San Francisco International Airport
2011 Environmental Sustainability Report

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Cover Photos:
SFO’s Terminal 2 renovation project became the first airport terminal in the U.S. to receive LEED® Gold certification from the U.S. Green Building Council (USGBC). The building’s green design features include [Clockwise]:

1. energy-efficient lighting
2. paperless ticketing throughout the terminal, adding convenience and saving trees
3. abundant natural light and art installations from local artists
4. “hydration stations”, which allow travelers to refill reusable water bottles post-security
5. LEED Gold Certification Plaque, awarded by the USGBC to recognize the building’s sustainability performance
A Message from the Director John L. Martin

San Francisco International Airport’s 2011 environmental sustainability report provides information on our recent initiatives to reduce the environmental impacts of our overall activities. A number of these accomplishments advance elements of our new five-year strategic plan, which defines our near-term goals and objectives. In particular, we are proud of the numerous “firsts” in which SFO has led the aviation industry. These “firsts” are consistent with our overall aspiration for the future, and our vision, in “Reaching for No. 1.”

Since our last Environmental Sustainability Report in 2007, SFO has continued to lead the industry by trying out new ideas and new technologies to reduce our greenhouse gas (GHG) emissions, improve our energy efficiency, reduce water use and waste generation, and conserve our natural resources. Some of our recent actions include:

► Renovation of Terminal 2, which became the first airport terminal in the U.S. to achieve Leadership in Energy and Environmental Design (LEED®) Gold certification from the U.S. Green Business Council.
► Achieving LEED Gold certification for the renovation of the new Airport Business Center.
► Reducing GHG emissions from SFO-controlled operations as well as providing financial and physical facility support for GHG emission reductions by SFO enterprises. SFO is well on its way to meeting the City’s mandate of 25% reduction from 1990 GHG emission level by 2017.
► Mitigating 99% of SFO’s carbon footprint by enabling the reduction of GHG emissions by SFO enterprises.
► Launch of an online visual flight tracking tool. This unique three-dimensional application enables near real-time monitoring of flights to more precisely assess noise impacts.
► Installation of “hydration stations” at Terminal 2, where passengers can easily refill water bottles post-security. These facilities help to significantly reduce the amount of plastic bottle waste.
► Reducing the amount of solid waste produced. In FY 2010 SFO increased its recycling and composting of recoverable materials to a record 74%. The recycling rate has continued to increase since the end of FY 2010.
► Installing infrastructure to support electric vehicles. As use of electric vehicles becomes more widespread, the Airport has installed publicly accessible charging stations in the garages.
► Tree planting. SFO has planted over 2,000 trees around the Airport over the past few years; one of the best things to do for air quality and the environment.

At San Francisco International Airport we are proud of our accomplishments, but we also understand that to become and stay the No. 1 Airport in the country requires continuous improvement in all facets of our operations. The Airport Commission, and SFO management and employees have embraced this responsibility and are committed to our mission to provide an exceptional airport in service to our communities.

John L. Martin
Airport Director
Five-year Strategic Objectives

SFO recently undertook a strategic planning process that resulted in the identification of eight strategic goals, each with supporting objectives. These goals and objectives will guide the Airport’s decision-making through 2016. As part of the strategic planning process, SFO asked 23 Task Forces—comprised of representatives from across the organization—to work with three steering committees to develop strategic initiatives that will help the Airport achieve its goals and objectives. These Task Forces worked for eight months and were guided by the Airport’s overall aspiration for the future, its vision, of “Reaching for No. 1”. Many of these objectives overlap with the Airport activities described in this report.

 Customers/Passengers

1. Be ranked No. 1 by passengers in the following categories:
   - US International Gateway Airport in customer satisfaction by ACI-ASQ survey.
   - US International Airport in customer satisfaction for overseas travelers by Skytrax survey.

2. Be considered a world-class airport by customers.

3. Be nimble about meeting passenger demands and needs for services.

4. Be the airport of choice for premium passengers.

5. Have the most efficient airport ground transportation system in the country.

 Airlines/Aircraft/Routes

1. Ensure SFO can meet passenger traffic growth in the next five years and improve airlines’ on time arrival performance to 75%.

2. Ensure competitive air service.

3. Increase current international passenger traffic by 30% in five years.

4. Maintain average CPE below $18.90 in constant FY 07-08 dollars in order to maintain and attract airline service.

 Non-airline Revenue

1. As part of maintaining average CPE below $18.90, achieve non-airline revenues below:
   - 2011/2012 $358 M
   - 2012/2013 $375 M
   - 2013/2014 $387 M
   - 2014/2015 $396 M
   - 2015/2016 $403 M

2. Increase per passenger spending annually as follows:
   - Food & Beverage 2.5%
   - Retail 3.0%
   - Duty Free 3.5%

 Employees and Organization

1. Be ranked one of the Bay Area’s best employers in SF Business Times’ annual list.

2. Be known for innovation, expertise, and management excellence in the aviation industry.

CPE=Cost per enplaned passenger
### Environmental Sustainability

1. Achieve 100% mitigation of SFO-controlled GHG emissions by 2012.

2. Achieve 50% reduction in baseline GHG emissions from SFO-controlled operations by 2015.

3. Increase the solid waste recycling rate to 80%.

4. Achieve LEED Gold certification in all new buildings.

### Safety and Security

1. To be an airport innovative leader in safety & security and implement at least two new industry-leading security programs in the next five years.

2. Maintain SFO’s airfield in as safe as possible condition through the use of technology, procedures, inspections and continual evaluation of airfield best practices.

3. Be the least vulnerable US airport to terrorist activity and possess the best integrated response capability.

4. Coordinate the sharing of information and planning among all federal and local law enforcement agencies to ensure all the dots are continually connected.

### Infrastructure

1. As part of maintaining average CPE below $18.90, invest in capital projects strategically.

2. Minimize overall life cycle costs of facilities.

3. Maintain the airport’s infrastructure in optimal condition.

4. Continue to invest in capital projects that make the airport environmentally sustainable.

5. Implement projects that will generate net revenue to the extent possible, while meeting the airport’s mission.

### External Relations

1. Support awareness among government entities of SFO as a successful enterprise, that is well managed and a valuable asset to San Francisco and the Bay Area communities.

2. Develop and maintain productive relationships with government agencies and local cities and counties.

3. Increase local business participation with SFO.

4. Develop and maintain a model employment development program for the benefit of the communities that SFO serves.
San Francisco International Airport (SFO) is the premier airport serving Northern California, located on San Francisco Bay 14 miles south of the City. SFO has long demonstrated its commitment to environmental stewardship, implementing ambitious initiatives ranging from reducing carbon emissions to reducing aircraft noise. SFO strives for excellence and identifies environmental sustainability as one of the key pillars of its mission. This chapter describes the context for environmental sustainability within the airport organization and provides a snapshot of SFO’s environmental sustainability performance.

SFO’s Mission is “to provide an exceptional airport in service to our communities”
1

SFO Profile
SFO 2010 Snapshot

**Airside:**
- 1,700 acres

**Runways:**
- 28R/10L (11,870 feet)
- 28L/10R (10,602 feet)
- 1R/19L (8,648 feet)
- 1L/19R (7,500 feet)

**Natural Tidelands and Wetlands:**
- 2,500 acres

**Landside:**
- 1,000 acres

**Major Facilities:**
- Terminal Complex
- Airport Business Center
- Engineering Building
- Building and field maintenance facilities
- Crash/fire/rescue facilities
- Utilities
- Aircraft fueling
- Airport police
- Commercial enterprises
- Rental car facilities

**Employees:**
- 1,849 Full Time Employee Equivalents in FY 2010

**Activity Levels:**
- 2010 Operations: 387,248
- 2010 Passengers: 39,391,234
- 2010 Cargo Tons: 426,724

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**Airside Land Uses**

Airport land uses are broadly categorized as either “airside” (where aircraft operate) or “landside” (devoted primarily to passenger uses, airport administration, and support).

**Airside Land Uses**

SFO currently maintains four intersecting runways: two parallel east-west runways and two parallel north-south runways. The majority of aircraft landings occur on Runways 28R and 28L and the majority of the takeoffs occur from Runways 1R and 1L.

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**Landside Land Uses**

Ten years ago, the Airport underwent a major expansion, adding more than 5 million square feet of new landside improvements including:

- A new International Terminal;
- Two new boarding areas;
- A new Airport people-mover (AirTrain);
- A new multi-modal connection for Bay Area Rapid Transit (BART) and AirTrain;
- Various other office/administrative space, airline maintenance support, and air cargo, and;
- Parking, roadway, and other transportation-related improvements.
- In FY 2010, SFO also undertook the renovation of Terminal 2, converting the old International Terminal to a world class LEED® Gold certified terminal for domestic airlines.
1. SFO Profile

Aviation Activity

Airport activity levels refer to SFO annual aircraft operations, passenger traffic, and cargo loads. Activity levels provide a measure for Airport growth and the context for assessing the Airport’s environmental performance.

SFO is one of the busiest airports in the U.S., ranking 15th in total annual aircraft operations for 2010.

Aircraft Operations

In 1997, aircraft operations (aircraft landings and takeoffs) peaked at SFO and remained fairly stable for the following four years. The number of operations dropped after the events of September 11, 2001 but has shown improvement in subsequent years.

Passenger Activity

The number of passengers flying to and from SFO peaked in 2000 and then declined until 2003. This number has increased steadily since 2003. Aircraft load factors have also continued to increase in recent years in response to high fuel costs and other economic factors; most airlines are flying their aircraft at the highest historical load factors (the percentage of aircraft seats occupied).

Cargo Activity (metric tons)

Cargo shipments at SFO peaked in 2000 and remained steady through most of the decade. In recent years, cargo shipment at SFO has declined, reflecting the impact of the current economic recession. However, in 2010 cargo shipments showed a slight increase compared to the 2009 level.
In 2010, over 39 million passengers traveled to and from SFO. Of these passengers, the majority (over 30 million) traveled domestically. In addition, SFO provides non-stop service to Canada, Asia, Oceania, Europe, as well as Central and South America. The two service areas that grew the most in 2010 compared to 2009 were Central and South America (12.2% increase), as well as Asia, India, and the Middle East (10.4% increase). SFO passenger volume has steadily increased since 2003.
1. SFO Profile

SFO Environmental Performance

SFO monitors its environmental performance in each of the categories described below.

640,000 sq ft

SFO renovated its 640,000 sq. ft. Terminal 2 with sustainable design features and received LEED Gold certification for this terminal in 2011.

Green Buildings and Facilities

Reopened in 2011, the Airport’s renovated Terminal 2 received Leadership in Energy and Environmental Design (LEED) Gold certification from the U.S. Green Building Council (USGBC) and demonstrates SFO’s commitment to efficiency, passenger comfort, and creativity. Terminal 2 features approximately 640,000 square feet of space that can accommodate 5.5 million passengers per year, 14 gates, 30,793 square feet of retail development, and a number of sustainability features to reduce greenhouse gases, waste, and water use. SFO operates a number of other buildings designed with green building elements, including the International Terminal. The Airport Business Center also received LEED Gold certification in 2011.

Chapter 2, Green Buildings and Facilities, describes the green building projects that SFO and its tenants have undertaken in recent years.
SFO has developed a comprehensive greenhouse gas (GHG) emissions reduction program to meet the City and County of San Francisco’s goal of reducing GHG emissions 25% below 1990 levels by 2017. SFO is on the path to meet this goal, having already reduced its GHG emissions 19% below 1990 levels in FY 2010.

SFO’s GHG emissions reduction program includes initiatives to enhance the Airport’s energy efficiency, as well as increase its use of renewable energy and clean fuels. In addition to decreasing its directly controlled emissions, SFO has implemented a number of GHG mitigation measures that reduced the emissions of SFO enterprises by 41,816 metric tons in FY 2010.

Chapter 3, Climate Change, describes current and planned activities to further reduce SFO-controlled GHG emissions as well as projects to mitigate overall GHG emissions from Airport enterprises. This chapter also describes the Airport’s efforts to develop a climate change adaptation plan.
SFO Environmental Performance

SFO monitors its environmental performance in each of the categories described below.

SFO has reduced its electricity consumption by 6.3% since 2004, despite increases in passenger activity.

Starting in 2007, SFO has implemented a number of electric energy efficiency projects which along with planned projects will achieve 10,938 MWh of electricity savings per year. With over 49 electric energy efficiency projects implemented to date, by FY 2010 the Airport had reduced its electricity consumption by 6.3% compared to FY 2004 electricity use. Projects implemented to date include lighting improvements, HVAC efficiency improvement projects, and SFO Information Technology energy saving measures.

Chapter 4, Energy Conservation and Renewable Energy, describes SFO’s efforts to enhance the energy efficiency of airport facilities, provide a diverse mix of clean fuel infrastructure, and use alternative sources of power for facilities and equipment.
SFO has continued its comprehensive air quality enhancement program to minimize air quality impacts from aircraft and associated ground service equipment (GSE), cars, and buses at the Airport, and from fuel and energy use at Airport facilities. Elements of SFO’s air quality improvement program include:

- Converting SFO’s fleet vehicles to clean fuels, such as compressed natural gas (CNG) and biofuel, or using electric vehicles
- Offering incentives to passengers and rental car companies to increase the availability and use of fuel efficient rental cars
- Encouraging employees and passengers to use alternative transportation by providing efficient public transportation access to the Airport and offering employees incentives to use public transit
- Reducing air pollutant emissions resulting from airside operations by providing ground power and preconditioned air to aircraft at the gates, encouraging aircraft single-engine taxiing, electrifying GSE, and providing airside alternative fuel infrastructure

Chapter 5, Air Quality, describes the air quality benefits of improvements to SFO’s transportation system. To date, more than 500 diesel and gasoline-powered vehicles have been converted to or replaced with vehicles using alternative fuels, resulting in savings of 1.3 million gallons of gasoline and diesel fuel per year.
SFO Environmental Performance

SFO monitors its environmental performance in each of the categories described below.

SFO has eliminated all incompatible land uses within the State CNEL 65 dB noise contour.

Through its noise insulation program, SFO became the first major airport in California to eliminate all incompatible land uses within the State Community Noise Equivalent Level (CNEL) 65 decibel (dB) noise contour line and to operate without a variance. Incompatible land uses include residences, schools, hospitals, convalescent homes and places of worship, which could be adversely affected by excessive noise, as defined in Title 21 of the California Code of Regulations.

In 2011, SFO released a powerful new user-controlled online flight tracking tool, which provides the public with live flight information for aircraft anywhere in the SFO airspace. Users can utilize this tool to identify the location, altitude, operator (airline), flight number, and departing/arriving airport (SFO, San Jose, or Oakland). Please visit http://www.flyquietsfo.com/.

Chapter 6, Noise Abatement, describes SFO’s ongoing efforts to reduce the impacts of noise on its neighboring communities.
SFO has reduced its potable water use by 14% since 2004.

SFO’s rigorous water conservation program has resulted in a decline in total Airport water use by 14% since 2004. In 2010, water use per passenger reached a new low of 12 gallons per passenger, down from 16.6 gallons per passenger in 2006. This steady decline in water use can be attributed to a number of water efficiency measures that SFO has implemented, including installing low-flow and sensor-operated restroom fixtures, elimination of unnecessary hydrant flushing, and replacement of aging and leaking water distribution pipes.

Chapter 7, Water Conservation and Water Quality Enhancement, describe the water conservation initiatives and water quality protection activities that SFO has undertaken.
SFO monitors its environmental performance in each of the categories described below.

558 acres

SFO has mitigated for 32 acres of on-Airport fill by improving 558 acres of existing wetlands and tidal marshes, including the creation of over 80 acres of new wetlands throughout the Bay Area.

Natural Resources Management

As mitigation for the Airport’s Master Plan construction projects, SFO has compensated for 32 acres of on-Airport fill by improving 558 acres of wetlands and tidal marshes (including the creation of 84 acres of new wetland) throughout the Bay Area, committing more than $20 million to this effort. Over the past ten years, SFO has also developed approximately 50 acres of landscaping around the Airport. In total, the Airport has planted 2,020 trees of over 15 different species, resulting in an estimated 121 metric tons of carbon sequestration per year.

Chapter 8, Natural Resources Management, describes SFO’s efforts to improve on-Airport environmentally sensitive habitats and manage wildlife, while maintaining airport safety.
SFO’s recycling in 2010 included composting 36% of airport waste, which was processed at the facility shown in the photo above.

SFO has one of the largest recycling and composting programs in San Mateo County and continues to demonstrate exemplary performance in recycling and waste minimization. Notably, the Airport has increased its solid waste recycling rate from 51% in 2002 to an impressive 74% in 2010, bringing SFO very close to achieving its interim goal of recycling 80% of its solid waste by 2015. SFO’s recycling in 2010 included composting 36% of airport waste, which was processed at the facility shown in the photo above. SFO continues to recycle almost all of its construction and demolition waste, with a consistent recycling rate over 90%.

Chapter 9, Solid and Hazardous Waste Management, describes SFO’s efforts to reduce, reuse, and recycle waste, as well as effectively and safely manage the generation, storage, and disposal of hazardous materials and waste.
SFO Environmental Performance

SFO monitors its environmental performance in each of the categories described below.

1,016 miles

In 2011, 628 airport employees participated in a walking challenge. Each team walked 1,016 miles over the 10 week duration of the challenge.

Employee Wellness

To promote employee wellbeing, SFO has established an award-winning wellness program with the goal of making the airport a more pleasant and healthy workplace. Fitness classes, educational tools and information, as well as preventative health care services such as flu shots and health screening, are provided at the airport, making it easy for employees to participate in these programs and utilize these services.

Chapter 10, Employee Wellness, describes SFO's initiatives to promote employee wellbeing.
Awards

Over the years SFO has received a number of awards reflecting excellence in service, superior facilities, and diligence in environmental achievements. A sampling of these awards is shown below.

2011
- Leading Edge Editors’ Picks for Terminal 2 — Executive Travel magazine
- Healthiest Place to Work for large companies (500-1,999 employees) in the greater Bay Area — San Francisco & Silicon Valley/San Jose Business Times
- Airports Council International North America Excellence in Airport Marketing & Communications Contest, 3rd Place, Social Media Campaigns
- Public Managerial Excellence Award to Cheryl Nashir, SFO Associate Deputy Airport Director for Revenue Development and Management— Municipal Fiscal Advisory Council
- Best Overall Concession Program, Large Airport (three-way tie) — Airport Revenue News
- Best Concessions Design, Large Airport (tie) — Airport Revenue News
- Best Airport in North America — Business Traveller Germany

2010
- Airport Safety Award — Federal Aviation Administration
- Best Overall Concessions Program, Large Airport — Airport Revenue News
- Second, Best Airports 2010 eDreams
- Fit Business Award (bronze) — California Task Force on Youth and Workplace Wellness

2009
- Best Airport Terminal in the United States — Dwell Magazine
- Best of Decade for International Terminal — San Francisco Chronicle
- Best of Decade for “You are Hear” Music Program — San Francisco Chronicle
- Silver Medal for Best Airport Website — flightglobal.com
- One of top Five US Airport Websites — aviation.com
- Best Airport Restaurants in the Country — poll, Airport Revenue News
- Fit Business Award (bronze) — California Task Force on Youth and Workplace Wellness

2008
- Best Airport in North America — Skytrax
- Fit Business Award — California Task Force on Youth and Workplace Wellness
- Nomination for Best Government Website, flysfo.com — Webby Awards
- Environmental Programs Award — U.S. Environmental Protection Agency Region 9
- Fit Business Award (silver) — California Task Force on Youth and Workplace Wellness

2007
- Environmental Management Award — Airports Council International-North America
- Fit Business Award (silver) — California Task Force on Youth and Workplace Wellness

2006
- Best Airport in North America — CityBloc.com
- Best Airport in North America — Skytrax
- Herman C. Bliss Airports Partnership Award — Federal Aviation Administration
- Best Airport in North America — Business Traveller Germany

2005 and prior
- Best Airport in United States Award — Executive Travel Magazine, 2005
- Eagle Award International Air Transport Association, 2004
- Certified Forest Products Council Certified Sustainable Product Use Award, 2003
- Honored for Clean Vehicle Policy Natural Gas Coalition at 9th Annual Achievement Awards, October 2001
- Saluted by Secretary of Transportation Norman Y. Mineta for Leadership in Usage of Alternative Fuel Vehicles, May 2001
- “Clean Air Hero” Award the American Lung Association, received by SFO Senior Transportation Planner Roger Hooson for work to improve air quality, April 2001
- Excellence in Environmental Achievement Award Governor’s Office of Environment, 1998
- Environmental Action Award of Excellence San Mateo County Economic Development Association, September 1998
- Environmental Excellence Award Airport Council International, 1998
An interior view of Terminal 2. The facility features approximately 640,000 square feet that can accommodate 5.5 million passengers per year, 14 gates, 30,793 square feet of retail development, and a number of sustainability features to reduce greenhouse gases, waste, and water use.

