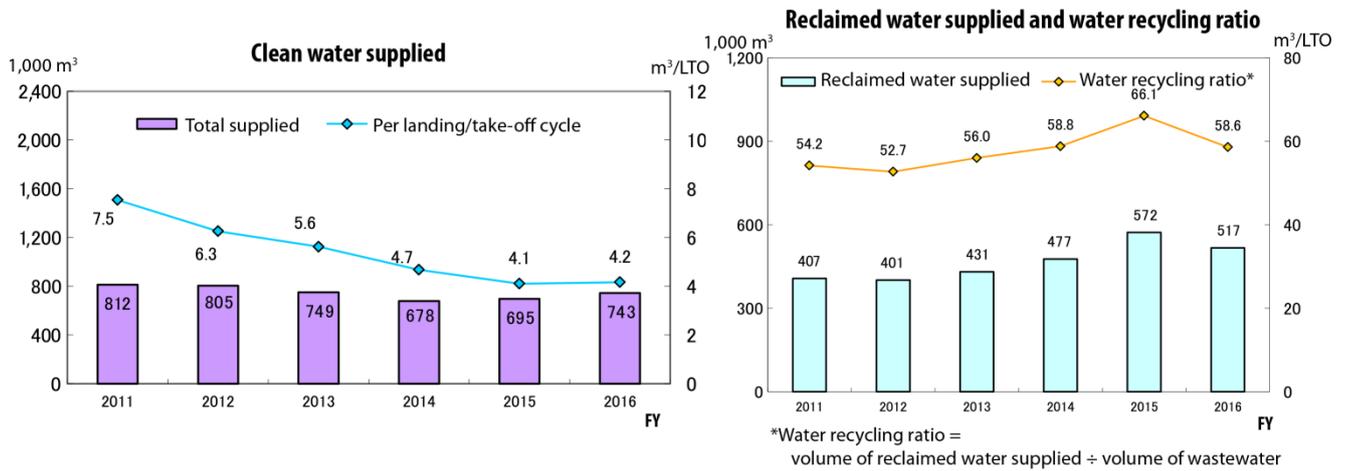


#### ● Efforts of airport island businesses to reduce waste generated

**Japanese domestic airlines:** About one-sixth of the total amount of waste generated at KIX comes from aircraft. Recognizing the need to reduce waste by sorting it and reducing its volume, airlines including JAL and ANA sort garbage coming from the aircraft passenger cabins. They are also separating used newspapers from aircraft cabins. A large quantity of packing material (plastic) is used in air cargo operations to prevent leakage, etc., and an effort is being made to recycle rather than treat it as waste.

## ■ Reducing clean water usage, using reclaimed water

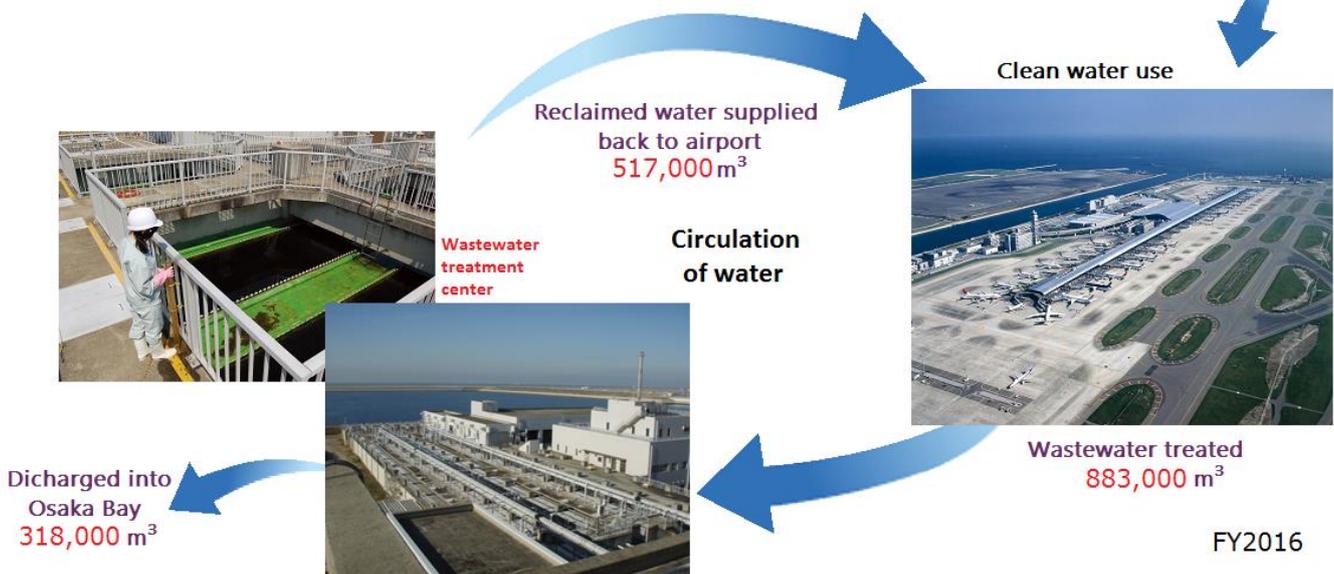
On the KIX airport island, reclaimed water from airport facilities is purified at the wastewater treatment center and used for flush toilets and for watering plants, as well as for cleaning roads and other ground surfaces. In fiscal 2016, a total of 743,000 cubic meters of water was supplied to the airport (equivalent to 4.2 cubic meters per landing and takeoff cycle). We used 517,000 cubic meters of reclaimed water, and our water recycling rate was 58.6%.



### Uses of reclaimed water



Clean water supplied  
743,000 m<sup>3</sup>



- **Efforts to reduce water consumption**

The Nankai Bus Co. has installed water-saving bus washing equipment at its facilities on the airport island. Also, the company has installed wastewater filtering and recirculation system to re-use wastewater, which is reducing the consumption of clean water.

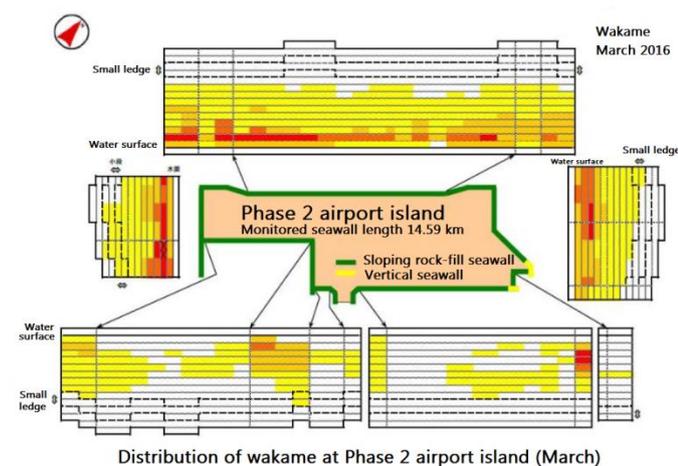
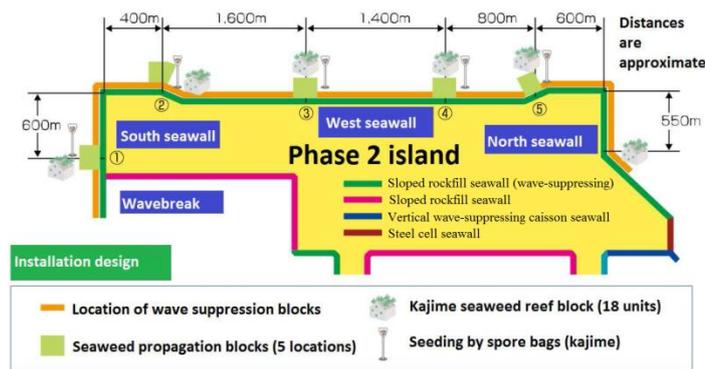


## (4) An airport that respects biodiversity

Seaweed beds have been planted to help create marine habitat in Osaka Bay and we have been monitoring growth. An effort was made to provide better growing conditions for seaweed by installing special blocks on the sloping rock-fill seawalls built for the Phase 2 airport island construction, and a number of other approaches were attempted, including seaweed seeding. We have been creating seaweed habitat for about seven years near the Phase 1 island, and about three years near the Phase 2 island. Also, by our efforts to promote greenery on the island, including ceremonial tree plantings and the expansion of flower spots, we are working to restore and protect coastal flora.

### ■ Protecting and restoring seaweed habitat, coastal flora

Encouraged by the results of monitoring the Phase 1 airport island seawall, KIX installed 3,200 seaweed-growing blocks (specially developed for this purpose) at five locations along the Phase 2 airport island seawall. To foster the quick formation of seaweed beds, seedlings were supplied by the placement of spore bags containing species such as *Sargassum filicinum* (*shidamoku* in Japanese) and *Eisenia bicyclis* (*kajime* in Japanese).

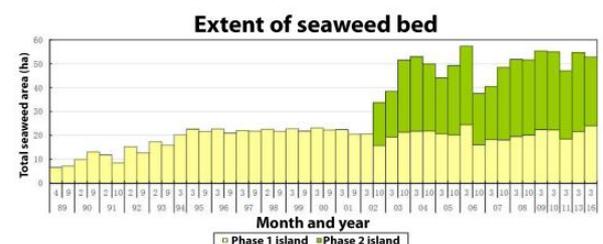


Note: Reference to “seeding by spore bags” refers to an initiative to actively supply spores by placing net bags (spore bags) into the sea containing large mature seaweed blades.

In addition, the transfer of 18 seaweed reef blocks with significant *Eisenia bicyclis* growth from the Phase 1 airport island seawall in March 2002 to six locations near the Phase 2 island provided a stable supply of seedlings for the core seaweed bed.

A survey in March 2016 found that as a result of these seaweed projects, the total area of seaweed beds around the Phase 1 and Phase 2 airport islands amounted to about 53 hectares, and *wakame* seaweed distribution was as shown in the figure below. Recent studies have found *kajime* to be declining, so transplanting and other new efforts are being made to care for and maintain the seaweed beds.

| Rating       | Coverage     | Condition    |
|--------------|--------------|--------------|
| Red with X   | 81 - 100%    | Very dense   |
| Red          | 51 - 80%     | Dense        |
| Orange       | 21 - 50%     | Sparse       |
| Yellow       | 5 - 20%      | Spot by spot |
| Light Yellow | Less than 5% | Traces only  |



Note: Since FY2012, seaweed bed studies are done once every three years.

## ■ Island greening projects

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### ● Expanding the flower spots

We have planted "flower spots" in various locations on the airport island with seasonal flowers, with the help of the Smart Island Council. Aiming to preserve landscapes and create spaces of rest and restoration on the airport island, we are working to improve and expand the flower spots.