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Photography and Gensler
2. Green Buildings and Facilities

An early adopter of green building technologies, SFO has consistently demonstrated sustainability leadership in the airport industry. Green buildings and facilities help minimize the use of resources, reduce potentially harmful environmental effects of development, and create healthier environments for passengers and employees.

SFO designs, constructs, renovates, and operates facilities in an environmentally-responsible and energy-efficient manner because it makes sense, both economically and environmentally. During 2011, SFO accomplished another significant green achievement, receiving Leadership in Energy and Environmental Design (LEED®) Gold certification for its renovation of Terminal 2— the first airport terminal in the United States to achieve this level of environmental performance.

**SFO Policy**

*Airport facilities, where practicable, shall be designed, constructed, and rehabilitated to make use of sustainable materials and green building techniques, meeting LEED Gold certification. SFO shall incorporate sustainability and life cycle cost analyses into current and future planning, design, construction, operations, and maintenance of its facilities.*

**Objectives**

- Achieve LEED Gold certification in all new buildings.
- Establish proven programs with baseline performance standards, from which operations can be tracked and monitored.
- Ensure projects are in accordance with San Francisco Building Code Chapter 13C and California’s Building Standards.
2. Green Buildings and Facilities

What Have We Accomplished?

The Airport has taken concrete steps to ensure buildings are more resource-efficient, including requiring that:

- All new buildings have low-flow restroom fixtures and automatic-shutoff valves to conserve water.
- Lighting improvements include replacing existing fixtures with lamps that generate more light (lumens) while consuming less energy and containing little or no mercury.
- Specifications for all new and remodeled buildings include strict requirements for recycling construction waste and demolition debris.

Terminal 2 is an excellent example of SFO’s innovative and effective use of green building techniques. The redevelopment of Terminal 2, which stemmed from an increase in passenger demand, has established a new standard for terminal space that is operated at optimal efficiency and creates a pleasant environment for passengers.

Airport tenants, including leading concessions and airlines, have joined SFO in its pursuit of green building excellence, adopting simple energy and resource-efficient design strategies whenever possible.

Terminal 2

Originally constructed in 1954 as the Airport’s Central Terminal, Terminal 2 was renovated in 1983, but was closed to passengers in 2000 after the construction and opening of SFO’s International Terminal. Airline operations then shifted to the new International Terminal, but Terminal 2 continued to be used for Airport administrative offices in addition to housing FAA’s main control tower. In 2008, due to an increase in passenger demand, the Airport decided to reopen Terminal 2. SFO developed plans to renovate the Terminal using sustainability principles, materials, and techniques. The $383 million project transformed Terminal 2 into a state-of-the-art domestic terminal. In April 2011, Terminal 2 officially reopened to great acclaim from airlines, concessionaires, and passengers. In late 2011, the

In 2008, to accommodate growth in passenger traffic and airline demand for gates, SFO embarked on a $383 million project to renovate Terminal 2 into a state-of-the-art domestic terminal. The Terminal received LEED Gold certification in 2011.

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SFO has adopted the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) green building rating system, which is a consensus-based international standard for developing high performance, sustainable buildings. Members of the USGBC from all segments of the building industry helped develop the LEED rating system and continue to contribute to its evolution.

LEED provides a practical framework to identify and implement green building and sustainable design for construction, operations, and maintenance of buildings. It offers a flexible system of rating buildings based on the following categories:

- **Sustainable Sites**: Discourages use of previously undeveloped land and encourages minimization of a building’s impacts, and construction-related impact, on natural resources. Encourages appropriate landscaping and transportation choices.
- **Water Efficiency**: Encourages smarter use of water through use of more efficient indoor appliances and fixtures, and water-conscious landscaping.
- **Energy and Atmosphere**: Encourages energy minimization strategies such as energy use monitoring, efficient design, efficient appliances and lighting, and the use of renewable energy sources.
- **Materials and Resources**: Encourages the reduction of waste, use of sustainably grown, harvested, produced, and transported products and materials, and reuse and recycling.
- **Indoor Environmental Quality**: Encourages activities that improve indoor air quality, the use of natural daylight, and acoustics.
- **Locations and Linkages**: Encourages new construction be built near already existing infrastructure, community resources, and transit as well as locations that promote walking and use of the outdoors.
- **Awareness and Education**: Encourages providing users of the building, home, or facility with the education and awareness of what makes the building sustainable, and how they contribute by using its green features.
- **Innovation in Design**: Encourages innovative technologies and strategies to improve a building’s performance or to account for other green building techniques that are not addressed in other performance areas.

The highest level of certification is **Platinum**, followed by **Gold**, **Silver**, and **Certified**.

For more information, please see [www.usgbc.org](http://www.usgbc.org)

5.5 million passengers per year; and includes 14 gates, 30,793 sq ft of retail development, a pedestrian bridge to AirTrain, and a number of sustainability features described below.
2. Green Buildings and Facilities

SFO’s Terminal 2 features abundant natural light, which with the use of highly efficient lighting and machinery is expected to reduce energy consumption upwards of 2.9 gigawatt hours, compared to a building designed to code. This is enough energy savings meet the needs of approximately 431 California residences for a year.1

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Terminal 2’s Sustainability Features
Terminal 2’s sustainability features include:

- Greenhouse Gas Emissions Reduction Initiatives
- Waste Reduction
- Reclaimed Water Reuse Program

Greenhouse Gas Emissions Reduction Initiatives
Terminal 2’s design includes a number of measures to reduce the carbon footprint of the terminal, such as:

- Preconditioned (PC) Air and 400 Hz Power Supply Systems: SFO provides PC Air and 400 Hz power supply to aircraft at all Terminal 2 gates. These facilities are conservatively estimated to reduce jet fuel consumption by aircraft Auxiliary Power Units (APU) by 521,000 gallons per year and reduce GHG emissions by approximately 5,100 metric tons per year.

- Energy Efficiency Measures: The incorporation of energy efficient lighting and efficient machinery are expected to reduce electrical energy consumption by 2.9 gigawatt hours per year, and natural gas consumption by 116,000 therms per year, resulting in a reduction of 750 metric tons of GHG emissions per year.

- Building Materials Savings: By reusing a substantial portion of the infrastructure of the existing building in the renovated Terminal 2, SFO generated cost savings and reduced the global warming impact of the renovated terminal by a one-time reduction of approximately 12,300 metric tons of GHG emissions.

- Plug-in Electrical Chargers for Ground Service Equipment (GSE): SFO installed chargers for use by GSE equipment at all gates, resulting in both fuel saving and a reduction in GHG emissions.

- Preferential Parking for Electric and Hybrid Vehicles: SFO allocates preferential parking spaces and public charging stations in the Domestic Parking garage for exclusive use by hybrid and electrical vehicles.

Waste Reduction
SFO’s Zero Waste Program requires the reuse/recycling of all waste generated during construction projects to the extent feasible. Contractors recycled over 90% of Terminal 2 construction and demolition debris.

SFO also requires ongoing source separation of all recyclable solid waste to help meet its interim goal of recycling 80% of the generated waste by 2015. All Terminal 2 food vendors are required to use biodegradable tableware and source separate all food service wastes for direct transport to off-Airport composting facilities.
All Terminal 2 food vendors are required to use biodegradable tableware and source separate all food service wastes for direct transport to off-Airport composting facilities. Passengers are encouraged to deposit their waste at recycling and composting receptacles located throughout the terminal.

As part of its design, Terminal 2 includes sustainability education components, achieved through creative graphics and signage. In this educational display, the passenger’s attention is drawn to a very large trash compactor located outside the window. The accompanying descriptions explain how the airport waste is managed.
2. Green Buildings and Facilities

Trees feature prominently in the design of the American Airlines Admirals Club, a symbol of the space’s use of sustainable design elements. The American Airlines Airport Lounge received LEED Silver certification for Commercial Interiors.

Reclaimed Water Reuse Program
SFO has installed a dual water supply system at Terminal 2, which will allow the use of reclaimed water from the Airport’s Mel Leong Wastewater Treatment Plant. The Airport is currently designing the new pipeline to bring treated effluent from the treatment plant for appropriate gray water use – such as toilet flushing – at Terminal 2 and landscape irrigation at other areas at SFO.

Terminal 2 Tenant and Concessionaire Facilities
Terminal 2 is occupied by two airlines, Virgin America and American Airlines, as well as a number of concessionaires.

Virgin America
Virgin America occupies seven gates at Terminal 2. They have created an innovative space near their gates, with waiting areas designed to be calming to passengers. Virgin America ticket counters also use “mood-lit” energy-efficient LED lighting at counters and the airline takes advantage of the Terminal’s abundant natural lighting, which significantly reduces the overall electricity usage rate.

Virgin America supplemented Terminal 2’s overall design with additional sustainable design elements, such as using:

- Environmentally-friendly certified wood and other green building materials
- Night/day motion sensors
- Energy efficient heating, cooling, and ventilation in Virgin America staff spaces
- EnergyStar-rated computer and office equipment
- Low-VOC paints and coatings

Virgin America’s spaces have received LEED Platinum certification for Commercial Interiors – the highest level for LEED certification.

American Airlines
American Airlines is also committed to implementing programs that reduce its environmental impact. The airline’s operations are located in Terminal 2, and provide the Terminal’s only airport lounge, the SFO Admirals Club. This club also incorporates sustainable design features and has received LEED Silver certification for Commercial Interiors.

Concessions Program
As with other tenants, SFO’s concessionaires are encouraged to use green building materials for their facilities and are required to segregate the recyclable and compostable portion of their solid waste.

For Terminal 2, the Airport encouraged its food and beverage tenants to provide sustainable food to the greatest extent possible. Food products considered “sustainable” include:
- Organic, local products
- Organic or natural meats
- Dairy products free of the rBST hormone
- Cage-free and antibiotic-free eggs
- Sustainable seafood
- Fair-Trade organic coffee
- Non-genetically modified agricultural products
- Products that do not include artificial colors, flavors, or additives
- Non-hydrogenated oils

Other products provided and/or used include biodegradable to-go containers and utensils; compostable bio-resin or paper bottles for water; and the use of low- or no-phosphate detergents for dishwashing operations.

**Building 575: The SFO Business Center**

Building 575 has also been renovated using green building techniques and now serves as the Airport’s Business Center. Several administration offices from Terminal 2 were relocated to this building, and the Business Center now houses the Airport Commission employees working in Information Technology and Telecommunications (ITT), Aviation Management, Parking Management, Revenue Development and Management, Finance and Accounting, and staff of the Airport Liaison Office. The Business Center received LEED Gold certification in 2011.

SFO’s Business Center design included the following green building elements:

- **Sustainable Materials**
  
  Over 90% of the wood used on the project was Forest Stewardship Council (FSC)-certified as responsibly managed and harvested. The majority of the space was furnished with furniture purchased locally from a salvage and

---

**[LEFT]**

The SFO Business Center is the second major Airport renovation project that has been awarded LEED Gold certification.

**[RIGHT]**

The SFO Business Center features three charging stations and dedicated electric vehicle parking spaces. The electric chargers are available for public use.
The aesthetically engaging landscaping surrounding the SFO Business Center contains plants that do not require regular watering. This xeriscaped landscaping has contributed to a reduction in water use by 153,675 gallons per year.

Xeriscape landscaping refers to landscaping and gardening that is designed to reduce or eliminate the need for supplemental irrigation. Xeriscapes are often achieved by using drought-tolerant plants and/or plants that are native to the area, and therefore are able to thrive in the existing climate, without additional watering.

Energy Efficiency
Efficient LED and fluorescent light fixtures and other high efficiency equipment have contributed to creating a sustainable space in the Business Center. The project achieved a 20% reduction in lighting power density (a reduction of nearly 10,000 watts), and uses automatic lighting controls to minimize excess use of lighting in the offices. The space also uses energy-efficient EnergyStar approved appliances and submeters that aid in monitoring the energy used by these appliances.

Water Efficiency
Water use has been reduced by 153,675 gallons per year (a reduction of more than 40% below the building code requirement) due in part to the use of water efficient fixtures such as low-flow toilets and automatic shutoff faucets, and xeriscape landscaping outside the building.

Occupant Wellbeing
Healthy interior spaces were emphasized with air quality management plans during and after construction. Renovations included the use of construction materials such as paints, carpets, adhesives, and furniture that emit minimal to no volatile organic compounds (VOCs), which can be harmful to human health. SFO also emphasized occupant wellbeing by installing systems that enable occupants to control lighting and temperature in their individual office space.

Along with the building’s “green” features, other amenities serve to encourage sustainable practices, such as bike racks, a changing room, and shower facilities for bicycle commuters, electric vehicle charging stations, and specially designated parking spaces for carpoolers.

Signature Flight Support Fixed Base Operator Terminal/Hangars
Signature Flight Support Corporation’s facility at the Airport was awarded LEED Gold certification for Commercial Interiors in 2010. Facility improvements included an extensive renovation of the existing 9,800 sq ft executive terminal and the two existing 25,000 sq ft aircraft hangars. The renovation included new heating, ventilation, and air conditioning...
equipment as well as replacement of the lighting systems for improved energy efficiency and performance. These efforts resulted in a 47% reduction in energy use from lighting relative to industry standards. Interior finishes, doors, and millwork were also replaced and low VOC binders and adhesives were used to improve the indoor air quality.

**International Terminal**
SFO’s International Terminal is a model of energy efficient design, utilizing the latest technologies and products available to create a more environmentally friendly facility. The International Terminal contains 2.5 million sq ft of space and accommodates 24 aircraft gates, ticket counters, baggage handling facilities, and U.S. customs facilities to provide passengers with efficient service in an appealing environment. SFO developed the International Terminal following the principles of LEED. Its unique features include:

- **Sustainable Materials:** Sustainable products were incorporated into the terminal design, such as 21,000 sq ft of Forest Stewardship Council (FSC) certified cherry wood paneling.
- **Reduced Water Use:** Ground landscaping is comprised of native plants and trees grown specifically in Bay Area nurseries.
- **Building Systems Optimization:** A computerized system monitors and adjusts energy usage in the International Terminal Building to ensure optimum energy efficiency.
- **Energy Efficient Design:** The terminal has an energy conservation system that includes coated glass that minimizes heat loss, use of daylight to reduce the need for electric light sources; as well as energy efficient lighting. Chilled and hot water distribution pumps are equipped with variable frequency motors to modulate water output in proportion to building cooling and heating demands.
- **Preconditioned Air and Ground Power Supply to Aircraft:** 400 Hz power and preconditioned air is provided to aircraft docked at all boarding gates to reduce GHG and other air pollutant emissions that would result from the use of the aircraft’s Auxiliary Power Units (APUs). In FY 2010 these facilities resulted in a reduction of 18,300 metric tons of GHG emissions and a saving of 1,866,000 gallons of jet fuel for airlines.
**Boarding Area E Planned Renovation**

A major renovation and expansion project is currently under design for Boarding Area E. This project will pursue the same green building standards of excellence that were achieved for the Terminal 2 renovation. The Airport envisions creating a terminal space with unique and acclaimed restaurants, local food and merchandise, unexpected and re-purposed spaces, a focus on sustainability and cutting edge technologies, and design features that bring people together. These concepts will serve as the basis for the project, while achieving the following goals:

- Increase space at gate waiting areas
- Increase concession space
- Increase the space for amenities
- Increase natural daylight
- Enhance the customer experience

**Greening Existing Buildings**

SFO recognizes that greening new or renovated buildings is only half the battle. Enhancing the efficiency of the existing airport building stock is also an important element to SFO’s green building program with the objectives of reducing energy consumption and greenhouse gas emissions.

In 2011, SFO undertook a study to evaluate the feasibility of securing LEED certification under the Existing Buildings Operations and Maintenance standard (LEED EBOM) for the entire Terminal Complex. LEED EBOM is different from LEED for New Construction (LEED NC) in that it focuses on the ongoing efficient operation of buildings; whereas LEED NC is intended to ensure that facilities are designed and built to a green standard. Pursuing LEED EBOM certification would ensure the terminal complex is operated and maintained in a way that maximizes resource efficiency and minimizes the environmental footprint of building operations.

Securing LEED EBOM certification for 9 million sq ft of terminal and related space would make SFO the first major airport to earn a high level of LEED EBOM certification for an entire terminal complex.

1 Assumes an average electricity use of 6,721 kWh per California resident in 2010.

International Terminal Building at SFO displays greenery and abundant light. SFO's International Terminal was designed to minimize its environmental footprint. This project led the way to SFO's comprehensive green building program, which now includes a suite of LEED-certified buildings.
Solar panels atop SFO’s Terminal 3, generating renewable electricity for the Airport. These panels were installed in February 2008. SFO has taken steps to reduce its GHG emissions and encourages others to do the same by supporting alternative energy projects.
3. Climate Change

SFO strives to set environmental sustainability goals that are often more ambitious than the mandated local, state, or federal requirements. The City and County of San Francisco has set a goal of reducing GHG emissions to 25% below 1990 levels by 2017. SFO is on the path to meet this goal and by FY 2010 had already reduced its GHG emissions to 19% of 1990 levels. In addition, SFO has mitigated 99% of the GHG emissions from SFO-controlled operations by reducing the GHG emissions from aircraft parked at the boarding gates and from vehicles rented by passengers at SFO, among other measures. This chapter describes current and planned activities to further reduce SFO-controlled GHG emissions and provides details on projects to mitigate the Airport’s GHG emissions. Lastly, this chapter describes the need for developing a climate change adaptation plan.

Policy

In 2008 the Board of Supervisors adopted, and the Mayor signed into law, Ordinance No. 81-08 Climate Change Goals and Action Plan, which mandates GHG emissions reductions of 25% by 2017, 40% by 2025, and 80% by 2050, below 1990 emission levels. Each City Department, including the Airport, must meet these targets. The Airport shall continue to reduce its carbon emissions in order to meet the City’s goal.

Objectives

- Achieve 100% mitigation of SFO-controlled GHG emissions by 2012
- Achieve 50% reduction from 2010 baseline GHG emissions from SFO-controlled operations by 2015
- Increase the solid waste recycling rate to 80% by 2015 to conserve resources and offset GHG emissions
- Increase the use of renewable sources of energy
- Consider the risks of changing climatic conditions in airport planning and operational decision-making
What Have We Accomplished?