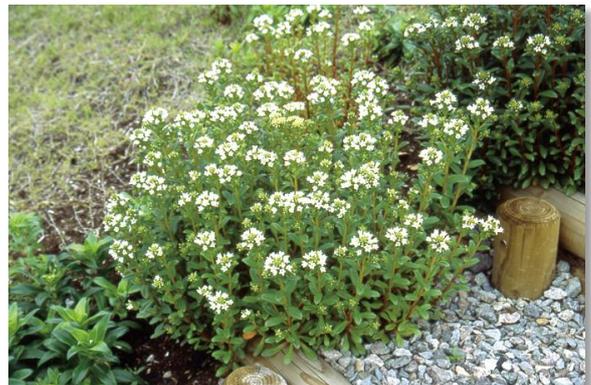


### ● Coastal vegetation: Restoration/protection

On the Phase 2 airport island, we have created areas for plants such as *Dianthus japonicus* Thunb. ("hamanadeshiko" in Japanese), *Lysimachia mauritiana* Lam. ("hamabossu"), *Calystegia soldanella* ("hamahirugao") and *Vitex rotundifolia* ("hamagou") in order to restore and protect shoreline vegetation of the Osaka Bay area.



"Hamanadeshiko"



"Hamabossu"

## ■ Scenic improvement projects

### ●Green space at KIX Sora Park

KIX Sora Park is a large grassy green park near Terminal 2 where people can relax and enjoy picnics while watching aircraft take off and land. The Sora Farm uses compost from grass clippings from Osaka International Airport. Jogging and walking courses are lined by sakura cherry trees along the inner waters of the airport island. At the annual Dragon Boat Festival on the inner waters, teams from Japan and around the world join in heated competitions, with the international airport as a backdrop.



### ●“Zero Garbage” clean-up activities

Outdoor clean-up activities are conducted around Japan on “Zero Garbage Day,” May 30 each year. After our Idling Prevention Campaign we organized a “Zero Garbage” campaign at KIX from May 30 to June 13, involving clean-up activities by KIX Smart Island Council member businesses that have ten or more employees.



## (5) An airport that respects the local community

We have cooperated with others to boost interactions with local communities, and have been pleased to have many people come to the airport island for events and attractions that create interest and excitement about KIX. To promote good relations, since fiscal 2002 we have been providing guest speakers and offering airport tours to introduce participants to the various kinds of work done at the airport.

We provide environment-related information via an environmental section on the KIX website. The Kansai International Airport Environmental Center in the Observation Hall is designed for communication with local communities, including a variety of environmental information. We will continue our efforts to convey information to appeal to various audiences.

### ■ Provision of environmental information

Environmental information about KIX operations and projects is available on a dedicated section of our website, which carries environmental monitoring results from airport operations, environmental reports, and environment-related events.

The monitoring results are also available at our Environmental Center.

We have installed monitors in the terminal buildings and Observation Hall public area to display the status of electricity generation by photovoltaic panels (KIX Megasolar). The public can view information such as electricity generated to date, CO<sub>2</sub> emissions reduced, and the current sunlight intensity.



Visual displays of environmental information

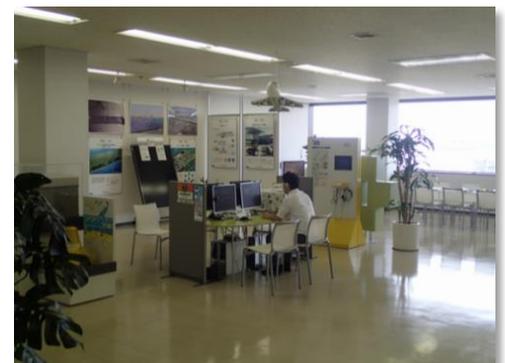


Company website (CSR reports)

### ■ Opportunities for environmental education

#### Environmental Center

The Environmental Center located in the second floor entrance hall of the Sky View Kansai Airport Observation Hall has display panels about the airport's environmental initiatives. In April 2012, we launched the "Professor KIXeco" quiz system, which lets users have fun while learning environmental information. People can also experience actual sound levels, and see how independent agencies conduct noise analysis.



## ■ Dialogue with local communities

### ● Family Eco Classes

To raise awareness of environmental initiatives at Kansai International Airport, we offered hands-on "KIX Family Eco-Classes: Hydrogen/Magnesium Air Fuel Cells" for higher and middle-year elementary school kids to learn eco-friendly topics in a fun way. Forty parent-child groups participated this year. On the theme of clean energy, Iwatani Corporation presented half on hydrogen and fuel cell design, and Furukawa Battery presented the second half on magnesium air fuel cells. Participants enjoyed learning about science and the environment.



### ● School speakers, eco-education at KIX Sora Farm

We offer guest speakers for local elementary schools and airport tours for older students of elementary schools to learn about aircraft and the Kansai International Airport. In fiscal 2016, 589 students from 11 schools participated. As an airport that recycles resources and respects the community, we held a potato-harvesting event for 80 local elementary school kids at the KIX Sora Farm, an eco-farm that grows crops with organic compost (Itami Airport No. 2 brand) made from grass clippings from Osaka International Airport.

### ● Kansai Airports Ekiden (relay marathon)

The first Kansai Airports Ekiden marathon was held on Saturday, November 26, 2016. Fifty-nine six-person teams (354 runners) ran along a special route through the green park. Participants applied through businesses operating at KIX and ITM.