Greenhouse Gas Reductions and Mitigation Measures

The Airport Commission has demonstrated leadership since 2008 in taking action to meet the requirements of City Ordinance No. 81-08, Climate Change Goals and Action Plan, by implementing a comprehensive GHG emission reduction program that resulted in a 19% decrease in GHG emissions in FY 2010, compared to 1990 levels. In addition to reducing the GHG emissions from SFO-controlled operations, SFO has implemented a number of GHG emission mitigation measures that yielded a total mitigation of 41,816 metric tons, equivalent to 99% of SFO’s GHG emissions, in FY 2010. Although SFO did not attempt to formally certify these mitigation measures as emission offsets, they nevertheless reduced the GHG emissions at SFO and had a positive climate impact. SFO has also achieved GHG emission offsets by sequestering carbon through trees planted at the Airport and through recycling/composting 74% of the solid waste generated at the Airport.

The graph below shows the gross GHG emissions from SFO-controlled operations, as well as the mitigation/offset levels for the 1990 baseline and 2008 through 2010.

Sources of SFO-Controlled GHG Emissions

Category 1 emissions are emissions generated by SFO-controlled operations. Baseline GHG emissions are defined in this report as the sum of direct and indirect emissions from operating facilities under the Airport’s control. In 2010, the Airport emitted a total of 44,562 metric tons of GHG, generated from the sources described below.

Direct Emissions (82%)

GHG emissions are generated on-site at SFO from the operations listed below:

- Consumption of various fuels by vehicular traffic on SFO-controlled roads, SFO fleet vehicles, emergency generators, SFO Shuttle buses, etc. (14,877 metric tons in 2010)

Although the number of SFO passengers has increased by 30% since 1990, SFO was able to reduce the GHG emissions from Airport-controlled operations (“Category 1”) by 19% in FY 2010 compared to 1990 levels. In addition to the measures SFO has implemented to reduce/offset its direct GHG emissions, the Airport has invested in GHG emission mitigation projects to further minimize its impact on climate change.
How do Airports Calculate Greenhouse Gas Emissions?

Currently, the United States has no national standard for preparing an Airport Greenhouse Gas Emissions inventory. The Transportation Research Board (TRB), a division of the National Academies, published a guidebook under the Airports Cooperative Research Program (ACRP) to provide consistent guidance on developing airport GHG emissions inventories. SFO used the methodology presented in this guidebook to prepare its GHG Inventory, which includes complete details of Category 1 Emissions for SFO-controlled operations as well as estimated values for Category 2 and Category 3 emission generated by airport enterprises and operations related to SFO.

SFO has used the following airport-specific ownership and control categories for evaluating its carbon footprint which is consistent with ACRP guidelines:

**Category 1 - SFO-controlled Emissions**
GHG emissions from operations that are under the control of SFO, including emissions from boilers, purchased electricity, SFO employees’ commute and from all modes of travel on SFO-controlled roads. This category includes all of Scopes 1 and 2, and a portion of Scope 3 emissions.

**Category 2 - Airlines, Concessionaires, and Airline Support Services Emissions**
GHG Emissions, within the physical boundaries of SFO; by airline operations, including landing and take-off (LTO) cycles; ground service equipment (GSE) and other support services; and by various concessionaires and other tenants. This category includes mostly Scope 2 emissions.

**Category 3 - Optional Emissions**
U.S. Environmental Protection Agency (EPA) defines optional emissions as those emissions that are not directly emitted by, but are connected with, the reporting enterprise’s operations. Examples include GHG emissions from passenger travel to and from SFO, outbound cruising aircraft, and delivery trucks. This category includes Scope 3 emissions.

Other classifications are also used for quantifying the GHG emissions in the context of international climate change initiatives such as the Kyoto Treaty such as “Scopes 1, 2, and 3,” referred to above, which differentiate emissions based on whether they are generated directly or indirectly by the operating entity.


Note the significant difference in the scale between the two graphs.

The graphs above show SFO’s category 1, 2, and 3 GHG emissions for 1990, and FY 2008 through FY 2010. Although the City and SFO’s GHG reduction goal applies to those emissions over which SFO exerts direct control (Category 1), SFO also tracks the emissions from all other Airport-related activities, such as airlines and enterprise operations and passenger travel to and from the Airport.
3. Climate Change

- Consumption of natural gas, including natural gas supplied to all tenants by SFO (17,714 metric tons in 2010)
- Fugitive refrigerant gas releases (3,512 metric tons in 2010)
- Process emissions at SFO’s wastewater treatment facilities (322 metric tons in 2010)

Indirect Emissions (18%)
GHG emissions generated off-site but associated with the consumption of resources by SFO-controlled operations or by the activities connected to such operations, are classified as indirect emissions. The various categories of indirect emissions for SFO-controlled operations are listed below:

- GHG emissions from various modes of commute travel by SFO employees (2,553 metric tons in 2010)
- Electrical energy consumption, including electrical energy supplied to all tenants by SFO (4,764 metric tons in 2010)
- Solid waste disposal (820 metric tons in 2010)

Aircraft operations are clearly a substantial source of GHG emissions at SFO, far outweighing the impact of SFO-controlled operations. However, these operations are neither owned nor totally controlled by SFO and are therefore not included as Category 1 GHG emissions.

The Airport has taken concrete steps to reduce the GHG emissions associated with direct and indirect sources listed above. These initiatives are described in the following chapters:

Chapter 2: Green Buildings and Facilities
Chapter 4: Energy Conservation and Renewable Energy
Chapter 5: Air Quality
Chapter 9: Solid Waste and Recycling

For example, the Airport has invested in on-site renewable energy systems (Chapter 4), is converting its vehicle fleet to low emission vehicles (Chapter 5), is incorporating efficient building design principles into new development (Chapter 2), and is increasing its rate of recycling (Chapter 9).

SFO Fuel Consumption—Vehicle & Shuttle Fleet and Emergency Generators (FY 2010)

- Natural gas consumption: 40%
- SFO fuel consumption (vehicle & shuttle fleet, & emergency generators): 33%
- Fugitive refrigerant gas releases: 8%
- Wastewater treatment facilities: 1%
- Electrical energy consumption: 10%
- SFO employee commuting: 6%
- Solid waste disposal: 2%

This chart shows the sources of direct and indirect GHG emissions from SFO-controlled operations (Category 1). The majority of Category 1 GHG emissions (73%) at SFO result from the combined natural gas consumption by SFO and SFO enterprises, plus fuel consumption by SFO-controlled operations.
Greenhouse Gas Emission Offset Measures
SFO has implemented two GHG emission offset measures over the years, consisting of carbon sequestration by landscaping trees and recycling/composting of solid waste generated at the Airport.

Solid Waste Recycling/Composting
SFO recycled 38% of the regular solid waste generated at the Airport in FY 2010 and composted an additional 36% of the waste for a total of 74%. These recycling/composting operations generated 2,205 metric tons of GHG emission offset in FY 2010.

Tree Plantings
SFO has planted 2,020 trees of different varieties around the Airport in recent years. These trees are estimated to sequester approximately 121 metric tons of carbon dioxide per year.

SFO’s Climate Action Plan: Third Party Verified
San Francisco local law mandates that all city departments, including the Airport, develop a Climate Action Plan (CAP) that outlines the procedures for meeting the City and County of San Francisco’s GHG emission reduction goals. SFO has been preparing annual CAPs since 2008. In the interest of complete transparency, in 2011, SFO chose to seek third party verification of its plan. SFO enlisted ICF International, an internationally-recognized climate change management firm, to validate SFO’s GHG inventory and confirm the emissions reductions, offsets and mitigations reported in the CAP. This work is currently ongoing. Taking initiative in seeking third-party verification of its CAP underscores the Airport’s dedication to realizing true reductions and mitigations in GHG emissions.

Greenhouse Gas Emission Mitigation Measures

SFO has also successfully implemented a number of measures to mitigate GHG emissions indirectly associated with its operations. These measures, totaling 41,816 metric tons in FY 2010, are described below:

**Preconditioned Air and 400 Hz Power**
Installation of preconditioned air supply (PC Air) and 400 Hz power supply equipment at the International Terminals A and G, Terminal 2, and the majority of domestic boarding areas has reduced the need for the use of aircraft Auxiliary Power units (APUs) by the air carriers for providing electric power and conditioned air to the aircraft during the deplaning and enplaning of passengers. In FY 2010, the PC Air and 400 Hz Power system operated by the Airport mitigated the aircraft GHG emissions by 21,889 metric tons.

**Construction and Demolition (C&D)**

**Solid Waste Recycling**
The GHG emission mitigation associated with the C&D recycling operations at SFO are estimated at 462 metric tons in FY 2008, 13,095 metric tons in FY 2009, and 4,545 metric tons in FY 2010. The magnitude of GHG emission mitigation associated with C&D recycling varies based on the quantity of construction and demolition waste generated in each year. Due to this variability SFO treats the impact of these recycling operations as GHG emission mitigation rather than GHG emission offset. In contrast, SFO treats the recycling/composting of regular solid waste as an offset measure due to permanence and steady state condition of these operations.

**Green Car Rental Incentive Program (GCRIP)**
In 2009, SFO initiated the Green Car Rental Incentive Program (GCRIP), a program that provides financial incentives to the Airport rental car companies to increase the number of fuel efficient cars with an EPA rating of 17 or higher to 15% of their rental vehicle inventory. As a part of the GCRIP, SFO also initiated a three-year program to reward the passengers renting a “green” vehicle by providing a $15 discount on each rental transaction. In FY 2010, the net GHG emissions mitigated by the GCRIP was estimated at 11,442 metric tons.

**BART**
SFO provided partial funding for the Bay Area Rapid Transit (BART) extension to SFO which in FY 2010 resulted in a reduction of about 69 million miles of commute travel by airline passengers based on monthly passenger data provided by BART. SFO shares approximately 9.1% of this mitigation based on the Airport’s capital contribution to the BART extension. In FY 2010, it is estimated that the BART extension mitigated SFO’s GHG emissions by 2,076 metric tons.

**AirTrain**
In 2003, SFO completed the construction of AirTrain, which has eliminated the need for the use of shuttle buses by all on-Airport rental car agencies. In FY 2010, the AirTrain system mitigated SFO’s GHG emissions by 1,864 metric tons.

Achieving SFO’s GHG Emission Reduction Goal
SFO considers GHG emission reduction a key tenet of its mission “to provide an exceptional airport in service to our communities.” SFO will continue to implement its GHG emission reduction and mitigation programs in order to minimize the Airport’s impact on the environment. Ongoing and planned GHG emission reduction and mitigation measures that will bring SFO closer to meeting its sustainability goals include:
Proposed GHG Emission Reduction Measures

- Additional electric energy efficiency improvements identified in SFO’s Energy Audit. These measures could further reduce SFO-controlled (Category 1) GHG emissions by up to 473 metric tons per year. Also, projected reductions in natural gas consumption could reduce the GHG emissions by 5,219 metric tons per year.

- Planned fleet vehicle replacements, including 234 of the existing aged vehicles over a six year period, mostly with CNG powered vehicles, where available. This program is expected to reduce the Category 1 GHG emissions by 354 metric tons per year upon completion.

- Lighting fixture replacement for tenant occupied buildings. SFO is planning to replace all outdated lighting fixtures in tenant occupied buildings in the next two years. Because electric energy consumption by tenants is included in the SFO baseline GHG emissions, the reduction in energy consumption from the new fixtures would aid in reducing the carbon footprint of SFO-controlled operations.

Proposed GHG Emission Offset Measures

- Increasing the solid waste recycling rate to 80% by 2015 from the 2008-2009 recycling rate of 62%. This measure is expected to yield an additional GHG emission offset of about 2,000 metric tons per year.

Proposed GHG Emission Mitigation Measures

- Full year operation of installed PC Air units at Boarding Areas C and F in FY 2011. These systems are expected to yield a combined additional GHG emission mitigation of 5,728 metric tons per year.

- Activation of PC Air and 400 Hz power supply systems at renovated gates in Terminal 2. These systems are expected to yield an additional GHG emission mitigation of 5,731 metric tons per year.

- Full year operation of PC Air units at Boarding Area E in FY 2014. These systems are expected to yield a GHG emission mitigation of 4,394 metric tons per year.

Note: A number of these measures associated with the Terminal 2 Renovation Project, PC Air installation at Boarding Areas C and F have already been implemented and are operational. Other measures such as PC Air units in Boarding Area E will become operational at the completion of ongoing renovations in this terminal.

This chart shows the magnitude of each GHG emission mitigation measure. Supplying PC Air and 400 Hz power to aircraft at the gates constitutes the largest GHG emission mitigation measure at SFO.
Estimates of the GHG emission reduction levels to be achieved to meet the mandates of Ordinance No. 81-08 were developed by comparing projected GHG emissions with the mandated target emission levels for 2017 and 2025. The results of these calculations indicate that, assuming an increase in baseline emissions by 17.5% in 2017 and 38.1% by 2025, SFO would need to reduce its emissions by an additional 2,801 metric tons by 2017 and 19,827 metric tons by 2025 to comply with the requirements of Ordinance No. 81-08. The Airport plans to achieve these GHG reductions by continually seeking greater opportunities for efficiencies and utilizing the most up-to-date technologies and strategies.

**Climate Change Adaptation**

To date, the majority of efforts to address climate change have been focused on climate change “mitigation”, or implementing GHG emission reduction and offset measures. However, due to the long term impact of greenhouse gases on the climate, it is considered advisable to evaluate the impact of potential changes in the climate and develop Climate Change Adaptation Plans to ensure continued operation of the facilities and services.

Both the state of California and the Bay Area local governments have initiated efforts to prepare climate change adaptation plans. At the state level, Executive Order S-13-08 outlines the following actions:

- Calls for additional research on future magnitude of sea level rise in California;

- Requires all state agencies that are planning construction in coastal areas to consider the project’s vulnerability to sea level rise and reduce expected risks; and

- Requires the development of a state Climate Adaptation strategy, which assesses California’s vulnerability and outlines solutions that can be implemented within and across state agencies to promote resiliency.

In the San Francisco Bay Area, the Bay Conservation and Development Commission (BCDC) has developed a report that analyzes the vulnerabilities to climate change in the Bay and recommends policies that would alter design and siting requirements for some projects requiring permits from BCDC. The BCDC 2008 vulnerability assessment, *Living With A Rising Bay: Vulnerability And Adaptation In San Francisco Bay And On the Shoreline* [http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf](http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf), is based on research findings by the United States Geological Survey (USGS) on expected inundation due to sea level rise in the Bay Area and on an analysis of the socioeconomic impacts of the potential inundation by the Pacific Institute. The results of these efforts show that:

- Approximately 180,000 acres of shoreline lands are vulnerable to flooding following a 16-inch rise in sea level, and more than 213,000 acres following a 55-inch rise in sea level, potentially flooding over a quarter-million of the Bay’s residents.

- The replacement value of the resources at risk would be about $62 billion.

SFO has installed a sea wall along most of the adjacent shoreline with an elevation of 3 feet above the high tidal water level in the Bay. SFO is also planning to extend this wall to cover the remaining shore line at the Airport. A focused assessment of Climate Change impacts at the Airport will also be carried out in the ongoing Sustainability Planning process.


2 See BCDC’s Proposed Climate Change Bay Plan Amendment website [http://www.bcdc.ca.gov/proposed_bay_plan/bp_amend_1-08.shtml](http://www.bcdc.ca.gov/proposed_bay_plan/bp_amend_1-08.shtml) for additional information
Due to the Airport's proximity to the Bay, SFO recognizes its vulnerability to inundation due to future rise in sea level. As part of its ongoing Sustainability Planning process, SFO will conduct a focused assessment of potential climate change impacts at the Airport.
Since 1998, SFO has initiated an Airport-wide program to replace legacy lighting fixtures with new energy efficient lighting fixtures. These lighting improvement projects have saved 10,938 megawatt hours (MWh) of electricity annually, enough energy to meet the annual electricity needs of approximately 1,627 California residents.¹
Energy conservation and the use of renewable energy yield numerous economic and environmental benefits including reducing greenhouse gas (GHG) generation, improving air quality, as well as reducing energy costs. SFO maximizes these benefits by using hydroelectricity supplied from the City’s Hetch Hetchy facilities, continually seeking ways to enhance the energy efficiency of airport facilities, providing infrastructure for a diverse mix of clean fuels at the Airport, and using alternative sources of power for facilities and equipment, as described in this chapter.

**SFO Policy**

*SFO shall reduce energy use to the maximum extent practicable and seek to utilize clean and renewable energy sources.*

**Objectives**

- Reduce overall power use by maximizing energy efficiency.
- Enhance the use of energy supplies based on renewable, environmentally sound resources to the maximum extent practicable.
- Minimize GHG and ozone-depleting emissions associated with energy use at the Airport.
SFO continues to implement measures to maximize its energy efficiency and encourages tenants to do the same. In FY 2010, overall airport electricity consumption decreased 2.8%, from 332,078 MWh in FY 2009 to 322,927 MWh in FY 2010. Combined SFO and tenant natural gas consumption increased, however by 5.9% since FY 2009. This increase in natural gas consumption in FY 2010 was likely due to an increased demand for chilled water.

For context, 322,927 megawatt hours, the electricity used by SFO and its tenants in FY 2010, is enough to meet the annual electricity needs of over 48,000 California residents.\(^2\)
What Have We Accomplished?

Energy Use

Electricity and Natural Gas Consumption

SFO uses electric energy for lighting and for powering equipment (such as people movers); and heating, ventilation, and air conditioning (HVAC) equipment at the terminals, boarding areas, and other SFO facilities.

Combined SFO and tenant electric energy consumption decreased from 332,078 megawatt hours (MWh) in FY 2009 to 322,927 MWh in FY 2010, showing a 2.8% decrease in overall airport electricity consumption.

SFO-specific electric energy consumption increased, however, from 165,846 MWh in FY 2009 to 173,100 MWh in FY 2010, showing a 4.4% increase. The increase in SFO electric energy consumption was likely due to demand from final phases of the Terminal 2 renovation and activation of the Terminal in the last four months of FY 2010. A 5.4% increase in passenger traffic and a 1.1% increase in flight operations at SFO could also have impacted this energy use. Despite the recent increases, SFO’s energy efficiency improvement program has resulted in a 6.3% overall reduction in electricity use since FY 2004.

Combined SFO and tenant natural gas consumption increased from 3,143,872 therms in FY 2009 to 3,330,555 therms in FY 2010 indicating a 5.9% increase, but remaining below FY 2008 consumption. This increase was likely due to an increased demand for chilled water.

Vehicle Fleet Fuel Consumption

In addition to electricity and natural gas used to power its facilities, SFO uses a mix of fuels to power its vehicle fleet, including gasoline, diesel, biodiesel, electricity, and compressed natural gas (CNG).

Fuel Usage of SFO General and Shuttle Fleets

<table>
<thead>
<tr>
<th>General Fleet</th>
<th>Shuttle Fleet</th>
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<tbody>
<tr>
<td>GASOLINE</td>
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<td>60%</td>
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<tr>
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<td>CNG</td>
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<tr>
<td>gasoline</td>
<td>gasoline</td>
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<tr>
<td>gallons</td>
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<tr>
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<tr>
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<td>BIODIESEL</td>
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<tr>
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<tr>
<td>gallons</td>
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<tr>
<td>23%</td>
<td>0%</td>
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</tbody>
</table>

SFO seeks to power its general fleet and shuttle fleet using a diverse mix of fuels. In FY 2010, 50% of SFO’s general fleet usage was from gasoline, 23% from biodiesel, and 27% from CNG. SFO’s shuttle fleet used 40% biodiesel and 60% CNG.
Energy Efficiency Program

Initiated in 2007, SFO’s program of implemented, ongoing, and planned electric energy efficiency projects have collectively resulted in a significant amount of electricity savings per year. With over 49 electric energy efficiency projects implemented to date, the Airport has reduced its electricity consumption by 6.3% since FY 2004, based on FY 2010 consumption. While the implementation of programs and purchase of equipment requires an initial investment, the expenditures are typically recovered through energy cost savings. The elements of SFO’s energy efficiency program are described below.