### ● EcoPro 2016 exhibit

We presented an airports booth exhibit at the 2016 EcoPro International Exhibition on Environment and Energy at the Tokyo Big Site. The event lasted three days starting December 8 and attracted 167,000 visitors. We featured our various environmental initiatives, including the Kansai Airports Hydrogen Grid Project, KIX efforts to grow seaweed beds, and the use of runway grass clippings at ITM.



## ■ Cooperation with businesses at the airport

### ● KIX Smart Island Council initiatives

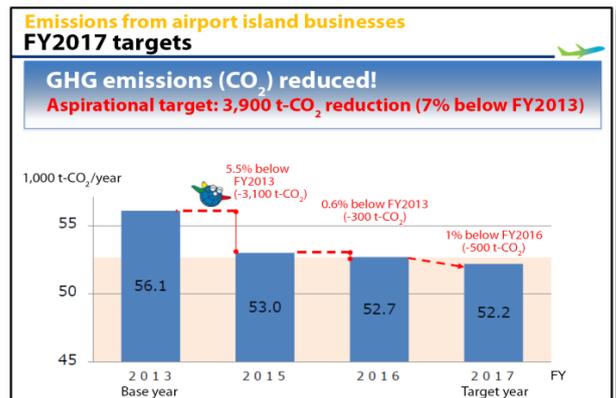
The KIX Smart Island Council was established as a body for Kansai Airports, operators and businesses at the Kansai International Airport to work together on common objectives, including environmental protection and improvements. With 48 business members, the Council conducts activities such as the vehicle Idling Prevention Campaign, the Garbage Zero Campaign, Flower Spot plantings, and Good Practices presentations. With the slogan of “Eco Action KIX: Small Actions Have Big Results,” the Council set a target of reducing CO<sub>2</sub> emissions from airport facilities and operations vehicles by 5% (3,000 tons) between fiscal 2013 and 2017, and actions included reducing waste, promoting energy conservation, and introducing eco-cars. The reduction target was surpassed early, with a 6% reduction in emissions by the end of fiscal 2016, so the Council is now planning further reduction efforts.

### ● Trainees from Asia

In March 2017, we welcomed trainees from Asia as part of a course being offered by the Overseas Human Resources and Industry Development Association (HIDA). We introduced them to our environmental initiatives at the Kansai International Airport and took them on a tour of our wastewater treatment center and other sites.

### ● Participation in Airports Council International (ACI)

Kansai Airports is a member of Airports Council International, an organization representing 623 organizations that manage 1,940 airports in 176 countries and regions around the world (as of January 2017), and a member of the ACI Asia-Pacific Regional Environment Committee. The seventh meeting of this committee was held in Dubai, UAE, in October 2016 to discuss airport environmental actions.



CO<sub>2</sub> emission reductions by airport businesses



## 6. Environmental performance data: (1) Environmental accounting

### • Environmental accounting

Since fiscal 2002, we have been developing an environmental accounting system to evaluate the costs and benefits of our environmental initiatives, in order to further enhance their effectiveness and efficiency.

The greatest cost for environmental protection would be the cost of building the airport on an artificial island five kilometers off the coast of the Senshu area to reduce the impacts of aircraft noise. However, as no methodology has yet been well-established to quantify the environmental benefits of reducing noise, our accounting efforts have focused on categories for which quantitative methods do exist, such as wastewater treatment and waste management.

#### /Accounting method

- ◆ Scope of accounting: Airport operator
- ◆ Accounting period: April 1, 2016, to March 31, 2017
- ◆ Environmental cost categories: Based on “Environmental Accounting Guidelines 2005” (Ministry of the Environment), considering specific conditions of the airport operator.
- ◆ Environmental cost details:
  - Business area cost – Land costs related to incineration plant and sewage treatment plant; facilities costs; maintenance/facilities costs related to energy and water-conservation; other maintenance costs
  - Administrative costs – Environment-related social contribution costs, environmental studies

The total environmental protection costs in fiscal 2016 amounted to 5.4 billion yen.

To calculate environmental benefits (based on physical quantities) for the wastewater treatment plant we chose total nitrogen (T-N) as a representative indicator for water quality and reduction of the pollution load flowing into Osaka Bay. For the incineration plant, as a representative indicator of environmental benefits we selected NOx from waste incineration from among other air pollutants. We then calculated the quantity of reduced environmental loads from the difference between legislated/regulatory standards and actual emission quantities, and attempted converting this to a monetary measure using an integrated coefficient based on LIME (see Note). The resulting environmental benefits (based on physical quantities) came to 12 million yen.

We estimated cost savings from environmental initiatives to be 794 million yen.

Note: “Life cycle impact assessment Method based on Endpoint modeling.” A methodology to integrate multiple environmental indicators into one in order to evaluate environmental benefits.

### Cumulative cost of environmental monitoring and studies

A total sum of about 8.9 billion yen has been spent on environmental monitoring and studies between the year the airport opened and fiscal 2016, including major areas of concern such as aircraft noise, flight paths and altitude, air quality, water quality, bottom sediment, and aquatic life. The figure includes the cost of maintenance and upgrading of monitoring facilities.

| Accounting category       |  | Cost (million yen) |
|---------------------------|--|--------------------|
| Business area costs       | Pollution prevention                         | 2,482              |
|                           | Energy/water conservation                    | 1,306              |
|                           | Treatment/disposal of general waste          | 1,468              |
|                           | Subtotal                                     | 5,256              |
| Administrative costs      | Social contributions relating to environment | 21                 |
|                           | Environmental studies                        | 124                |
|                           | Subtotal                                     | 145                |
| Total environmental costs |  | 5,400              |

Note: Totals may not match due to rounding.

#### Environmental benefits

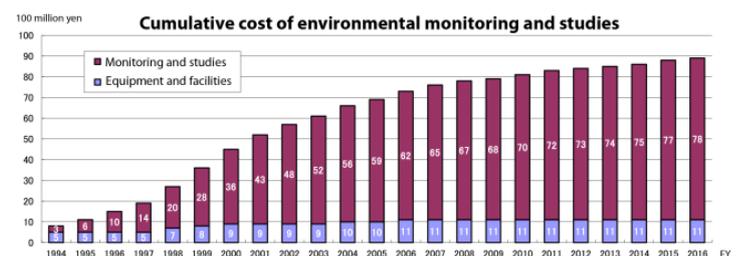
|                    | Env. impact reduced | Monetary equiv. |
|--------------------|---------------------|-----------------|
| Wastewater plant   | T-N: 76.82 tons     | 6 million yen   |
| Incineration plant | NOx: 34.07 tons     | 6 million yen   |

#### Savings (benefits) from environmental measures

(all below in million yen)

- 1 Reduced municipal water use, due to reclaimed water use: 218
  - 2 Reduced public sewage treatment fees due to treatment at KIX: 276
  - 3 Reduced incineration costs off island due to incineration at KIX: 291
  - 4 Reduced economic cost due to energy saving: 10
- Total: 794

Note: Totals may not match due to rounding.