Energy Audit

Conducting an energy audit is essential to understand the energy flows throughout the Airport’s facilities and to identify opportunities for increased efficiencies.

In February 2007, SFO completed a preliminary Energy Audit in cooperation with the San Francisco Public Utilities Commission (SFPUC). The effort was part of SFPUC’s Clean Energy Clean Air Program to reduce operating costs and improve energy efficiency at the Airport. The preliminary audit identified a number of energy and lighting efficiency opportunities, which SFO continues to implement.

As a next step, SFO completed an investment grade audit of the mechanical and Heating Ventilating and Air Conditioning (HVAC) systems in the main terminal complex. This investment-grade audit expanded upon the preliminary energy audit, detailing technical and economical issues necessary to justify the investment for implementing energy efficiency measures. The resulting report included recommendations that could reduce SFO’s energy costs by $6.1 million per year, with a capital investment of $36.8 million, a simple payback of just six years.

Retro-commissioning: The key to maximizing building performance

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. It can often resolve problems that occurred during the design or construction of the building, or address problems that have developed throughout the building’s life. In all, retro-commissioning improves a building’s operations and maintenance (O&M) procedures to enhance overall building performance.

Benefits of retro-commissioning include:

- Increased asset value
- Energy savings, valued at $0.11 - $0.72/sq ft
- Improved occupant comfort
- Improved indoor environmental quality

Retro-commissioning is also an element of LEED EBOM certification.

For more information on Retro-commissioning, visit the California Department of General Services. Retro-commissioning Fact Sheet [www.documents.dgs.ca.gov/green/eeproj/retrocommfactsheet.doc](http://www.documents.dgs.ca.gov/green/eeproj/retrocommfactsheet.doc)
years. Investment would primarily include upgrading outdated equipment, but would result in reduced operation and maintenance costs as well as a reduced electrical demand for the Airport’s heating and cooling systems.

The investment grade audit recommended the following improvements:

- Optimization of control systems
- Conversion of air handlers to more efficient variable air volume (VAV) units
- Boiler replacements in the central plant
- Component upgrades to the cooling tower fans
- Optimization of the chilled water and heating hot water distribution systems and conversion to variable flow systems.
- Installation of a thermal energy storage system at the central plant that can generate and store chilled water at night
- Reset of zone temperature set-points.
- Retro-commissioning

In addition to energy savings, the recommended improvements were projected to reduce approximately 15,368 metric tons of GHG emissions per year.

SFO continues to evaluate the recommendations from these energy audits and has implemented a number of these recommendations to date.

**Lighting Efficiency Improvements**

SFO’s Facilities Division has implemented over 60 projects since 1998 to replace legacy lighting fixtures across the airport with new energy efficient lighting fixtures, such as LED roadway lighting and more efficient terminal lighting, affording the passengers an improved environment as well as reducing energy consumption. These lighting improvement projects have saved 10,938 MWh of electricity per year, enough energy to meet the annual electricity needs of approximately 1,627 California residents each year.¹

SFO is planning to retrofit all remaining legacy light fixtures throughout the Airport over the next two years, which will yield significant additional energy savings and GHG emission reductions.

*SFO operations and maintenance staff replace lighting fixtures in Terminal 3 with new energy efficient fixtures. These lighting improvement projects have resulted in annual electricity savings of 10,983 MWh.*
SFO’s new heat exchanger reduces electric energy consumption by providing chilled water to terminals in the winter without the need for using the chillers. A Stanford University analysis estimated that this system has saved the Airport 649,247 kWh and $90,895 in electricity costs per year.

**Hot Water Boiler Improvements**

In the last two years, the Airport has replaced all four of its hot water boilers in the Central Plant with the latest and most efficient boiler models. The new boilers meet the revised and more stringent Bay Area Air Quality Management District’s emission requirements. The new boilers should also aid in reducing the growth of natural gas consumption at the Airport.

**HVAC Improvements**

In 2009, SFO installed a new heat exchanger for supplying chilled water to terminals during cold temperature days. The heat exchanger has allowed SFO to provide chilled water to the terminals in the winter without the use of chillers, achieving substantial savings on energy costs.

A cost-benefit analysis for the heat exchanger, conducted by Stanford University, estimated that the system has saved the Airport 649,247 kWh and $90,895 in electricity costs each year.

**Information Technology Energy Saving Measures**

For the past five years, SFO’s Information Technology Transfer (ITT) department has embarked on an aggressive carbon footprint reduction program to reduce energy consumption by computers, printers, and monitors. The energy efficiency measures implemented in this program include:

- **Printer Consolidation for reduced energy use**
  SFO has implemented a printer consolidation program to reduce the total number of printers used airport-wide. The objective was to utilize one printer for every 8 staff personnel, thereby reducing electrical usage.

- **Paper Reduction through Duplex Printing**
  Two-sided printing settings have been programmed for all printers. This action has reduced SFO’s paper consumption by 50% to date.

- **Energy Star computers and laptops**
  Since 2005, SFO has been gradually replacing older, outdated computers used by staff with Energy Star compliant laptops, computers, and monitors. These computers are more energy efficient and reduce SFO’s electrical usage.

- **Automated Shutdown of inactive computers at night**
  In order to further reduce unnecessary energy usage, the Airport automatically shuts down inactive computers each night. This simple measure has reduced energy consumption by 1.2 million kWh annually, compared to energy consumption prior to 2005.

- **Server replacement for reduced energy use**
  The Airport has implemented a replacement program to retire older, stand-alone servers. These servers have been replaced with rack-mounted, “blade” servers that are more energy efficient.
Thin Client Computers that use only 8% of the energy used by a typical desktop
A Thin Client is a computer that depends heavily on a central computer, or server, to fulfill its traditional computational roles. These computers are much more energy efficient than traditional computers because they process little information on-site. As part of an Airport initiative to give all employees computer and email access, the Airport is replacing existing computers and deploying new thin client computers for employee use.

The Airport is also considering additional power management strategies, such as establishing computer sleep or hibernation default settings, and training employees to customize these settings to conform to individual work patterns.

Renewable Energy
Use of renewable energy is an important element of SFO’s overall GHG emissions reduction strategy, since renewable energy, such as hydropower and solar panels, produce electricity without generating any greenhouse gases or other hazardous emissions. Some GHG emissions and other wastes, however, are generated during the construction or manufacturing of the needed equipment.

Use of Hydropower
The bulk of the electricity for both the Airport (including AirTrain) and tenant facilities is supplied by the Hetch Hetchy Water and Power system (HHWP) which is a conglomerate of dams, hydroelectric plants, reservoirs, aqueducts, pipelines and transmission lines operated by the SFPUC. In FY 2010, the Airport consumed 322,927 MWh predominantly from this source. The use of hydropower greatly reduces the greenhouse gas emissions associated with the airport’s electricity use.
SFO’s First-of-its-Kind “Green” Data Center: A model for innovation and efficiency

**Background**
As part of the City’s Data Center Consolidation Plan, SFO is planning a new data center building at the Airport. This new SFO Data Center will be a “Class A - COLO”, a type of mission critical data center that services multiple agencies.

**Sustainable Design**
Data centers increasingly have been high energy users to match the ever growing demand for high capacity network servers. SFO’s new data center, however, will be designed using the most up-to-date standards to maximize energy efficiency.

The 2011 Thermal Guidelines, developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), has established new indoor environmental design criteria. The guidelines allow for a much wider indoor temperature and humidity design range, whereas for the last 40 years, the indoor design conditions required stringent temperature controls, resulting in heavy reliance on computer room air conditioning units and chiller plants.

SFO is now proposing a data center design that will utilize the cool ambient air of the San Francisco Bay Area as the primary source for conditioning the air in the facility, thereby avoiding the use of energy-intensive traditional cooling units.

To maximize the outside air cooling concept, the architect has incorporated two key architectural elements into the new building. These keys include “half dome” hot aisles located at the roof level and floor to ceiling louvered walls. These building features were specifically designed to discharge heated air at the roof level using high efficiency exhaust fans, and introduce cool outside air at the floor level into the data center.

Based on this high volume, high air-exchange rate design, it is anticipated that even during warm outside air conditions (75°F-85°F), the data center will be within the range of acceptable temperature and humidity. However, for the few hours each year when outside air is above 90°F, the mechanical system will utilize indirect evaporative cooling units to cool the data center.
Solar Energy Installations
The Airport currently has two operational solar arrays totaling 475 kW. Together, these installations generated 747 MWh of electricity in FY 2010, resulting in a reduction of 224 metric tons of GHG emissions. The Airport is planning to expand the solar energy program by installing an additional 170 kW of generating capacity in the near future.

- The Airport installed its first solar array in August 2001. The installed 2,000 sq ft of panels have a 20 kW capacity and generates 22,300 kWh annually.
- In February 2008, in conjunction with SFPUC, SFO installed 50,000 square feet of solar panels on the roof of Terminal 3. Visible from AirTrain, the array demonstrates to the public the Airport’s commitment to sustainability.

- The Airport has also proposed two new solar projects for implementation in the coming years:
  - A 120 kW solar carport in the Long Term Parking Lot DD that would include over 100 Level I-equipped parking stalls dedicated to plug-in vehicles only.
  - A 50 kW solar array atop the new Airfield Operations Facility.

SFO has installed two solar panel arrays: one on the roof of Terminal 3 (above) and the second at the Engineering Building (left). Together these installations generated 747 MWh of electricity in FY 2010, resulting in a reduction of 224 tons of GHG emissions. The Airport is planning to expand the solar energy program by installing an additional 170 kW of generating capacity in the near future.

Electric Charging Infrastructure
SFO continues to build the required charging infrastructure to promote the use of electric vehicles on Airport. To date, SFO has accomplished the following improvements to the Airport’s electric charging infrastructure:

- Installation of electric chargers for aircraft ground service equipment (GSE) vehicles at all gates at Terminal 2. SFO’s policy is to equip all new gates with electrical chargers for GSE.
- Installation of 20 Level II electric vehicle chargers that can provide a full recharge in 4 to 8 hours
- Deployment of additional 110V Level I chargers as part of the Terminal 2 Reconstruction
- Dedicated 28 parking spaces (and provided space for up to 48 vehicles) for Plug-In "EV" vehicles only.

1 Assumes an average electricity use of 6,721 kWh per California resident in 2010.


This map, displayed on the Airport’s website, shows the locations of plug-in electric vehicle charging stations at the Airport. Please visit:

Biofuels now offer the most promising means of reducing aircraft GHG emissions. Currently, aviation represents 2% of global emissions, but is expected to grow to 3% by 2050. A number of airlines are pursuing alternative fuels as a means to combat crude oil price volatility, save costs, and reduce GHG emissions. On July 1, 2011, the U.S.-based technical-standards group –ASTM– approved biofuels for commercial aircraft use. Since then, a number of airlines have initiated commercial and demonstration flights. Although aircraft GHG emissions are not accounted for as part of Airport-controlled emissions (Category 1), SFO encourages airline initiatives to reduce their GHG emissions.

**Sources of aircraft biofuel**
Sources of biofuel vary depending on the region where biofuels are processed. Sources currently include plant sources, such as algae, waste oils, and solid biomass, such as organic waste.

**Airlines are exploring the use of biofuels**
In February 2008, Virgin Atlantic flew the very first biofuel test flight between London and Amsterdam, using a 20% blend of biofuels in one of its engines. Air New Zealand, Continental Airlines, Japan Airlines, Air China, and United Airlines have since initiated demonstration flights without passengers.

A number of airlines have taken their commitment to biofuels one step further, by using biofuel on commercial flights: Alaska Airlines has committed to make a number of biofuel-powered flights. Lufthansa has flown several flights in Europe using a biofuel blend, and United Airlines made a biofuel passenger flight in November 2011, a first for a domestic carrier.
SFO has established an exemplary air quality improvement program that focuses on reducing air emissions from vehicles driving around the airport. As part of this effort, SFO has dedicated parking spots for clean fuel vehicles, such as electric vehicles ("EVs"), across the airport.
SFO continues to be a leader in converting its fleet to clean vehicles and establishing innovative programs to encourage Airport enterprises to take similar actions. The Airport’s comprehensive air quality enhancement program minimizes air quality impacts from aircraft and associated ground service equipment, cars and buses driving in and around the Airport, and from fuel and energy use at Airport facilities. As air emissions are closely linked to ozone and greenhouse gas generation, SFO’s air quality enhancement initiatives not only benefit the health of the local community but also help to reduce the Airport’s impact on climate change. The air quality benefits of transportation system improvements are described in this chapter.

SFO Policy

*SFO shall continue to encourage the use of public transit, and, to the maximum extent practicable, require the use of increasingly efficient vehicles and engines, and the use of clean fuels.*

Objectives

- Use alternate clean fuels such as compressed natural gas (CNG), biodiesel, hydrogen, and electricity for vehicles and equipment.
- Retrofit existing diesel-powered vehicles and equipment to reduce emissions.
- Reinforce SFO’s 2000 Clean Vehicle Policy that requires 100% clean vehicle use by 2012 where practicable.
- Develop staged intermediate air quality enhancement goals for Airport tenants and commercial entities serving the Airport.
- Minimize air emissions by increasing the use of clean energy sources, developing additional solar energy supplies, and evaluating the possible use of wind power.

5. Air Quality
5. Air Quality

What Have We Accomplished?

Air quality conditions in the San Francisco Bay Area are in compliance with the federal and state standards except for ozone and particulate matter. For these air quality parameters, the Bay Area is designated by the U.S. EPA as a non-attainment area, requiring the submittal of an implementation plan by the state to bring the area into compliance with the standards. Information on California’s State Implementation Plan is available at http://www.arb.ca.gov/planning/sip/sip.htm.

Air pollutant emissions from the various stationary sources at the Airport are compiled by the California Air Resources Board. Emissions from SFO-controlled operations are summarized in the graph below for the period 2003 through 2008. Overall, air pollutant emissions were at lower levels in 2008 than in 2003, despite a significant increase in air passenger traffic over that period. The modest increases in emissions of Total Organic Gases (TOG), Reactive Organic Gases (ROG), Carbon Monoxide (CO), Nitrogen Oxide (NOX), Particulate Matter (PM) and Particulate Matter less than 10 micrometers in diameter (PM10) can be attributed to normal variations in heating, ventilation, and air conditioning (HVAC) loads at the terminals.

SFO’s air pollutant emissions reduction program addresses the emissions from major point sources, such as refueling and heating/cooling, as well as emissions from ground transportation (cars and other vehicles operating at or traveling on Airport-owned roadways). SFO is minimizing air emissions from the Central Plant through the ongoing energy efficiency improvement program (Chapter 4). Key elements of SFO’s ground-transportation-related air quality improvement program include:

- Clean Vehicle Program/Alternative Fuels program
- Encouraging Alternative Transportation Use
- Airside Operations and Facility Improvements

![Historical Air Pollutant Emissions from Stationary Sources at SFO](image)

This graph shows the annual air pollutant emissions from stationary sources at the Airport. Though some increases can be observed since 2005, the pollutant levels reflect normal variations in airport operations.
Clean Vehicle and Alternative Fuel Program
In 2000, SFO adopted a Clean Vehicle Policy that established aggressive target dates to replace gasoline and diesel powered vehicles with clean air vehicles powered by alternative fuels such as CNG and electricity. Where manufacturers offer competitive alternative fuel products, the policy sets a goal of 100% clean air vehicles in Airport and Airport-permitted fleets by 2012. The fleet vehicles that are covered by SFO’s Clean Vehicle Policy include hotel and parking courtesy shuttles, shared-ride vans, taxis, airline crew shuttles, and airfield vehicles such as baggage tractors, belt loaders, and aircraft push-back tractors.

Financing and Incentives
SFO uses a number of different financing and incentive mechanisms to achieve the clean vehicle transition:

- **Vehicle acquisition incentives for SFO and permitted operator fleets**
  The Airport has secured $12 million in vehicle acquisition incentives from the Bay Area Air Quality Management District (BAAQMD), Metropolitan Transportation Commission (MTC), and San Francisco County Transportation Authority (SFCTA) for vehicles operating to and from the Airport.

- **Funding from federal and state agencies for SFO fleet and infrastructure**
  SFO has obtained $4 million for airfield vehicles and infrastructure, on-Airport shuttles, Airport utility vehicles, and an advanced hydrogen vehicle refueling station from federal and state agencies including the Federal Aviation Administration (FAA), Environmental Protection Agency (EPA), California Air Resources Board (CARB), and California Energy Commission (CEC).

- **Financial and nonfinancial incentives**
  SFO encourages alternative fuel vehicle use by fleet operators through a variety of financial and nonfinancial incentives, including:
  - **penalty trip fees** for hotel courtesy shuttles have reduced miles traveled by one third
  - **“head of the line” privileges** for CNG taxicabs
  - a requirement that shared-ride van operators use CNG or equivalent emission vans
  - **CNG fueling stations.** The Airport hosts two of the largest public CNG fueling stations in Northern California.

- **Green Car Rental Incentive Program.** The GCRIp provides financial incentives to Airport rental car companies to increase the number of “green” fuel efficient or alternative-fueled vehicles in their rental car inventory. As part of the GCRIp, SFO also initiated a three-year program to reward the passengers renting a “green” vehicle, by providing a $15 discount on each rental transaction. In FY 2010, 25.6% of car rental transactions were for “green” vehicles, saving over 1 million gallons of gasoline for the passengers and reducing 11,442 metric tons of GHG emissions to the atmosphere.

Advertisement for SFO’s Green Car Rental Incentive Program
5. Air Quality

The Airport levies higher fees on those operators that do not comply with the requirements of the Clean Vehicle Policy.

**Greening Airfield Vehicles**
SFO’s Clean Vehicle Policy extends to airfield vehicles. The move to electrify aircraft ground service equipment (GSE) started more than a decade ago. Now, over 300 all electric vehicles and a growing number of clean diesel vehicles are in service. By 2012, about half the GSE fleet will use clean power, up more than 40% in a decade. As part of the Terminal 2 renovation project, electric chargers were installed and are sufficient to serve that building’s GSE needs.

**Diesel Vehicle Filters and Rebuilds**
Major charter bus and scheduled airporer bus firms, and SFO’s on-Airport shuttle bus company have installed the most advanced particulate filters available on 125 diesel vehicles serving SFO. These filters reduce emissions of fine particle by 97% and of nitrous oxides by 85%, in a major advance for public health. The firms have also added new vehicles to their fleets that incorporate engines and filters providing equivalent emission reductions. On the airfield, Southwest Airlines and others are completely rebuilding diesel-powered ground support equipment with the cleanest available engines.

**City and County of San Francisco “Zero Emissions 2020” Plan**
In addition to its own Clean Vehicle Policy, SFO is participating in the City’s Zero Emissions 2020 Plan, which commits all City departments to developing a clean air plan for public transit. In coordination with San Francisco Municipal Railway (MUNI), “Zero Emissions 2020” focuses on the purchase of cleaner transit buses, including hybrid diesel-electric buses. Because the Airport’s own clean vehicle policy is more aggressive than the City’s, SFO remains ahead of the City goal.