## (2) Environmental performance data

| Item  | Units                       | FY2011  |         |         |         |         |         | Compared to base year (FY2011)          |          | Scope of data used |   |
|---|-----------------------------|---------|---------|---------|---------|---------|---------|---|----------|--------------------|---|
|   |                             | FY2011  | FY2012  | FY2013  | FY2014  | FY2015  | FY2016  |   |          |                    |   |
| <b>Primary energy managed by airport operator</b>           |                             |         |         |         |         |         |         |   |          |                    |   |
| Electricity consumption                                     | (MWh)                       | 102,270 | 102,872 | 104,801 | 104,098 | 102,774 | 104,517 | 2,247 MWh                               | (2.2%)   | Up                 |   |
| Energy consumption for cooling                              | (GJ)                        | 249,918 | 246,304 | 246,745 | 228,966 | 237,318 | 266,452 | 16,534 GJ                               | (6.6%)   | Up                 |   |
| Energy consumption for heating                              | (GJ)                        | 161,025 | 162,491 | 157,141 | 155,856 | 143,704 | 158,136 | 2,889 GJ                                | (1.8%)   | Down               |   |
| Natural gas consumption                                     | (m <sup>3</sup> )           | 111,204 | 108,591 | 120,932 | 277,213 | 256,793 | 288,000 | 176,796 m <sup>3</sup>                  | (159.0%) | Up                 |   |
| Crude oil equivalent  | (kl)                        | 40,855  | 40,931  | 40,503  | 39,823  | 39,340  | 37,443  | 3,412 kl                                | (8.4%)   | Down               |   |
| <b>Total greenhouse gas emissions from KIX</b>              |                             |         |         |         |         |         |         |   |          |                    |   |
| Carbon dioxide (CO <sub>2</sub> )                           | (10,000 t-CO <sub>2</sub> ) | 42.7    | 45.2    | 46.4    | 48.5    | 52.6    | 53.7    | 11.0 <sup>10,000 t-CO<sub>2</sub></sup> | (25.8%)  | Up                 | * Emissions from aircraft are calculated to include the airport's portion of the aircraft "landing and take-off" (LTO) cycle as defined by ICAO (movement of the aircraft between an altitude of 3,000 feet and the ground for both landing and take-off).<br>* Emissions from vehicles are from vehicles operating within the restricted areas, and exclude through-traffic of trains, ships, and vehicles.* |
| (per aircraft landing/takeoff)                              | (t-CO <sub>2</sub> )        | 3.96    | 3.51    | 3.48    | 3.35    | 3.11    | 3.01    | 0.95 t-CO <sub>2</sub>                  | (24.0%)  | Down               |   |
| Methane   | (t-CO <sub>2</sub> )        | 354     | 420     | 435     | 472     | 655     | 689     | 335 t-CO <sub>2</sub>                   | (94.7%)  | Up                 |   |
| N <sub>2</sub> O  | (t-CO <sub>2</sub> )        | 2,431   | 2,800   | 2,921   | 3,137   | 3,451   | 3,673   | 1,242 t-CO <sub>2</sub>                 | (51.1%)  | Up                 |   |
| Total   | (10,000 t-CO <sub>2</sub> ) | 43.0    | 45.5    | 46.7    | 48.9    | 53.0    | 54.1    | 11.1 <sup>10,000 t-CO<sub>2</sub></sup> | (25.9%)  | Up                 |   |
| (per aircraft landing/takeoff)                              | (t-CO <sub>2</sub> )        | 3.99    | 3.54    | 3.50    | 3.37    | 3.13    | 3.03    | 0.96 t-CO <sub>2</sub>                  | (24.1%)  | Down               |   |
| <b>Concentrations, measures for air and water pollution</b> |                             |         |         |         |         |         |         |   |          |                    |   |
| Dioxins   | (ng-TEQ/Nm <sup>3</sup> )   | 0.04    | 0.00685 | 0.00905 | 0.00401 | 0.00154 | 0.07511 | —                                       |          |                    | Concentrations in incineration plant emissions  |
| Nitrogen oxides (Nox)                                       | (ppm)                       | 45      | 32      | 42      | 30      | 34      | 38      | —                                       |          |                    |   |
| Soot and dust   | (g/Nm <sup>3</sup> )        | *       | *       | *       | *       | *       | *       | —                                       |          |                    |   |
| COD   | (mg/L)                      | 8.6     | 9.2     | 10.3    | 9.0     | 8.9     | 9.0     | —                                       |          |                    | Water quality of discharge from wastewater treatment plant  |
| T-N   | (mg/L)                      | 3.7     | 5.1     | 6.0     | 5.6     | 5.8     | 6.7     | —                                       |          |                    |   |
| T-P   | (mg/L)                      | 0.1     | 0.1     | 0.1     | 0.1     | 0.1     | 0.025   | —                                       |          |                    |   |
| <b>Waste disposal</b>                                       |                             |         |         |         |         |         |         |   |          |                    |   |
| Total disposal – general waste                              | (t)                         | 7,919   | 8,579   | 9,073   | 9,294   | 10,359  | 10,898  | 2,980 t                                 | (37.6%)  | Up                 | Volume handled by incineration plant  |
| Total landfilled – general waste                            | (t)                         | 1,019   | 994     | 910     | 965     | 992     | 1,032   | 13.0 t                                  | (1.3%)   | Up                 |   |
| Quantity recycled   | (t)                         | 876     | 978     | 969     | 1,073   | 1,364   | 1,481   | 605.0 t                                 | (69.1%)  | Up                 |   |
| <b>Water resources</b>                                      |                             |         |         |         |         |         |         |   |          |                    |   |
| Clean water supplied  | (1,000 m <sup>3</sup> )     | 812     | 805     | 749     | 678     | 695     | 743     | 69.0 <sup>1,000 m<sup>3</sup></sup>     | (8.5%)   | Down               | Amount supplied to airport island   |
| Reclaimed water   | (1,000 m <sup>3</sup> )     | 407     | 401     | 431     | 477     | 572     | 517     | 110.0 <sup>1,000 m<sup>3</sup></sup>    | (27.0%)  | Up                 | Volume handled by wastewater treatment plant  |
| Wastewater treated  | (1,000 m <sup>3</sup> )     | 750     | 761     | 769     | 811     | 865     | 883     | 133.0 <sup>1,000 m<sup>3</sup></sup>    | (17.7%)  | Up                 |   |
| Wastewater discharged                                       | (1,000 m <sup>3</sup> )     | 315     | 329     | 322     | 311     | 264     | 318     | 3.0 <sup>1,000 m<sup>3</sup></sup>      | (1.0%)   | Up                 |   |
| <b>Reference values for airport activity volume</b>         |                             |         |         |         |         |         |         |   |          |                    |   |
| No. aircraft landings-takeoffs                              | (10,000 LTOs)               | 10.8    | 12.9    | 13.3    | 14.5    | 16.9    | 17.8    | —                                       |          |                    | Overall measures of KIX operations  |
| Air passenger traffic                                       | (10,000 persons)            | 1,386.3 | 1,680.4 | 1,812.6 | 2,004.6 | 2,405.7 | 2,572.1 | —                                       |          |                    |   |
| Cargo volume  | (10,000 tons)               | 71.2    | 68.7    | 67.1    | 74.1    | 70.0    | 75.3    | —                                       |          |                    |   |

\* Indicates below minimum measurement threshold

The thermal conversion coefficient for heating and cooling for FY2016 used here is from actual numbers from the Kansai International Airport Heating & Cooling Supply Co.

## 7. Chronology of environmental initiatives

| Year | Mo. | Event   |
|------|-----|---|
| 1968 | 4   | Ministry of Transport (MOT) launches basic study for airport siting   |
| 1971 | 10  | Minister of Transport asks Council for Civil Aviation for advice on scale/siting for Kansai International Airport                 |
|      | 11  | MOT conducts trial flights to study noise levels at 3 candidate sites (Senshu, Kobe, Akashi)                                      |
| 1972 | 8   | Council for Civil Aviation (Kansai International Airport committee) conducts hearings with local communities                      |
| 1973 | 8   | MOT surveys 3 candidate sites commercial aircraft air pollution   |
| 1974 | 8   | Council for Civil Aviation reports initial findings to Minister of Transport: Optimal airport location is off coast of Senshu     |
| 1975 | 9   | MOT convenes series of briefings in communities   |
| 1976 | 9   | MOT announces Survey Implementation Guidelines  |
| 1977 | 10  | Marine observation facilities completed   |
| 1978 | 2   | MOT announces plans for noise, vibration, and air pollution studies, starts site studies  |
|      | 3   | MOT begins bore studies near candidate sites  |
| 1979 | 5   | MOT conducts flight studies with aircraft   |
| 1981 | 5   | MOT presents three reports: Airport Proposal, Environmental Impact Assessment, and Approaches to Regional Infrastructure          |
| 1983 | 12  | MOT begins ground improvement testing off the coast of Senshu   |
| 1984 | 10  | Kansai International Airport Co. (KIAC) established   |
| 1986 | 2   | Kansai Int'l Airport Env. Monitoring Org. established (Osaka Pref. Governor, mayors of 9 cities, 4 towns currently)               |
|      | 6   | Environmental Impact Assessment submitted to governor of Osaka Prefecture   |
|      | 12  | Environmental Monitoring Plan adopted environmental monitoring begins   |
| 1987 | 1   | Permit obtained for land reclamation on public waters for Phase 1 construction. Phase 1 construction begins                       |
|      | 6   | Construction begins on bridge linking mainland to airport begins, KIX Environmental General Center opens                          |
| 1989 | 6   | Phase 1 airport island seawall construction completed   |
| 1994 | 1   | Phase 1 airport island construction areas completed   |
|      | 3   | Plan for Environmental Monitoring of KIX Construction/Operation adopted   |
|      | 7   | Kansai International Airport Environmental Center opens   |
|      | 9   | Kansai International Airport (KIX) opens for service (Sep 4). Monitoring begins: Aircraft noise, low-freq. air vibration          |
| 1995 | 8   | Council for Civil Aviation releases Basic Approach to 7th Airport Preparatory 5-Year Plan (mid-term report)                       |
| 1996 | 6   | Kansai International Airport Land Development Co. (KALD) est., designated by Min. Transport as official land developer            |
| 1997 | 6   | MOT releases "Comprehensive Initiatives relating to Flight Path Issues at KIX" paper  |
| 1998 | 10  | Environmental Impact Assessment on Phase 2 Construction submitted   |
|      | 12  | New flight paths introduced. Environmental Monitoring Plan for aircraft noise, etc., reviewed, monitoring enhanced                |
| 1999 | 6   | Environmental Monitoring Plan for Phase 2 Construction Project adopted  |
|      | 7   | Permit obtained for land reclamation on public waters, Phase 2 construction (start Jul 14. Silt protection sheets deployed        |
|      | 11  | KIX International Symposium marks fifth anniversary of opening  |
|      | 12  | KALD acquires ISO 14001 certification for environmental management system   |
| 2001 | 1   | KIAC establishes Environmental Management Committee   |
|      | 4   | KIX receives "Monument of the Millennium" award from American Society of Civil Engineers, as offshore airport                     |
|      | 6   | KIAC adopts Environmental Management Plan (Eco-Island Plan)   |
|      | 9   | Placement begins for wave-dissipating blocks to support seaweed bed growth along Phase 2 seawall                                  |
|      | 11  | International Airport Symposium 2001 hosted, Phase 2 airport island seawall completed   |
| 2002 | 10  | KIAC adopts Regulations Governing the Use of Waste Processing Facilities  |
|      | 12  | KIAC establishes Energy Conservation Committee  |
|      | 12  | KIAC releases first Eco-Island Report (2002 edition)  |
| 2003 | 12  | KIAC establishes KIX Customer Satisfaction Council  |
| 2004 | 9   | International Airport Symposium 2004 hosted   |
|      | 12  | KIAC, KALD mount their first exhibit at "Eco-Products 2004" exhibition  |
| 2005 | 7   | Kansai International Airport Environmental Center relocated to Kanku Observation Hall   |
| 2006 | 8   | Kansai International Airport & Rinku Town designated by government as CNG vehicle model project areas                             |
| 2007 | 1   | KIAC awarded MITI Award at FY2006 Nat'l Energy-Efficiency Best Practices Conf., for IT-based air con system in passenger terminal |
|      | 5   | JHFC hydrogen charging station for vehicles opens at KIX  |
| 2008 | 3   | KIX Eco-Island Promotion Council launched   |
|      | 3   | KIX Environmental Plan adopted  |
|      | 4   | Windbreak fence completed for KIX rail system access bridge, use of pro-beam low-location lights begins                           |
|      | 5   | Kanku Environmental Exhibition features KIX Environmental Plan  |
|      | 6   | First idling-prevention awareness campaign launched   |
|      | 7   | First conference held to report on KIX Eco-Island Promotion Council environmental initiatives                                     |
| 2009 | 10  | Study tour organized by KIX Eco-Island Promotion Council  |
|      | 7   | Full-scale use of truck-mounted ground power units (GPUs) begins  |
|      | 11  | KIX Science Classes held  |
| 2010 | 1   | Partial changes to aircraft auxiliary power unit (APU) usage restrictions (use reduced from 30 to 15 min. before departure)       |
|      | 9   | Photovoltaic system installed for temperature-controlled building for medical products  |
| 2011 | 1   | IATA Environment Stand display installed at KIX   |
|      | 3   | Rapid charger installed at KIX for electric vehicles  |
|      | 7   | Japan fully adopts digital terrestrial broadcasting; measures targeting signal interference                                       |
|      | 9   | Electricity-powered commercial shuttle vehicles introduced (two vehicles by fiscal year end)                                      |