**Clean Air Vehicle Program Successes**
Clean air vehicle use substantially reduces legacy vehicle emissions. Despite the post-2001 air traffic downturn which seriously delayed vehicle replacements in many cases, SFO has met the conversion targets for public transit vehicles, hotel courtesy shuttles, off-Airport parking shuttles, and aircraft ground support equipment. By 2012, SFO plans to replace 100% of conventional vehicles with clean air vehicles, where viable clean fuel options are available. In 2008, the Airport partnered with the San Francisco Taxi Line outside Terminal 1. SFO allows taxi drivers using CNG-powered vehicles to skip to the head of the taxi queue. This financial incentive encourages taxicabs to drive cleaner vehicles.
Municipal Transportation Agency (MTA) to develop a Clean Taxi Policy. The City’s taxi fleet (which handles 99% of Airport pickups) currently consists of over 1000 hybrid-electric cabs and about 100 CNG cabs, representing at least 75% of all City cabs on the path to full compliance in 2012.

**SFO Clean Vehicle Count**

SFO strives to maintain a diversity of fuel uses at the Airport in order to maintain flexibility in its fleet vehicle composition, while supporting a variety of technologies. In FY 2010, over 3,000 electric, CNG, advanced diesel, biodiesel, and propane vehicles were in operation at SFO. These include the following types of vehicles:

- 168 BART, AirTrain rail cars (electric)
- 1,200 taxicabs (hybrid-electric, CNG)
- 500+ rental cars (hybrid-electric)
- 53 limousines (hybrid-electric, CNG)
- 250 highway coaches (filtered diesel)
- 23 transit buses (CNG, filtered diesel)
- 115 minibuses (CNG)
- 125 vans (CNG)
- 400 airfield vehicles (electric, rebuilt diesel, propane)
- 300 staff and utility vehicles (CNG, plug-in electric, hybrid-electric, biodiesel [some with particulate filters])

In FY 2010, the following fuel sources were in use at the Airport:

- **Compressed Natural Gas**: The majority of on-road alternative fuel vehicles at the Airport operate on CNG, which emit 25% less CO₂ than gasoline powered vehicles per mile traveled.¹ To date, more than 500 diesel and gasoline-powered vehicles have been replaced with CNG models, resulting in savings of over 1.5 million gallons of gasoline and diesel fuel annually by SFO ground transportation and ground service vehicles.

- **Electric Plug-In Vehicles**: SFO’s Clean Air Vehicle Policy extends to airfield vehicles and equipment. The move to electrify GSE vehicles started more than a decade ago. Of the 1,000 privately-owned and operated off-road GSE vehicles that are dedicated to the airfield, about 400 are electric vehicles, resulting in savings of 700,000 gallons of diesel fuel per year. This includes 83 vehicles that replaced propane vehicles. Due to a new CARB rule (LSI rule), off-road propane vehicles are no longer considered compliant with emissions standards. Also, SFO operates 28 neighborhood electric vehicles that are typically designed to have a top speed of 30 miles per hour.

¹ A CNG-powered airport shuttle bus. The majority of on-road alternative fuel vehicles at the Airport operate on CNG, which emit 25% less CO₂ than gasoline powered vehicles per mile traveled.¹
Electric Vehicle Charging Stations

SFO offers electric charging stations for private motorists, airport fleet vehicles, as well as for aircraft ground service equipment (GSE) vehicles used on the airfield (e.g. aircraft pushback tugs).

GSE Electrical Chargers
SFO’s policy is to equip all new aircraft gates with electrical chargers for GSE. Currently electric chargers are located at all gates at Terminal 2. In addition, airlines provide their own GSE chargers at other boarding areas.

Automobile Chargers
Twenty 208V Level II electric vehicle charging stations have been installed in SFO’s short-term parking garages for the use of private motorists. Depending on the vehicle, these chargers can provide a full recharge in 4 to 8 hours. In addition, the Airport installed additional Level I chargers in Terminal 2 garages as well as at parking stalls at the Airport Business Center. These 110V systems can provide a full charge in 10 to 20 hours. The Airport is also preparing to lease land for an electric vehicle battery exchange station that quickly swaps spent batteries for recharged ones. Only specially-manufactured vehicles will be able to use this facility.

The Airport is considering sponsoring one or more 480V (“fast”) charging facilities in the garages. Motorists would be required to pay to use these chargers and they would potentially be offered in conjunction with retail or fueling concessions. These chargers can bring a vehicle to full charge in less than one hour.

Hybrid-Electric Vehicles: The Airport operates 26 hybrid-electric vehicles, and continues to replace aging vehicles with hybrid-electric ones.

Biodiesel: San Francisco’s Department of the Environment credits SFO with being the first city department to run all its diesel vehicles on a 20% biodiesel blend (20% soy fuel, 80% diesel fuel). Currently, all 12 Airport-owned diesel shuttle buses are using B-20 biodiesel with annual diesel fuel savings of 35,000 gallons, and all 137 Airport-owned diesel vehicles used biodiesel in FY 2010.
Encouraging Alternative Transportation Use

SFO recognizes that offering public transportation alternatives is an essential component of SFO’s mission of providing an exceptional airport in service to Bay Area communities, and improving local air quality.

Public Transportation Improvements

AirTrain: As described in Chapter 3, Climate Change, SFO inaugurated service on AirTrain in 2003. AirTrain eliminated 200,000 car rental shuttle bus trips from the terminal loop annually, reducing both traffic congestion and the emissions created by traditionally fueled vehicles.

Bay Area Rapid Transit (BART): BART began serving SFO in 2003, connecting the Airport with downtown San Francisco, the Peninsula and much of the East Bay. Customers arriving on BART are able to exit the Airport BART station and walk directly to the international airline ticket counters or connect to AirTrain (one level up at a shared AirTrain/ BART Station) to reach the domestic terminals. Currently approximately 10% of passengers use BART for travel to and from SFO. In some East Bay localities, BART carries over 25% of the Airport customers.

Caltrain: A BART cross-platform connection to Caltrain at the Millbrae station provides direct access from the Peninsula’s key rail route to the Airport terminals.

Transit-First Program

SFO is a leader among US airports in the use of shared ground transportation for Airport access. SFO’s Transit-First Policy promotes the use of public and private high occupancy vehicles (HOV) for traveling to the Airport, increasing the use of shared-ride modes over driving alone. This results in improving regional intermodal ground access between the Airport and regional rail, bus, and waterborne transit systems. The Transit-First Policy gives priority to public and private high occupancy transportation modes. The use of BART by passengers has increased significantly since 2006. Approximately 10% of air passengers use public transportation in the form of BART/ Caltrain in 2011. SFO is exploring initiatives that could further increase the use of public transit by passengers.

Passenger Travel Modes (2011 Survey)

Results from a 2011 Airport Customer Survey indicated that most customers reach the airport by automobile; with more than half saying either they were dropped off, took a taxi or limo, drove a rental car, or drove their own vehicle and parked. Approximately 10% of air passengers used public transportation in the form of BART/ Caltrain in 2011. The use of BART by passengers has increased significantly since 2006.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Vehicle (Parked or Drop-Offs)</td>
<td>43%</td>
</tr>
<tr>
<td>Door-to-Door Van/Hotel Shuttle/Charter Bus</td>
<td>18%</td>
</tr>
<tr>
<td>Taxi/Limousine</td>
<td>16%</td>
</tr>
<tr>
<td>Rental Car</td>
<td>13%</td>
</tr>
<tr>
<td>BART</td>
<td>10%</td>
</tr>
</tbody>
</table>

Note: Passengers transferring from another flight are not included in the chart above.
Employee Commuting Travel Modes (2011)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>80%</td>
</tr>
<tr>
<td>Carpool</td>
<td>11%</td>
</tr>
<tr>
<td>BART/BUS</td>
<td>8%</td>
</tr>
<tr>
<td>Motorcycle/Scooter</td>
<td>0.6%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>0.5%</td>
</tr>
<tr>
<td>Shuttle/Taxi/Limousine</td>
<td>0.2%</td>
</tr>
<tr>
<td>Telecommute</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Results from a January 2011 Employee Survey show that 80% of employees drive alone, 11% carpool, 8% use public transportation, and 1.2% use other modes (bike, etc.).

Employee Commute Program

In 1993, SFO added a “Trip Reduction Rule” to the Airport’s official Rules and Regulations aimed at reducing employee trips to the airport in single occupancy vehicles. SFO’s Employee Trip Reduction Program includes the following elements:

- New employees are notified of the Airport’s Trip Reduction Rule.
- SFO conducts a biennial survey of all employees regarding their commuting habits.
- Ground transportation information is provided on SFO’s website and at information booths in the terminals, also through a public media campaign and curbside program.

In January 2009, the City and County of San Francisco issued a new Commuter Benefits Ordinance that requires all employers in San Francisco with 20 or more employees to implement a community benefits program. As a result of this ordinance, SFO amended its Trip Reduction Rule to require each covered employer to provide employees working at SFO with one of the following:

1. Use of pre-tax dollars for public transit and vanpool expenses
2. An employer-paid benefit allowance for commuting expenses such as bus or rail passes up to the value of a Municipal Railway monthly pass (currently $72/month);
3. Employer provided transportation.

The most recent survey of Airport Commission employees’ commute travel was conducted in January 2011, the results of which are shown in the adjacent graphic. Convenience, travel times, and the availability of free parking are the determining factors in employee commute decisions.

Bicycle Use

SFO encourages bicycle commuting as well as using bikes to get around at the Airport. SFO has been expanding its bike lane network and in 2012 plans
to make shared smartbikes available to employees for use at the Airport. North and South McDonnell Road offer good bicycle access with a marked route into the airport beginning at San Bruno Avenue from the north, and Millbrae Avenue from the south. In addition, SFO offers five courtesy bicycle parking areas at the airport, where passengers and airport employees may utilize courtesy bicycle racks. To gain access to the airport via bicycle, BART and SamTrans offer a convenient bike/transit option that is safe and environmentally friendly.

A bike lane on South McDonnell Road offers bicyclists a marked route to their destination at the Airport. Although only 0.5% of employees commute by bike, the bike lanes are also used by many regional cyclists. The McDonnell Road bike lanes are a key link in the Bay Trail, which encircles the Bay.

Airside Operations and Facility Improvements
Over the past several years SFO has implemented a number of measures to reduce the generation of waste materials and emission of air pollutants, including the modification of operating procedures and the use of technologically-advanced equipment.

Procedures employed by aircraft operators can reduce fuel consumption and emissions associated with aircraft ground operations. SFO does not currently have any mandatory programs requiring fuel efficiency or emission reduction requirements by air carriers. However, most airlines have internal policies aimed at reducing fuel consumption that also result in associated reductions in air pollutant emissions. SFO encourages airlines and ground service equipment operators to institute environmentally and economically beneficial operational procedures, such as:

- Single-engine taxiing of aircraft,
- Airside alternative fuel infrastructure,
- Conversion to clean fuel ground service equipment, and
5. Air Quality

- Route planning, altitude selection, and reduced fuel loading for aircraft weight control.

**Airsides Alternative Fuel Infrastructure**

SFO has installed ground based energy supply and service facilities to curtail the use of aircraft auxiliary power systems for providing aircraft electricity and air conditioning at the gate:

- 400 Hz Ground Power and pre-conditioned air is provided at International Terminal gates, at most gates at Boarding Areas B, C, E, and F, and all gates at the renovated Terminal 2. Assuming similar usage for other areas of the Airport, the system at Terminal 2 could save 522,838 gallons of jet fuel and reduce the associated air emissions.

- Procurement and use of portable Ground Power Units (GPUs) by Airport tenants is encouraged by the Airport when Ground Power is not available at the gate.


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**SFO Hydrogen and Electric Battery Exchange Fueling Complex**

SFO is planning to lease property for hydrogen vehicle refueling and electric vehicle battery swap facilities. These facilities are set to open in late 2012 and 2013. They will be the first of their type at any North American airport. Hydrogen will be dispensed at sufficient pressure to allow vehicles up to 300 miles of range, while electric batteries would be exchanged in the time it takes to refill the tank in a hydrocarbon powered vehicle.

The facilities represent a partnership between SFO and private sector energy companies Linde LLC and Better Place and grant agencies including the California Air Resources Board and California Energy Commission.

SFO is an industry leader in deploying alternative fuel and low-emission vehicles at the Airport. Currently vehicles operated at SFO use CNG (taxis, vans, shuttles, and SFO fleet vehicles); pure electricity (cars and aircraft service vehicles); hybrid electric (taxis, rental cars, and Airport-owned vehicles) filtered diesel (charter, scheduled Airporter buses and Airport-owned vehicles) and biodiesel (Airport-owned vehicles). For more information on SFO’s Clean Air Vehicle policy, please see the fact sheet available at [http://www.flysfo.com/web/page/about/green/index.html](http://www.flysfo.com/web/page/about/green/index.html)

**Funding**

Total hydrogen fueling and battery swap facility investment exceeds $5 million, including over $1 million from the private sector.

**Location**

The hydrogen and electric vehicle battery swap complex will be located near Millbrae Avenue, a block from the Highway 101 interchange. Access will be from South McDonnell Road, just inside the boundary of SFO property.

**Uses**

The hydrogen fueling and electric vehicle battery exchange complex will add to the fuel diversity of the airport’s fleet vehicles and will be used by taxicabs, advanced fuel cell autos, on-Airport shuttle buses and San Francisco MTA buses powered by hydrogen, and airfield mobile lighting units that would replace the less fuel efficient diesel-powered units.
SFO recently launched a sophisticated, publicly accessible 3D flight tracking tool that users can employ to obtain detailed information about aircraft flight patterns.
6. Noise Abatement

SFO has led the industry in addressing community concerns about noise, installing its first noise monitoring system in 1975. Today, the system has grown to 37 noise monitoring units, including four on-airfield ground run-up units, four portable units, and 29 permanent noise monitoring sites located in communities surrounding the Airport. By using state-of-the-art technology, SFO can monitor noise levels and link noise events or complaints to specific flights and aircraft types. The Airport recently launched the first “real-time” online 3D flight tracking program that local residents and others can use to identify a potential aircraft noise source as well as track aircraft flight paths. This chapter describes the Airport’s ongoing efforts to reduce the impacts of aircraft noise at and around the Airport.

Policy

SFO shall continue to reduce noise impacts on the surrounding communities by encouraging the use of quieter aircraft and advanced final approach procedures by airlines, as well as by other means within the control of the Commission.

Objectives

- Provide information regarding aircraft operations to the general public.
- Provide technical support to the San Francisco International Airport/Community Roundtable.
- Serve as the focal point for community outreach in its efforts to reduce the impacts of aircraft noise on the surrounding communities.
- Implement innovative technologies to better serve the communities impacted by aircraft noise so that SFO would continue to serve as a national leader in implementing aircraft noise abatement programs.
What Have We Accomplished?

For more than 30 years, SFO has been a leader in noise monitoring, disclosure, and reduction programs and policies. As a result of these efforts, the number of people living within the 65 decibel (dB) Community Noise equivalent Level (CNEL) contour, the area defined as experiencing significant aircraft noise, dropped from 35,100 in 1976 to 3,298 at the beginning of 2000. Through the use of sound insulation and avigation easements, SFO has been able to eliminate all incompatible land uses within the noise impact area, as defined in Title 21 of the California Code of Regulations. Consequently, SFO was the first major airport in California to succeed in eliminating all incompatible land uses within the State 65 dB CNEL contour and to operate without a variance. In 2002, the San Mateo County Board of Supervisors honored the Airport with a resolution recognizing it as the first airport in the State of California to remove all incompatible land uses within the State-defined noise impact area.

The noise impact area of aircraft overflights are shown in the adjacent figure that depicts the 2nd Quarter 2011 65 dB CNEL aircraft noise contour around the Airport. Due to the Airport’s geographic location and landing and takeoff patterns, most of the significant aircraft noise impacts occur over the Bay with a portion of the 65 dB CNEL contour overlapping the municipal areas of San Bruno, South San Francisco, and Daly City.

The Noise Abatement Office has been responsible for implementation of the comprehensive Aircraft Noise Abatement Plan and for identifying noise reduction initiatives. The Office continues to work collaboratively with the FAA’s Air Traffic Control (ATC) Tower and the airlines to reduce nighttime noise and for the evaluation of new procedures to further reduce noise impacts. SFO continues to improve long-standing noise abatement programs such as the Fly Quiet Program, noise complaint tracking, aircraft noise monitoring, nighttime preferential runway use, and arrival procedure research. These programs and initiatives are intended to aid in achieving the Airport’s noise policy objectives.

What is “Compatible Land Use”?

The Federal Aviation Regulation (FAR) Part 150 designates noise compatibility areas by land use. Residential uses are considered compatible with Airport generated noise if the Community Noise Equivalent Level (CNEL) at the site is below 65 dB. If the homes are sound insulated, the noise compatibility threshold level is raised to 70 dB for the given site. Commercial land uses are considered to be compatible within CNEL contour lines of 80 dB or less. The CNEL noise metric, used by SFO and the State of California, gives both evening and late night noise a heavier weight to account for the more aggravating disturbance caused by such noise.

What is an “Avigation Easement”?

An avigation easement allows aircraft to fly, land, or take off in unobstructed airspace above a parcel of real property. Such an easement often prohibits the property owner from installing structures that exceed a specified height and/or grants the right to make noise and generate dust at or above the property in conjunction with proper operation of an aircraft.
SFO maintains a state-of-the-art permanent noise monitoring system to keep track of noise levels in communities around the Airport. SFO has deployed 29 permanent noise monitoring stations located around the Airport and also uses four portable units. Information produced from the Noise Monitoring System is central to the operations of the Aircraft Noise Abatement Office and serves as the basis for:

- Identifying overall trends in noise levels
- Evaluating airline compliance with noise abatement flight tracks, including the Fly Quiet Program
- Following up on unusual occurrences
- Monitoring preferential runway use programs
- Validating the accuracy of CNEL noise contour models

*This image shows the 65 dB CNEL aircraft noise contours at SFO for the 2nd Quarter of 2011. Most of the significant aircraft noise impacts occur over the Bay with a portion of the 65 dB CNEL contour overlapping the municipal areas of San Bruno and South San Francisco. SFO became the first major airport in California to succeed in eliminating all incompatible land uses within the State 65 dB CNEL contour.*
SFO installed a new Aircraft Noise Monitoring System in 2006, replacing the previous monitoring system which had been in operation for over 20 years. The enhanced system allows the staff to correlate noise events and complaints with individual flight operations and aircraft types. This system includes new digital noise monitoring equipment and additional noise monitoring stations in San Mateo County communities. In addition, the system provides more technical information for enhanced data analysis and real-time collection of aircraft flight track data and enhanced ability to account for low-frequency noise. Low-frequency noise, which is of particular concern to communities closest to the Airport, is produced by departing aircraft during “ground run-up” activity (engine testing for maintenance purposes or pre-flight checks), or during take-off.

As part of the system upgrade, a ground run-up monitoring system was installed in 2008 at the Airport. This system gives the Airport the tools to remotely monitor aircraft run-up activity via high definition cameras and noise monitoring stations 24 hours a day, and allows SFO to detect when ground run-up activity occurs at unauthorized airfield areas.

Locations of SFO ground run-up noise monitors, which are powered by solar panels.
Airport employees installing and programming noise monitors. SFO has deployed 37 noise monitoring stations on-airport and throughout the neighboring communities. Four of these monitors are solar-powered.

Live Online 3D Flight Tracking: the first of its kind

In 2011, SFO released a powerful new user-controlled online flight tracking tool, which provides the public with live* flight information for aircraft anywhere in the SFO airspace. This tool can help users identify the location, altitude, operator (airline), flight number, and originating/arriving airport (SFO, San Jose, or Oakland) for any flight of interest. This 3D flight tracking tool, the first of its kind to be made publicly available, also gives users a wide range of controls, including:

- The choice to playback flights from any past date or to view live flights*
- Ability to manipulate the screen view (zoom in and out, tilt, or rotate the view)
- Ability to use “overhead” view or track a selected aircraft in “pilot” view, which allows users to view an aircraft’s trajectory from the pilot’s perspective
- Ability to vary aircraft speed
- Satellite, street map, or aeronautical chart views
- Ability to view aircraft trails or “curtains” that extend the aircraft’s location to the ground-equivalent location, and flight track lines that do not disappear when aircraft have left the airspace
- Ability to find a specific address on the map and mark this location on the map
- Ability to tag aircraft with identifiers such as altitude, speed, operator (airline), flight number, and origin/destination

To access the live* online 3D flight tracking system, please visit SFO’s Fly Quiet website: http://www.flyquietsfo.com/

* The flight tracking display is delayed by 10 minutes for security, which also allows a user time to enter the website and identify an aircraft that may have caused a noise disturbance.

SFO developed this tool in collaboration with BridgeNet International.
Two views of SFO’s online 3D Flight Tracking Tool, the first of its kind to be publicly available. The tool allows anyone to track flights departing and arriving at SFO, San Jose, or Oakland, either in “overhead” mode (above) or “pilot” mode (below, from the “cockpit” of the aircraft).
Noise Complaint Program
The SFO Noise Abatement Office maintains a database of all noise nuisance complaints received from nearby communities. These complaints, which can be submitted online, are used to research the aircraft flight operations leading to the complaints. The data obtained are then shared with aviation industry professionals to assist in developing operational changes that could reduce or eliminate the nuisance conditions.

SFO has been logging noise complaints from over a dozen communities since 1970. On average, the Airport receives approximately 8,100 complaint calls each year from approximately 520 callers. The annual number of complaints has ranged from a high of 48,051 in 2000 to a low of 3,555 in 2003. In 2010, there were 8,716 noise complaints from 551 callers.

Noise Reduction Feasibility Study
SFO’s Aircraft Noise Abatement Office has worked with the Boeing Company, the FAA, NASA, and United Airlines to test the “Oceanic Tailored Arrivals” (OTA) procedure with the goals of reducing noise, fuel burn, and air emissions associated with arriving flights from the Pacific Rim. The OTA is a type of Continuous Descent Approach that gradually reduces the altitude of aircraft on approach instead of using a more traditional “step” method that cycles the power setting (and noise level) of an aircraft. The strategy is based on a simple concept: a gliding aircraft with engines at near idle is quieter than an aircraft changing altitudes and engine thrust multiple times during an approach. Trials of the procedure were made between 2006 and 2011, and some initial results were evaluated in a technical report published in 2007.

Airlines support the concept of OTA because it could save fuel, ensure more accurate arrival times, and potentially simplify the final approach following a long (12+ hours) trans-Pacific flight. Fuel savings to airlines could total up to 3,000 lbs. and CO₂ emissions could be reduced by up to 10,000 lbs. per
Boeing 777 aircraft flight. Air traffic controllers believe the OTA will assist them in planning ideal descents and improve efficiency during high traffic periods. Communities along the arrival routes would also benefit because the aircraft flying an OTA would operate at reduced power and with few or no drag-inducing and noise making surfaces (flaps, speed brakes, and landing gear) being deployed.

Currently, the OTA procedure is voluntarily flown by participating airlines. Full adoption of the OTA procedure in the future will require aircraft equipped with Future Air Navigation System (FANS) avionics, which provide for a direct data link between the aircraft and Air Traffic Control (ATC).

**Asia and South Pacific Initiative to Reduce Emissions (ASPIRE)**

SFO and New Zealand’s Auckland Airport are one of the first city pairs to be included in an industry effort to reduce noise levels and air pollutant emissions on heavily traveled air routes between the US and Asia/South Pacific. The ASPIRE program is a collaborative effort of the FAA, Airservices Australia, Airways New Zealand, Japan Civil Aviation Bureau, and the Civil Aviation Authority of Singapore. The Auckland, New Zealand to SFO route was one of the first to start testing procedures resulting in fuel savings and emissions reductions in 2008.

**The Fly Quiet Program**

The Fly Quiet Program, implemented by the Aircraft Noise Abatement Office, encourages individual airlines to operate as quietly as possible at SFO. As part of the program, Airport staff generates a Fly Quiet Report, which provides airline scores on the following elements (noise abatement ranking procedures for flight departures are shown in the following figure):

- **Fleet noise quality**
  Fly Quiet assigns a higher rating or grade to airlines operating quieter, new generation aircraft, while airlines operating older, louder technology aircraft would rate lower. The goal of this measurement is to fairly compare airlines—not just by the fleet they own, but by the frequency that they schedule and fly particular aircraft into SFO.

- **Number of times allowable noise levels were exceeded (Noise Exceedance)**
  Whenever an aircraft overflight produces a noise level higher than the maximum decibel value established for a particular monitoring site, the noise threshold is surpassed and a noise exceedance occurs. Noise exceedances are logged by the exact operation along with the aircraft type and airline name.

- **Nighttime preferential runway use**
  The main focus of this program is to maximize flights over water and minimize flights over land and populated areas between 1:00 a.m. and 6:00 a.m. Although the program cannot be used 100% of the time because of winds, weather, and other operational factors, the Airport, the Community Roundtable, the FAA, and the Airlines have all worked together to maximize the use of certain runways at night when conditions permit. The program is voluntary; compliance is at the discretion of the pilot.

- **Shoreline departure quality**
  Fly Quiet assigns a higher grade to aircraft that use the Shoreline Departure Procedure. This departure steers aircraft to the northeast shortly after takeoff in an attempt to keep aircraft and aircraft noise away from the residential communities located to the northwest of SFO. By keeping aircraft east of Highway 101, the majority of the overflights are experienced by industrial and business parks instead of residential areas and operators will receive a higher rating.
**Gap departure quality**

In order to mitigate the noise in the area northwest of the Airport resulting from aircraft using a procedure known as the Gap Departure, Fly Quiet assigns scores based on aircraft altitudes recorded along the departure route. Scores are assessed at specified points or gates set approximately one mile apart, with the aircraft at a higher altitude receiving higher scores, since “higher is quieter”.

**Foster City arrival rating**

In an effort to further reduce nighttime noise in neighboring communities, this rating is designed to maximize over-bay approaches between 11:00 p.m. and 6:00 a.m. Airlines arriving to Runways 28 during these hours are assessed based on which approach flight path was used. Over-the-bay approaches are rated “good”, versus over-the-communities which are rated “poor”.

Two additional metrics have been developed and are tracked through the Airport/Community Roundtable Work Program, resulting from concerns raised by local communities. The Late Night Woodside Very high frequency Omni-directional Radar (VOR) report shows the flight number and altitude for each aircraft that uses the Woodside VOR on approach to SFO between the hours of 10:30 PM and 6:30 AM. In the Foster City Shortcut report shows flight numbers and times for each aircraft that overfly large areas of Foster City and Redwood Shores. Both of these reports are available in the website reports under Noise Abatement.

Recent Accomplishments of the Community Roundtable

The SFO/Community Roundtable is one of the longest established community-based airport noise mitigation organizations in the country, and is an example of neighborhood groups working cooperatively with the Airport and the aviation industry to reduce noise impacts.

Celebrating its 30th Anniversary in 2011, the Roundtable’s 45 representatives and alternates are elected officials representing the City and County of San Francisco and San Mateo County, as well as advisory members, airline chief pilots, and FAA staff. SFO Airport Director John L. Martin and his staff support and attend these monthly meetings, at which public discussion focuses on airport noise abatement activities.

The Roundtable has been critical in serving as a communication conduit between the Airport and the surrounding community. Recent discussion items originating in the Roundtable have resulted in the following activities that have strengthened the SFO noise abatement program:

- Raising of minimum recommended aircraft altitude on arrival procedures (and thereby decreasing noise exposure)
- Making Website improvements and developing of electronic noise complaint forms
- Providing additional portable and solar-powered noise monitors

The SFO/Community Roundtable celebrated its 30th Anniversary in 2011 with cake and acknowledgements of the group’s important achievements in the past 30 years.

For more information on the San Francisco Airport/Community Roundtable, please see [http://www.sforoundtable.org](http://www.sforoundtable.org)
The Airport’s water conservation efforts aid in conserving existing freshwater supplies from the Sierra Nevada Mountains, an important freshwater resource for millions of Californians.
7. Water Conservation and Water Quality Enhancement

The Airport has implemented a number of water use efficiency measures to help conserve the existing freshwater supplies from the Sierra Nevada Mountains. The water efficiency measures also help to minimize wastewater generation, reduce energy consumption for water heating and cooling, promote habitat protection, and result in cost savings. In addition, state-of-the-art wastewater treatment and proactive voluntary measures to capture and treat the “first flush” of stormwater runoff at the Airport contribute to the enhancement of water quality in San Francisco Bay. Both water conservation initiatives and water quality protection programs at SFO are discussed in this chapter.

Policy

*SFO shall minimize potable water use by deploying water efficient fixtures and other facilities and shall contribute to improving water quality in the lower San Francisco Bay through state-of-the-art wastewater treatment and enhanced stormwater management.*

Objectives

- Maximize water conservation and minimize water use and waste.
- Strive to expand the use of the treated wastewater for landscaping irrigation and gray water uses, thereby reducing the demand for potable water.
- Enhance the management of stormwater runoff and non-stormwater discharges to the Bay.
- Discharge treated wastewater that meets or exceeds regulatory standards.
7. Water Conservation and Water Quality Enhancement

Water consumption per SFO passenger has declined steadily in recent years. In 2010, per passenger use was at 12 gallons, showing a 28% decline since 2004.

The Airport has achieved water use efficiencies by installing low-flow and sensor-operated fixtures in restrooms, such as the one shown above, located in SFO’s newly renovated Terminal 2.

SFO uses treated wastewater for the irrigation of all landscaping at the Sanitary and Industrial Wastewater treatment plants, which has contributed to a reduction in the Airport’s overall water use.
What Have We Accomplished?

**Water Conservation**

In recent years, the Airport has undertaken an aggressive water conservation program, resulting in a steady decline in total and per passenger water use. In FY 2010, SFO consumed 459 million gallons of water, showing a 14% reduction from 533 million gallons consumed in 2004.

The decline in water use can be attributed to the following measures SFO has implemented and expanded over time to conserve water and enhance efficiency:

- Installation of low flow restroom fixtures in all new buildings
- Installation of sensor-operated fixtures in public restrooms
- Elimination of unnecessary hydrant flushing
- Identification and replacement of aging/leaking water distribution pipes

The Airport is also planning to reuse treated effluent from the sanitary wastewater treatment plant for gray water use at Terminal 2 and in future new and renovated buildings, where possible. The Terminal 2 reuse program is expected to further reduce potable water usage by over one million gallons per year. The Airport anticipates this system will be operational by 2015.

**Wastewater Treatment**

In FY 2006, SFO pumped an average of 640,000 gallons per day of treated sanitary wastewater and 630,000 gallons per day of treated industrial wastewater to the North Bayside System Unit for discharge into lower San Francisco Bay through a joint deep water outfall. In FY 2010, an average of 540,000 and 610,000 gallons per day of treated sanitary wastewater and treated industrial wastewater were discharged into the Bay, respectively.

The generated wastewaters were treated in the Airport’s sanitary and industrial wastewater

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**Annual Average Daily Wastewater Flows at SFO Treatment Plants**

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<thead>
<tr>
<th></th>
<th>Industrial Wastewater Treatment Plant</th>
<th>Sanitary Waste Treatment Plant</th>
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<tbody>
<tr>
<td>FY 2006</td>
<td>0.60</td>
<td>0.63</td>
</tr>
<tr>
<td>FY 2007</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>FY 2008</td>
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<td>FY 2010</td>
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</table>

Volumes of sanitary and industrial wastewater vary from year to year, and are not within Airport control. In FY 2010, SFO treated an average of 540,000 and 610,000 gallons per day of sanitary wastewater and industrial wastewater, respectively.
treatment plants and the discharges met or exceeded the effluent water quality standards established in the National Pollutant Discharge Elimination System (NPDES) Permits issued for the two plants by the San Francisco Bay Area Regional Water Quality Control Board.

SFO’s sanitary wastewater treatment plant, named the Mel Leong Treatment Plant, provides secondary treatment for sanitary wastewater from the terminal buildings, aircraft blue waters, aircraft hangars, restaurants, shops, and other Airport facilities. In 2005, the Airport completed the construction of a new $37 million state-of-the-art Sequential Batch Reactor (SBR) treatment unit and other upgrades to the Mel Leong Treatment Plant. The plant has a design treatment capacity of 2.2 million gallons per day (mgd).

The Airport’s Industrial Wastewater Treatment Plant (IWTP) treats wastewater from industrial sources at the Airport as well as the first flush of stormwater runoff collected in the stormwater detention basins from developed areas of the Airport. The dry weather design capacity of the IWTP is 1.2 mgd and the wet weather design capacity is 1.7 mgd. The Airport is currently planning to upgrade the Industrial Wastewater Treatment Plant. Two options under consideration are to maintain a separate industrial wastewater treatment plant or to pre-treat the industrial wastewater in the existing plant and then process the flow through the new SBR unit at the sanitary wastewater treatment plant.

The Airport is meeting the treatment goals for both wastewater treatment plants by managing these plants at maximum attainable efficiency for the treatment technologies used in these facilities.

**Stormwater Runoff Management**

The first flush of stormwater runoff from terminals, taxiways, tarmacs, and aircraft and vehicle parking areas, as well as most of the landside areas is diverted to four detention ponds with a combined capacity of 8.6 million gallons. The runoff collected
in these ponds is treated in the IWTP before being discharged to the Bay. Any excess runoff generated by continuing or consecutive storm events is discharged directly to the Bay. A significant portion of annual stormwater runoff from developed areas of the Airport is thus captured for treatment. Stormwater runoff from other parts of the Airport flows into bioswales (grassy channels) before being discharged to the Bay or to wetland areas.

**Stormwater Runoff Pollution Prevention**

The Airport has prepared a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the NPDES Permit requirements for industrial and construction activities. In addition to fulfilling its permit requirements, the Airport proactively implements stormwater runoff treatment measures on a voluntary basis to enhance the water quality of the Bay.

**Stormwater Pollution Prevention Plan (SWPPP)**

For all Airport and tenant construction projects, a SWPPP must be submitted during the permitting process. These SWPPPs are reviewed for completeness by the Stormwater Pollution Prevention (SWPP) staff, and revisions to the plans are requested as appropriate. Construction activities are regularly monitored by SWPP staff to ensure that Best Management Practices (BMPs) are employed for the prevention of stormwater pollution at each site. The industrial elements of the SWPPP cover all non-construction activities at the Airport and provide BMPs for preventing stormwater pollution at each site. The BMPs include general maintenance, hazardous materials storage practices, clean-up of minor leaks and spills of petroleum products or other chemicals, street sweeping, runway surface scrubbing, etc. The SWPP staff conducts routine inspections of all Airport facilities to ensure compliance with BMPs. Citations and warning letters are issued by the staff if any deficiencies in the BMPs are observed at a site. The site is then revisited to ensure that corrective measures have been implemented.

**National Pollutant Discharge Elimination System (NPDES) Permit**

The NPDES permit for the Industrial Wastewater Treatment Plant includes specific provisions for visual observation of all stormwater outfalls during storm events and during dry weather conditions. Sampling and analysis of stormwater discharges at each outfall is also required during two major storm events in each wet season.
SFO has been actively engaged in enhancing the habitat of the state threatened California Red Legged Frog and its predator, the federally endangered San Francisco Garter Snake. SFO widened the South Lomita Canal pictured above to enhance the breeding habitat for the Red Legged Frog.
8. Natural Resources Management

SFO aims to preserve and enhance local natural resources in its daily operations and when planning new projects. The Airport is always looking to explore opportunities for improving environmentally sensitive habitats and managing wildlife while maintaining airport safety. Natural resources on SFO property include wetlands, uplands, Bay Water and tidal marshes, which provide habitat for a wide variety of vegetative communities and terrestrial and aquatic wildlife. Wildlife populations in the area include the endangered San Francisco Garter Snake and the threatened California Red-Legged Frog.

Even in more developed portions of the Airport, SFO provides habitat and contributes to plant and wildlife biodiversity around the airport through its landscaping program. Thoughtful landscaping has also resulted in GHG emission reduction at the Airport due to carbon sequestration by various species of trees planted at the Airport. This chapter describes SFO’s efforts to preserve and enhance local natural resources.

Policy

*SFO shall work in partnership with local, State, and Federal agencies to protect environmentally sensitive habitat on Airport property and on Airport land, while ensuring the safe operation of the Airport.*

Objectives

- Preserve existing wetlands’ biological resources at the Airport.
- Protect and restore viable existing remnant natural ecosystems on Airport property.
- Protect and manage federal and state endangered and threatened species on Airport property.
What Have We Accomplished?

West of Bayshore
In the wetland area owned by SFO west of the Bayshore Freeway known as the “West-of Bayshore” property the Airport has implemented an innovative approach to vegetation management that minimizes the use of heavy equipment in the fragile habitat. Special care is taken for this property’s maintenance because it contains habitat for San Francisco Garter Snake, which is designated as a federally endangered species and for California Red Legged Frog, which is designated as a state threatened species. The California Red Legged Frog is also designated as a California Species of Special Concern. The frogs are an important food source for the garter snake, so any decrease in their population would also negatively affect the garter snake population in the area. The Airport must conduct annual vegetation management on the property in order to minimize the risk of fire to neighboring residential areas. Historically, the Airport used work crews with sickles for this task, as power mowers could inadvertently result in harm to the endangered...
snakes. Lack of standing water (the area contains seasonal wetlands) and disturbance related to flood control activities also contribute to creating less-than-ideal habitat conditions for both species. The population of the garter snake had decreased to the extent that SFO, in cooperation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game, recently developed an action plan that would assist in the population’s recovery. Activities prescribed in the plan aim to benefit both the garter snakes and frogs. Implementation of the Recovery Action Plan has been ongoing since 2007 and is divided into several phases. Currently in the first phase, activities are focused on habitat enhancements of two canals and vegetation removal activities. Recovery actions planned in this phase seek to achieve a balance between habitat restoration and safety for nearby neighborhoods. Specific activities include:

- **South Lomita Canal.** Activities in the canal include the creation of four channel openings along South Lomita Canal, widening the channel in some areas, and vegetation removal in order to restore open water conditions.

- **Cupid Row Canal.** Activities include vegetation management and canal widening in order to provide open water conditions as well as the installation of a sediment trap at the canal’s upstream end.

- **Other property-wide enhancements.** In addition to the canals, the 7th Avenue ditch will be enhanced using similar techniques such as vegetation removal, and widening the ditch to increase frog breeding habitat and open water storage.

[TOP]
Workers lay down jute netting alongside a newly widened canal in order to prepare for the application of hydroseed. A seasonal pond that was deepened to encourage frog breeding on Airport property.

[BOTTOM]
*BART built this pond as on-site mitigation for the SFO-BART Extension project.*
Use of Goats
In 2006, SFO introduced the use of goats for vegetation management at the Airport. Goats are effective in removing such weeds and vegetation as yellow star thistle, coyote brush, Scotch broom, and Himalayan Blackberry bush. The herd used by the Airport, which consists of about 300 animals, can clear approximately 4 acres of brush in two weeks, depending on the type of vegetation. The goats are utilized on the airport to clear overgrown and undesirable invasive vegetation with minimal hazard to the endangered San Francisco Garter Snake.