| Year | Mo. | Event  |
|------|-----|--|
| 2012 | 4   | New Kansai International Airport Company (NKIAC) established   |
|      | 5   | KIX wins judges' special award, Airports Council Int'l (ACI) Asia-Pacific 2011 Green Airports Recognition Awards                 |
|      | 6   | Phase 2 airport island construction almost completed, land development work by KALD is completed                                 |
|      | 7   | Kansai International Airport and Osaka International Airport are merged  |
|      | 8   | KIX earns runner-up award in 2012 Osaka Environmental Awards for efforts to grow seaweed beds                                    |
|      | 10  | KIX Sky Park opens adjacent to Phase 2 Terminal Building, trial begins for hydrogen fuel cell buses                              |
|      | 11  | Olive tree planting ceremony along walking path for Phase 2, decision made to do KIX Megasolar project                           |
| 2013 | 12  | Exhibit at Eco-Products 2012 exhibition. Four regular chargers for electric vehicles installed in parkade.                       |
|      | 2   | Int'l Strategy Comprehensive Special Area expanded by Kansai Innovation to include KIX (green innovation theme)                  |
|      | 3   | Smart Eco Logi Council holds ceremony for launch of 20 large CNG trucks in international freight zone                            |
|      | 3   | KIX Eco-Island Promotion Council changes name to KIX Smart Island Council  |
|      | 4   | KIX Smart Island Plan adopted  |
|      | 8   | Summer Vacation Family Eco Classes held  |
|      | 10  | East Asia Airport Alliance (EAAA) annual general meeting held. "Environmental Relay Declaration" adopted                         |
| 2014 | 12  | Exhibit at Eco-Products 2013 exhibition. Winter Vacation Family Eco Classes held.  |
|      | 1   | KIX announces event for EAAA Environmental Relay   |
|      | 2   | KIX Megasolar starts generating electricity (largest photovoltaic system of any Asian airport)                                   |
|      | 5   | Hydrogen Grid Project launched   |
|      | 6   | Rapid charger installed for electric vehicles at open parking lot No.5, with 24-hour operations                                  |
|      | 7   | "Megasolar Observatory" and "Visualization Monitor" start operating  |
|      | 7   | Small wind turbine power generator installed—a first for any Japanese airport  |
| 2015 | 2   | Trial operations launched for first fuel cell-powered forklift at any airport in Asia, plus demonstration trial of hydrogen grid |
|      | 8   | "Hydrogen and Fuel Cell" Family Eco Classes held   |
|      | 9   | Megasolar system starts operating on roof of air freight warehouse in international freight zone                                 |
|      | 10  | Exhibit at Biwako Environmental Business Exhibition 2015   |
|      | 12  | Awarded the FY2015 Environment Minister's Award for Global Warming Prevention Activities   |
|      | 12  | Exhibit at Eco-Products 2015 exhibition  |
| 2016 | 1   | Largest hydrogen station at an airport in Asia opens   |
|      | 3   | Awarded 2015 Kansai Eco Office Grand Prize from Union of Kansai Governments  |
|      | 3   | Two new model fuel cell forklifts added for demonstration trials   |
|      | 4   | Kansai Airports starts operating   |
|      | 4   | Four more regular chargers installed for electric vehicles in parkade  |
|      | 6   | Environmental initiatives introduced at Fifth Fukeko Festival  |
|      | 6   | Potato harvest event at KIX Sora Farm promotes environmental education   |
|      | 6   | KIX Smart Island Exhibit in passenger terminals  |
|      | 8   | KIX Family Eco-Classes: Hydrogen/Magnesium Air Fuel Cells  |
|      | 12  | Airport Carbon Accreditation (ACA) obtained, a first for airports in Japan   |
|      | 12  | Exhibit at 2016 EcoPro International Exhibition on Environment and Energy  |
| 2017 | 1   | Terminal 2 opens (international flights)   |
|      | 4   | Large hydrogen filling station for industrial vehicles opens, a first in Japan   |

□ Notes

1. Lden (day-evening-night equivalent level)

An indicator for measurement for environmental quality standards to measure aircraft noise, in use since fiscal 2013. Units are in decibels (dB). (Previous indicator was WECPNL.) Under the environmental quality standards, a maximum Lden 57 dB (WECPNL 70) applies to exclusively residential areas, and a maximum of Lden 62 dB (WECPNL 75) applies to other areas where normal living conditions need to be protected.

2. Transitioning to quieter aircraft

KIX made an effort to move toward quieter aircraft by instituting a complete ban starting in April 2002 on flights by any aircraft not complying with Chapter III of the Convention on International Civil Aviation, Annex 16 (Environmental Protection) on aircraft noise standards of the International Civil Aviation Organization (ICAO).

3. Quieter flight procedures

Noise-reducing flight procedures for aircraft, including delayed use of flaps and delayed deployment of landing gear on approach to the runway.

4. Continuous descent operations (CDO)

A method of aircraft flight during descent, maintaining the minimum engine thrust for optimal descent (not horizontal flight) until the aircraft reaches the starting point for instrument landing. Benefits of the method include reduced fuel consumption and reduced CO<sub>2</sub> emissions.

5. Air heater used to prevent white smoke

An air heater is used to reduce moisture content in emissions by introducing heated air into the flow, to ensure that white smoke being emitted from exhaust stacks does not reduce visibility for aircraft or the control tower.

6. GPU (ground power unit)

Stationary or mobile equipment/facilities that supply air conditioning or electricity to parked aircraft. The use of GPUs can reduce the amount of fuel consumption by aircraft onboard auxiliary power units (APUs).

7. AIP

Aeronautical Information Publications (AIP) contain essential information for aircraft operation. In Japan they are compiled by the Civil Aviation Bureau (Ministry of Land, Infrastructure, Transport and Tourism).

8. Restricted areas

Runways and other landing/takeoff areas, taxiways, aprons, and other areas where entry has been restricted by signage.

Note: Numbers are rounded in all graphs.



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