Wildlife Hazard Management
Airports have to manage their facilities to discourage the use of their property as habitat by species that could pose a hazard to safe aircraft operation, such as bird strikes. However, wildlife hazard management can also include activities such as grass management (as some birds prefer to feed and breed in grassy habitats) and deer-proof fence installation (to prevent deer from encroaching on airport property), or wildlife trapping and removal activities.

The purpose of the Wildlife Hazard Management Plan and the Wildlife Hazard Assessment are to assist the Airport in developing an integrative and adaptive management program to effectively reduce wildlife/aircraft collisions by documenting baseline wildlife and habitat data that informs vegetation and water management techniques, and other control measures implemented by the Airport.
In the summer of 2011, the Airport completed a 12-month wildlife inventory and is completing a Wildlife Hazard Assessment (WHA), which provides the basis for the Airport’s Wildlife Hazard Management Plan. In June 2011, SFO updated its Wildlife Hazard Management Plan.

**Wetland Restoration**

Past construction projects have required the conversion of some former wetland areas to Airport uses. In such cases, SFO has implemented off-site mitigation measures by procuring and creating wetlands or by funding the creation of wetlands on public property. For example, as a mitigation measure for the Master Plan construction projects, SFO created over 80 acres of new wetland and improved more than 550 acres of existing wetlands and tidal marshes throughout the Bay Area, committing more than $20 million to this effort.

Wetland restoration projects at the Airport have also been proposed as mitigation for the Runway Safety Area project, Master Plan projects and for future as yet unspecified projects. Proposed new restoration projects include:

- **Deep Water Slough**: a 7 acre restoration at Redwood City.
- **SFO has entered into an MOU with the Presidio Trust to assist in the daylighting of three underground creek channels at the Presidio, creating 7.4 acres of wetlands and associated creek improvements:**
  - **Quartermaster Reach**: This project will “daylight” an approximately 850-foot length of stream, currently running underground in a culvert, and construct approximately one acre of open water/mudflat with channels and four acres of brackish marsh and dune swale, surrounded by coastal dune scrub and a series of pedestrian trails. Following daylighting of existing stormwater pipes, the area will be connected to the Crissy Field Marsh via a 34-foot-wide box culvert under Mason Street;

*Crissy Field, the site of one of SFO’s restoration projects, undertaken in collaboration with the Golden Gate National Parks Conservancy.*
YMCA Reach: The project will consist of approximately 650-foot length of new meandering stream channel within a two acre area of braided network of freshwater marsh, riparian scrub, and willow woodland habitat. The 520 feet of daylighted creek restoration is located immediately upstream of the Tennessee Hollow Creek’s restored stream and will help to extend a wildlife corridor through this part of the Presidio.

East Arm of Mountain Lake: The project will restore approximately 0.4 acres of existing freshwater marsh, and create approximately half an acre of seasonal freshwater marsh with riparian vegetation. The project is part of a larger multi-phased restoration effort for Mountain Lake which started in 2001.

Other wetland mitigation projects undertaken by SFO in the past include:

- **Restoration of Mountain Lake Park** in partnership with the San Francisco Department of Recreation and Parks and the Golden Gate National Recreation Area.
- **Crissy Field Restoration**: Together with the Golden Gate National Parks Conservancy, SFO created 18 acres of tidal marsh at Crissy Field at the Presidio.
- **The India Basin Hunters Point Recreation Project** restored up to 3.4 acres of tidal marsh.
- At the **Oliver Brothers Salt Ponds**, SFO and the Hayward Area Recreation and Park District restored and enhanced 324 acres of wetlands at a cost of more than $1.3 million.
- In **Palo Alto Harbor Point**, SFO worked with the City to restore 7.2 acres of tidal marsh.
- **At Outer Bair Island**, SFO and the California Department of Fish and Game created 42 acres of wetlands and enhanced 140 acres of existing wetlands.
- **Yosemite Slough in the Hunters Point area in San Francisco**: SFO is creating 12 acres of new wetlands in conjunction with the California Department of Parks and Recreation and the California State Parks Foundation. This project started construction in October 2011.
- **Hunters Point, Parcel E**: SFO has provided funding to ArcEcology to prepare environmental studies for a proposed Stormwater Wetland Open Space project in Hunters Point.

**Carbon Sequestration**

Over the past ten years, SFO has developed approximately 50 acres of landscaping around the Airport. In total, the Airport has planted 2,020 trees of over 15 different species, including sequoia, sycamore, and poplar. Each tree sequesters carbon dioxide in its biomass over its lifespan. SFO staff calculated the annual rate of carbon sequestration for each major tree species planted using the U.S. Forest Service’s Carbon Sequestration Model. SFO estimates that the new tree plantings sequester carbon dioxide at a rate of approximately 121 metric tons per year. Once the carbon dioxide is sequestered, it would not be released back into the environment because SFO’s management plan calls for the long term maintenance of the trees, and in the case a tree must be removed, SFO would salvage its wood, and plant a new one.

Large poplar trees line a parking garage at the Airport. Over the past 10 years, SFO has planted 2,020 trees, which are able to sequester approximately 121 metric tons of CO$_2$ per year.
The Zanker Disposal and Recycling “Z-Best Composting Facility”, located in Gilroy, CA, comports SFO’s food and other organic waste.

Photo courtesy of Zanker Disposal and Recycling
9. Solid and Hazardous Waste Management

SFO has one of the largest recycling and composting programs in San Mateo County. From the airlines to the terminals, from the construction sites to the reprographics department, the Airport uses both innovative and proven ways to maximize recycling of waste products.

SFO’s Hazardous Material and Waste Program is aimed at managing the generation, storage, and disposal of hazardous material and waste by the Airport and by Airport tenants. Environmental management efforts include a hazardous material substitution program; a program for the identification and abatement of asbestos and lead-based paint; and a program for reducing the use of pesticides, insecticides, and herbicides.

**SFO Policy**

*SFO shall minimize the generation of solid waste from operations and shall recycle the collected waste products to the maximum extent practicable.*

*SFO shall strive to reduce the use of hazardous materials, promote their reduced usage with the airlines and tenants, and seek to improve overall environmental quality through cleanup and restoration efforts focused on soil and groundwater contamination caused by accidental spills or leaks of fuel products or other chemicals.*

**Objectives**

- Minimize the generation of solid waste from Airport operations.
- Increase the solid waste recycling rate to 80% by 2015.
- Strive to eliminate or minimize hazardous materials use, hazardous waste generation, and the release of any hazardous materials to the environment.
- Maintain a record of all hazardous materials used, ensure that adequate training is provided for proper handling of such materials, and procure non-hazardous materials substitutes, when practicable.
- Seek to manage pests while minimizing the human health and environmental impacts of pesticides use.
What Have We Accomplished?

SFO continues to improve the recycling and waste minimization operations throughout the Airport. Notably, SFO has increased the solid waste recycling rate from 51% in 2002 to an impressive 74% in 2010, bringing SFO close to achieving the intermediate goal of recycling 80% of the generated solid waste by 2015. In addition, SFO continues to recycle almost all of the generated construction and demolition waste, consistently recycling over 90% of these wastes.

SFO provides specifically-labeled containers for bottles and cans, paper, food waste and other biodegradable materials, and trash around the Airport terminals for use by passengers, concessionaires, and other tenants. The waste material is then transferred to separate on-site dumpsters and compactors that are hauled to an off-site processing facility. All mixed solid waste is sorted by material type into recyclable or compostable components at the off-site facility and any residual solid waste is disposed of at a landfill. A significant portion of the solid waste collected at the terminals, consisting mainly of biodegradable materials, is hauled directly from the Airport to a composting facility.

In addition to minimizing the burden on already constrained landfills, recycling is also an important component of SFO’s carbon emissions reduction program. Because reused material requires less energy to convert to new products, recycling reduces CO$_2$ emissions from downstream manufacturing operations in comparison with the use of virgin materials.

The following elements of SFO’s solid waste management program are described in additional detail below:

- Solid Waste Reduction
- Composting
- Material Use Reduction
- Waste Separation
- Construction and Demolition Waste Recycling

Estimated Composition of Airport Solid Waste (2010)

SFO recycled an impressive 74% of the solid waste generated in 2010. The recycled materials consisted primarily of food and other compostable materials, paper, and cardboard.
Airport Solid Waste Recycling and Composting

In 2010, about 9,928 tons of solid waste was generated at SFO, of which 7,307 tons or 74% was recycled. SFO’s recycled solid waste is composed primarily of food/compostable materials (37%), cardboard (13%), and paper (11%), as shown on the adjacent pie chart.

The solid waste recycling rate at SFO has increased rapidly since 2007, as shown in the above graph. This increase in SFO’s recycling rate can be attributed to improved on- and off-site sorting of waste, as well as the success of SFO’s comprehensive composting program.

Composting

SFO has been able to successfully transform a 2006 pilot food waste separation program into an ongoing large-scale composting program. Currently, food waste along with biodegradable materials, landscaping trimmings, and wastewater treatment sludge is transported to off-site composting facilities. SFO also requires the use of biodegradable tableware, plates, containers, etc. by food vendors in all new leases and lease renewals. This measure enables the composting of 100% of the waste generated at SFO’s food concessionaires.

In 2010, SFO composted 3,623 tons of food and biodegradable waste, or 37% of SFO’s total annual waste. The success of the Airport’s composting program has significantly contributed to the increase in the Airport’s overall solid waste recycling rate.

Wastewater Treatment Plant Sludge Reduction and Recycling

SFO has improved the management of sludge generated at the two treatment plants in order to minimize the volume and weight of the sludge transported to composting facilities or disposed of in landfills. For this purpose, the Airport dewatered the anaerobically digested sludge on sand beds and uses a filter press for dewatering the IWTP sludge. In 2010, 732 tons of sludge were dewatered and delivered to a composting facility.
Material Use Reduction

Although recycling is integral to minimizing the waste sent to landfills, reducing the waste generation rate is equally important. SFO has implemented a successful resource conservation program that has helped reduce the airport’s overall generation of solid waste by 7% since its peak in 2007, as indicated on the adjacent graph. SFO’s resource conservation program seeks to educate, encourage, and persuade Airport staff, tenants, and the general public to generate less waste at the Airport. These initiatives address primarily the use of office paper, plastic bottles, and paper towels and are described below.

Paper Allocation

SFO assigns a paper allocation to each Division at 80% of the previous year’s consumption level and requires the submittal of a special request if the assigned allocation is prematurely exhausted.

Double-Sided Printing

SFO has programmed all printers and copiers to produce double-sided prints or copies and has posted signs at all copying machines encouraging users to save paper and avoid unnecessary copying and printing.

Electronic Document Transfer

SFO encourages all staff to transmit documents electronically, wherever possible.

Paper Towel Use Reduction

SFO has experimented with the use of electric hand dryers in the Airport terminal restrooms. The results of the pilot program have been promising and plans are being made for widespread use of these hand dryers throughout the Airport. The use of electricity by the dryers is mitigated by the benefits derived from saving paper towels. In terminal restrooms that still use paper towels, SFO has posted signs on dispensers encouraging users to “Please conserve natural resources. Take only what you really need.”
Of the 5.1 billion pounds of polyethylene terephthalate (PET) bottles and jars produced in the U.S in 2009, only 28% were recycled.1 Despite this recycled quantity being a record high, there still remain large quantities of plastic bottles that end up in landfills across the country.2

Although maximizing recycling of plastic addresses the impacts of plastic disposal in the U.S., the production of plastic water bottles consumes fossil fuels and water resources. According to a 2006 study by the Pacific Institute,3 bottled water production in the US consumed the equivalent of more than 17 million barrels of oil, not including energy for transportation, and generated 2.5 million tons of carbon dioxide emissions. In addition, bottling water requires 3 liters of water to produce 1 liter of bottled water.

For more information about San Francisco’s water bottle refill program and San Francisco tap water, please visit the San Francisco Public Utilities Commission website: http://www.sfwater.org/

Hydration Stations
In 2011, SFO installed Hydration Stations in key locations at the terminal complex with the goal of decreasing the waste generated from single-use plastic bottles that were being thrown away as a result of the security screenings. These Hydration Stations provide passengers with a convenient way to refill personal water bottles after passing through security.

Waste Separation
At SFO solid waste has been historically transported to, and disposed of in, landfills. In recent years, however, due to the mandates of State laws and City ordinances, a progressively higher percentage of the solid waste is either source separated at the Airport or is sorted at the offsite facilities of the waste haulers. This separation enables increased rates of recycling. The following describes recent efforts to improve waste separation:
9. Solid and Hazardous Waste Management

Enhanced On-Site Source Separation
In FY 2010 approximately 19% of the solid waste generated at the Airport was separated at the source for recycling and was transported directly to the recycling facilities. During this period SFO deployed additional solid waste containers, in sets of three, throughout the Airport for depositing:

- Paper,
- Bottles & Cans, and
- General Trash.

This procedure is employed in all of the terminals and facilitates source separation of the waste by the general public and SFO employees. Additional dedicated bins have also been deployed for temporary storage of the different waste types. These actions have contributed to SFO’s increased source separation rate, reaching 21% in the 4th quarter of 2010.

Improved Off-Site Separation
In FY 2010, SFO’s contractor achieved a recycling rate of 51% for mixed solid waste transported off the Airport. This value represents the average rate of recycling for the combined operation of South San Francisco Scavenger Company (SSFSC), including composting operations. SSFSC has continued to improve the offsite recycling rate and in the 4th quarter of 2010 and achieved a recycling rate of 54%.

Construction and Demolition Waste Recycling
The City’s Policy calls for recycling a minimum of 65% of non-hazardous construction and demolition waste generated at City construction projects. SFO maintains a goal to recycle at least 75% of the waste generated at Airport’s construction and demolition projects. SFO consistently surpasses this goal, achieving construction and demolition waste recycling rates above 90%.
Hazardous Material and Waste Management

SFO’s Hazardous Material and Waste Management Programs address the generation, storage, and disposal of hazardous material and waste generated by both the Airport and Airport tenants. Hazardous substances generally consist of materials with chemical and physical properties that may pose a hazard to human health and/or the environment when improperly handled, stored, disposed, or otherwise managed. The adjacent table shows the breakdown of hazardous waste that was disposed of at SFO in 2010.

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaded Paint Chips</td>
</tr>
<tr>
<td>Lead Contaminated Materials</td>
</tr>
<tr>
<td>Corrosive Solids</td>
</tr>
<tr>
<td>Waste Flammable Solids</td>
</tr>
<tr>
<td>Contaminated Soil</td>
</tr>
<tr>
<td>Friable Asbestos</td>
</tr>
</tbody>
</table>

Hazardous Materials Management

Hazardous waste generated by the Airport has declined since 2004 due to decreased remediation activities. However, all Airport enterprises using hazardous materials in the course of their routine activities are still required to prepare a Hazardous Materials Business Plan for submittal to San Mateo County. San Mateo County staff performs periodic inspections of hazardous materials storage, record keeping, and handling operations to ensure compliance with the County regulations.

The Airport through the City’s Health Department contractors continues to recycle hazardous waste such as fluorescent light fixtures, computer monitors, used oil products, paint residues, and other hazardous materials. Hazardous building materials such as asbestos containing materials and lead-based paint generated during various construction activities are disposed of in permitted landfills. Other hazardous wastes such as vehicle and general-purpose batteries are collected for recycling.
9. Solid and Hazardous Waste Management

Since 1992, the Airport and its tenants have carried out an extensive program of site investigation, characterization, and remediation of contaminated soil and groundwater to protect human health and safety and to prevent the degradation of environmental resources in and around the Airport. Work continues in areas of the Airport requiring additional monitoring, remediation, and/or investigation.

Soil and Groundwater Remediation
In addition to jet fuel, gasoline and diesel fuels are stored at the Airport in above-ground and underground tanks. Accidental releases, leaks, or spills of these hazardous materials could pose environmental and/or health and safety risks. SFO continues to implement a rigorous program for prevention of soil and groundwater contamination, which includes installation of state-of-the-art jet fuel supply pipelines and hydrant fuel pits in the airfield in order to minimize any risks of leakage. Old fuel pipelines that were suspected of leakage have been abandoned and replaced with new pipelines or tanker truck deliveries. Also, SFO continues to gradually decommission the abandoned fuel pipelines.

Material Substitution Program
The Airport remains an active participant in the San Francisco Department of the Environment’s Environmentally Preferred Purchasing Program, which seeks to minimize the purchase of products containing hazardous ingredients, in favor of alternate products that pose less risk to City employees and the public. Programs for the identification and abatement of asbestos-containing materials and lead-based paint, as well as for reducing the usage of pesticides, insecticides and herbicides have also been implemented. The Airport promotes the use of non-hazardous materials, where possible, and continues to seek environmentally safe solutions as better technology and products become available.

Demolition work at Terminal 2. Demolished waste is separated on-site and subsequently recycled. SFO contractors water down piles of debris to minimize dust pollution. In order to minimize waste and save materials from Terminal 2, demolition was performed selectively, leaving the steel and concrete shell.
Integrated Pest Management (IPM) Program
To comply with the City’s IPM Ordinance, the Airport Commission adopted an IPM policy and SFO published its first IPM plan in April 1998. With the use of alternative, less toxic methods, SFO reduced the use of pesticides and herbicides by approximately 82% between 1996 and 2001. While usage has continued to decrease for landscaped areas, pesticide use on runways and surrounding areas has increased. This increase is likely due in part to State and County regulations requiring the Airport to treat for West Nile Virus as well as an increase in the area for which SFO is responsible. The needed increase in pesticide use, however, continues to be moderated by the IPM program.

Reprographics Department Sustainability Practices
The Airport’s Reprographics Department has played a significant role in reducing the use of reprographics resources while continuing to serve the needs of the Airport. Actions taken by this department include:

▶ Reducing the number of copying machines Airport-wide.

▶ Primarily using paper that contains 30% post-consumer recycled paper.

▶ Changing the default settings of printers and copiers to “double-sided”.

▶ Ensuring all work orders are submitted to reprographics electronically.


An Airport employee stepping up to SFO’s “Stair Challenge”, held in October 2011. SFO’s Employee Health and Wellness Program offers employees a variety of measures to improve physical fitness, nutrition, and overall health.
10. Employee Wellness

The Airport Commission understands that enhancing the health of its employees enables the Airport to have a healthy business. To promote wellbeing, SFO has established an award-winning wellness program with the goal of making the Airport a more pleasant and healthy place to work. Many Airport Commission employees take advantage of SFO’s wellness program because services are conveniently offered in their offices and work spaces. Fitness classes, educational tools and information, as well as preventative health care services such as flu shots and health screening, are provided at the Airport, making it easy for employees to participate in the program and utilize these services.

**SFO Policy**

_The Airport Commission shall establish, implement, and manage an effective health and wellness program._

**Objectives**

- Be ranked one of the Bay Area’s best employers in SF Business Times’ annual list.
- Integrate health promotion activities into Airport Commission occupational safety and health programs.
- Support the City and County of San Francisco’s commitment to lead the way in worksite-based injury/illness prevention and health promotion by implementing ‘Shape Up At Work’ strategies, in accordance with mayoral Executive Directive 05-111.
- Increase employee productivity, improve employee health, and reduce total employee sick time hours.
10. Employee Wellness

The SFO-sponsored “Stair Challenge” draws employees from across the Airport organization to challenge themselves physically in a fun, social environment.

What Have We Accomplished?

SFO Wellness Program

SFO has been actively promoting employee health and wellness for several years. In 2011, however, the Airport Director took steps to expand the Airport’s program and increase employee participation by designating a Wellness Coordinator and forming a Wellness Advisory Council to act as a conduit for feedback from SFO employees. The Wellness Advisory Council is committed to educating and encouraging employees to live healthy lifestyles.

SFO’s Health and Wellness program is managed by the Airport’s Safety and Health division. Twenty seven “team leaders” from various airport work divisions assist with program implementation by coordinating wellness activities.

The elements of the Airport’s Wellness Program include:

- Employee Fitness
- Preventative Health Care
- Nutrition
- Education

In the past year, the Airport has sponsored an extensive number of initiatives as part of its Health and Wellness Program, as described below.
Employee Fitness
Fitness and exercise is an important aspect of maintaining employee health and morale. SFO has sponsored the following activities to help employees maintain physical and mental wellbeing:

► “Stair Challenge”
The Airport sponsored a Stair Challenge event on October 19, 2011. Utilizing one of the parking garages at the Airport, employees challenged themselves to see how many stairs they could climb in a 30 minute period.

► “Shape Up San Francisco” Walking Challenge
In 2011, 628 airport employees participated in this 10 week challenge to promote physical activity. Each team walked the equivalent of 1,016 miles over 10 weeks, the distance along the California coast. Pedometers were provided to employees to keep track of their miles.

► Fitness Classes
Yoga classes are taught by employee volunteers during lunch, and Zumba classes are offered during lunch and after work. Stretching and fitness rooms are also provided for Airfield Safety and Maintenance staff.

SFO Receives Employee Wellness Awards

SFO is proud to have received two separate awards recognizing the Airport’s proactive program to improve employee health and wellbeing.

Healthiest Workplace for large Companies in the greater Bay Area
On September 30, 2011, the San Francisco Business Times, in conjunction with the Silicon Valley/San Jose Business Journal, listed SFO as the healthiest workplace for large companies (500 – 1,999 employees) in the greater Bay Area. In announcing the award, the Business Times specifically cited the Airport’s creation of a Wellness Advisory Council and the naming of a Wellness Coordinator.

Fit Business Award
In November 2007, the California Task Force on Youth and Workplace Wellness honored SFO, as one of over 80 employers in the State, for its commitment to employee wellness and promoting a healthier workplace. The Airport received a Silver trophy at the Task Force’s 2007 Fit Business Awards ceremony, sponsored by Kaiser Permanente, in recognition of the Airport’s Health and Wellness Program. The program featured a 5-year implementation plan to provide SFO employees nutrition and fitness initiatives at the Airport. Program initiatives recognized with this award ranged from providing employees with health information and training to providing free blood pressure checks.
10. Employee Wellness

Organic garden beds outside the Airport Engineering Building (right) and at the Belle Air Elementary School in San Bruno (left). SFO staff constructed and now help maintain these gardens that provide a healthful and educational outlet for Belle Air Elementary school children and for SFO staff.

- **Plans to develop an Employee Fitness Facility**
  Scheduled to open in 2012, this employee facility will be located in the terminal complex and will include a space for cardio equipment (treadmill, elliptical, stationary bike) and fitness classes.

- **Preventative Health Care**
  SFO works with employees to take steps to prevent workplace injury or personal illness. These preventative health care measures include:
  
  - **Ongoing ergonomic evaluations** – conducted by Airport Safety and Health staff, these evaluations are intended to minimize work-related injury and illness by ensuring proper “fit” of workplace conditions.
  
  - **Medical monitoring program** – The Airport’s Medical Clinic provides free audiograms and consultations with an occupational medicine doctor.
  
  - **Flu Shots** – Each year, the Airport provides employees free flu shots.
  
  - **The Airport Medical Clinic actively participates in on-site safety fairs and events, offering free blood pressure checks and cholesterol screenings.**

- **Nutrition**
  Maintaining a healthy diet is crucial to prevent illness and improve general wellbeing. SFO encourages positive nutrition choices through the following initiatives:
  
  - **Healthy food alternatives, such as fresh fruit, provided at Airport Safety Committee and other safety meetings**
  
  - **Organic garden outside the Jason Yuen Engineering building.** SFO carpenters and landscaping staff built the two 4 ft x 6 ft garden beds, which produce greens, tomatoes, herbs, sunflowers, as well as lemons, limes, and tangerines. Members of the Airport’s Salad Club contribute to the purchase of seeds and the harvested foods are used as ingredients in the club’s salads.
  
  - **Organic garden at the Belle Air Elementary School in San Bruno.** The SFO Maintenance Division helped the school construct the school’s eight 4 ft x 6 ft garden beds. The elementary school children plant and harvest foods ranging from artichokes, red onion, strawberries, zucchini, rosemary, sage, Swiss chard and pumpkins. The Airport continues to provide general maintenance support to the garden, which is located on Airport property.
In addition to nutritious vegetables, SFO employees plant flowers, such as this Protea plant, to beautify their organic garden.

Wellness Education

SFO seeks to inform airport employees about the measures they could take to improve their own health. SFO wellness education initiatives include:

- Publication of quarterly health and wellness electronic newsletters
- Walking and stretching posters distributed throughout Airport Commission buildings and posted in employee lunch rooms and other common spaces
- Airport Safety Policy and Procedures Manual, which details the components of the Airport’s 5 year Health and Wellness Program
- Stretch break software program and DVD designed for all Airport Commission employees
- Monthly safety meetings to discuss safety and wellness topics
Appendix: SFO by the Numbers

Chapter 1: SFO Profile

### Aircraft Operations

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<tr>
<th>Year</th>
<th>Operations</th>
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<td>2001</td>
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<td>2002</td>
<td>351,453</td>
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<td>2003</td>
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<td>2007</td>
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### Passenger Activity

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<td>2001</td>
<td>34,632,474</td>
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<td>31,456,342</td>
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<td>2004</td>
<td>32,744,186</td>
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<td>2005</td>
<td>33,394,225</td>
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<td>35,790,746</td>
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<td>2008</td>
<td>37,402,445</td>
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<td>2009</td>
<td>37,453,634</td>
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<td>2010</td>
<td>39,391,234</td>
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### Cargo Activity

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<tr>
<td>2001</td>
<td>636,005</td>
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<td>2002</td>
<td>589,730</td>
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<td>2003</td>
<td>573,523</td>
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<tr>
<td>2004</td>
<td>562,875</td>
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<tr>
<td>2005</td>
<td>590,556</td>
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<tr>
<td>2006</td>
<td>594,857</td>
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<td>2007</td>
<td>562,933</td>
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<td>2008</td>
<td>493,628</td>
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<td>2009</td>
<td>408,102</td>
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<td>2010</td>
<td>426,724</td>
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### 2010 US Airports Ranking by Operations

<table>
<thead>
<tr>
<th>Rank</th>
<th>Airport</th>
<th>2010 Operations</th>
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<tbody>
<tr>
<td>1</td>
<td>Atlanta, GA (ATL)</td>
<td>950,119</td>
</tr>
<tr>
<td>2</td>
<td>Chicago, IL (ORD)</td>
<td>882,617</td>
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<tr>
<td>3</td>
<td>Dallas, TX (DFW)</td>
<td>652,258</td>
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<tr>
<td>4</td>
<td>Denver, CO (DEN)</td>
<td>635,458</td>
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<tr>
<td>5</td>
<td>Los Angeles, CA (LAX)</td>
<td>575,835</td>
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<tr>
<td>6</td>
<td>Houston, TX (IAH)</td>
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<td>7</td>
<td>Charlotte, NC (CLT)</td>
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<td>8</td>
<td>Las Vegas, NV (LAS)</td>
<td>505,604</td>
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<tr>
<td>9</td>
<td>Philadelphia, PA (PHL)</td>
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<tr>
<td>10</td>
<td>Detroit, MI (DTW)</td>
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<tr>
<td>11</td>
<td>Phoenix, AZ (PHX)</td>
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<td>Minneapolis, MN (MSP)</td>
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<td>13</td>
<td>New York, NY (EWR)</td>
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<td>14</td>
<td>New York, NY (JFK)</td>
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<td>15</td>
<td>San Francisco, CA (SFO)</td>
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<td>16</td>
<td>Miami, FL (MIA)</td>
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<td>17</td>
<td>Washington D.C. (DCA)</td>
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<td>18</td>
<td>Boston, MA (BOS)</td>
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<td>19</td>
<td>Phoenix, AZ (DVT)</td>
<td>368,747</td>
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<td>20</td>
<td>New York, NY (LGA)</td>
<td>367,346</td>
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Source: FAA Opsnet

### 2010 Passenger Volume and Growth by Continent

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<tr>
<th>Continent</th>
<th>Passengers</th>
<th>% Change since 2009</th>
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<tbody>
<tr>
<td>Asia, India &amp; Middle East</td>
<td>4,200,000</td>
<td>10.40%</td>
</tr>
<tr>
<td>Europe</td>
<td>2,200,000</td>
<td>-1%</td>
</tr>
<tr>
<td>Canada</td>
<td>1,300,000</td>
<td>12.2%</td>
</tr>
<tr>
<td>Mexico/Central &amp; South America</td>
<td>700,000</td>
<td>5.3%</td>
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<tr>
<td>Oceania</td>
<td>450,0000</td>
<td>-5.4%</td>
</tr>
<tr>
<td>U.S.</td>
<td>30,000,000</td>
<td>4.7%</td>
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Source: FAA Opsnet
Chapter 3: Climate Change

Annual GHG Emissions and GHG Mitigation/Offset Levels at SFO

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>FY 2008</th>
<th>FY 2009</th>
<th>FY 2010</th>
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<tbody>
<tr>
<td>Gross SFO-controlled GHG Emissions (tonnes)</td>
<td>52,248</td>
<td>41,064</td>
<td>45,047</td>
<td>44,562</td>
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<td>Annual GHG Emission Mitigation Level at SFO</td>
<td>0</td>
<td>18,293</td>
<td>39,409</td>
<td>41,816</td>
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<tr>
<td>Annual GHG Emission Offset Level at SFO</td>
<td>0</td>
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<td>2,870</td>
<td>2,326</td>
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Greenhouse Gas Emissions from all Airport-related Activities (Categories 1, 2, and 3)

<table>
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<tr>
<th>SFO Emission Category</th>
<th>GHG Emission (Tonnes)</th>
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<th>FY 2009</th>
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</thead>
<tbody>
<tr>
<td>Category 1-SFO-controlled Emissions*</td>
<td></td>
<td>52,248</td>
<td>37,419</td>
<td>42,177</td>
<td>42,236</td>
</tr>
<tr>
<td>Category 2-Airlines, Concessionaires, and Airline Support Services Emissions</td>
<td></td>
<td>839,000</td>
<td>688,275</td>
<td>668,037</td>
<td>676,169</td>
</tr>
<tr>
<td>Category 3-Optional Emissions</td>
<td></td>
<td>7,127,543</td>
<td>8,340,264</td>
<td>7,937,546</td>
<td>8,195,369</td>
</tr>
</tbody>
</table>

*Corresponds to gross SFO-controlled GHG emissions minus GHG emissions offsets from projects implemented by the Airport

Breakdown of SFO-controlled GHG Emissions Sources (FY 2010)

<table>
<thead>
<tr>
<th>(Direct Emissions)</th>
<th>FY 2010</th>
<th>Type of Mitigation Measure</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas Consumption</td>
<td>40%</td>
<td>PC Air and 400 Hz Power Supply at International Terminal</td>
<td>21,889</td>
</tr>
<tr>
<td>SFO Fuel Consumption (Vehicle &amp; Shuttle Fleet, Generator)</td>
<td>33%</td>
<td>Green Car Rental Incentive Program</td>
<td>11,442</td>
</tr>
<tr>
<td>Fugitive refrigerant gas releases</td>
<td>8%</td>
<td>Construction and Demolition Waste Recycling</td>
<td>4,545</td>
</tr>
<tr>
<td>Wastewater Treatment Facilities</td>
<td>1%</td>
<td>BART Extension to SFO (SFO’s share)</td>
<td>2,076</td>
</tr>
</tbody>
</table>

Breakdown of GHG Emission Mitigation Measures (FY 2010) (tons)

<table>
<thead>
<tr>
<th>(Indirect Emissions)</th>
<th>FY 2010</th>
<th>AirTrain Facility</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFO Employee Commuting</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical energy consumption</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid waste disposal</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Chapter 4: Energy

### SFO and Tenant Electricity Consumption

<table>
<thead>
<tr>
<th>Activity</th>
<th>Energy Consumption (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY 2008</td>
</tr>
<tr>
<td>Subtotal Electricity</td>
<td>338,729</td>
</tr>
</tbody>
</table>

### SFO and Tenant Natural Gas Consumption

<table>
<thead>
<tr>
<th>Activity</th>
<th>Energy Consumption (therms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY 2008</td>
</tr>
<tr>
<td>Natural Gas Consumption by SFO and tenants</td>
<td>3,640,573</td>
</tr>
</tbody>
</table>

### Fuel Usage of SFO General and Shuttle Fleets

<table>
<thead>
<tr>
<th>General Fleet</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline, gallons</td>
<td>50%</td>
</tr>
<tr>
<td>CNG, gasoline gallons equivalent (GCE)</td>
<td>27%</td>
</tr>
<tr>
<td>Biodiesel, gallons</td>
<td>23%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shuttle Fleet</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline, gallons</td>
<td>0</td>
</tr>
<tr>
<td>CNG, gasoline gallons equivalent (GCE)</td>
<td>60%</td>
</tr>
<tr>
<td>Biodiesel, gallons</td>
<td>40%</td>
</tr>
</tbody>
</table>
## Chapter 5: Air Quality

### Historical Air Pollutant Emissions from Stationary Sources at SFO (tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>TOG</th>
<th>ROG</th>
<th>CO</th>
<th>NOx</th>
<th>SOx</th>
<th>PM</th>
<th>PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>3</td>
<td>1.8</td>
<td>10.7</td>
<td>33.6</td>
<td>0.9</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>2004</td>
<td>2.4</td>
<td>1.5</td>
<td>7.4</td>
<td>27.8</td>
<td>0.4</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>2005</td>
<td>2.3</td>
<td>1.5</td>
<td>6.7</td>
<td>23.8</td>
<td>0.4</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>2006</td>
<td>1.9</td>
<td>1.1</td>
<td>7.4</td>
<td>25.7</td>
<td>0.2</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>3.1</td>
<td>8.3</td>
<td>25.2</td>
<td>0.2</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>2008</td>
<td>7.5</td>
<td>6</td>
<td>8.9</td>
<td>28.8</td>
<td>0.2</td>
<td>0.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

**Note:** Emissions are in tons. TOG: Toxic Organic Gases; ROG: Reactive Organic Gases; SOx: Sulfur Oxide; PM: Particulate Matter; PM10: Particulate Matter less than 10 microns in diameter.

### Passenger Travel Modes (2011 Survey)

<table>
<thead>
<tr>
<th>Mode of Travel</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Vehicle (Parked or Drop Offs)</td>
<td>43%</td>
</tr>
<tr>
<td>Door to door van/ hotel shuttle/ charter bus</td>
<td>18%</td>
</tr>
<tr>
<td>Taxi/ Limousine</td>
<td>16%</td>
</tr>
<tr>
<td>Rental Car</td>
<td>13%</td>
</tr>
<tr>
<td>BART</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Note:** Passengers transferring from another flight are not included in the chart above.

### Employee Commuting Travel Modes (2011)

<table>
<thead>
<tr>
<th>Commute Mode</th>
<th>% of Employees</th>
<th>Miles Travelled</th>
<th>GHG Emission, Tonnes/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>79.79</td>
<td>6,643,353</td>
<td>2,404</td>
</tr>
<tr>
<td>Carpool</td>
<td>10.53</td>
<td>310,741</td>
<td>112</td>
</tr>
<tr>
<td>BART/ Bus</td>
<td>8.1</td>
<td>674,410</td>
<td>29</td>
</tr>
<tr>
<td>Shuttle/Taxi/Limousine</td>
<td>0.18</td>
<td>14,987</td>
<td>2</td>
</tr>
<tr>
<td>Motorcycle/Scooter</td>
<td>0.58</td>
<td>48,291</td>
<td>9</td>
</tr>
<tr>
<td>Telecommute</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bicycle</td>
<td>0.52</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
<td>2,557</td>
</tr>
</tbody>
</table>

**Survey conducted in January 2011**

Source: California Air Resources Board
Facility ID: 1784
http://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php
Chapter 6: Noise Abatement

<table>
<thead>
<tr>
<th>Year</th>
<th>Operations</th>
<th>Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>436,659</td>
<td>27,103</td>
</tr>
<tr>
<td>2000</td>
<td>437,763</td>
<td>48,051</td>
</tr>
<tr>
<td>2001</td>
<td>407,040</td>
<td>43,242</td>
</tr>
<tr>
<td>2002</td>
<td>350,133</td>
<td>11,154</td>
</tr>
<tr>
<td>2003</td>
<td>335,785</td>
<td>3,555</td>
</tr>
<tr>
<td>2004</td>
<td>352,616</td>
<td>5,980</td>
</tr>
<tr>
<td>2005</td>
<td>350,508</td>
<td>6,718</td>
</tr>
<tr>
<td>2006</td>
<td>357,957</td>
<td>10,179</td>
</tr>
<tr>
<td>2007</td>
<td>371,291</td>
<td>7,842</td>
</tr>
<tr>
<td>2008</td>
<td>393,714</td>
<td>7,668</td>
</tr>
<tr>
<td>2009</td>
<td>378,205</td>
<td>5,481</td>
</tr>
<tr>
<td>2010</td>
<td>386,064</td>
<td>8,716</td>
</tr>
</tbody>
</table>
## Chapter 7: Water Conservation and Water Quality Enhancement

### Annual Water Use and Water Use per Passenger

<table>
<thead>
<tr>
<th>Annual Water Consumption at SFO (millions of gallons)</th>
<th>Annual Water Use</th>
<th>Total SFO Water Use per Passenger (gallons per passenger)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>491.2</td>
<td>2002</td>
</tr>
<tr>
<td>2003</td>
<td>470.0</td>
<td>2003</td>
</tr>
<tr>
<td>2004</td>
<td>533.2</td>
<td>2004</td>
</tr>
<tr>
<td>2005</td>
<td>479.3</td>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
<td>480.6</td>
<td>2006</td>
</tr>
<tr>
<td>2007</td>
<td>502.7</td>
<td>2007</td>
</tr>
<tr>
<td>2008</td>
<td>507.4</td>
<td>2008</td>
</tr>
<tr>
<td>2009</td>
<td>475.8</td>
<td>2009</td>
</tr>
<tr>
<td>2010</td>
<td>458.5</td>
<td>2010</td>
</tr>
</tbody>
</table>

### Annual Average Daily Wastewater Flows at SFO Treatment Plants (millions of gallons)

<table>
<thead>
<tr>
<th></th>
<th>FY 2006</th>
<th>FY 2007</th>
<th>FY 2008</th>
<th>FY 2009</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary Waste Treatment Plant</td>
<td>0.64</td>
<td>0.6</td>
<td>0.59</td>
<td>0.54</td>
<td>0.54</td>
</tr>
<tr>
<td>Industrial Wastewater Treatment Plant</td>
<td>0.63</td>
<td>0.48</td>
<td>0.49</td>
<td>0.61</td>
<td>0.613</td>
</tr>
</tbody>
</table>
## Chapter 9: Solid and Hazardous Waste Management

### Estimated Composition of Airport Solid Waste (2010)

<table>
<thead>
<tr>
<th>Material</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal, Glass, Plastic</td>
<td>434</td>
</tr>
<tr>
<td>Paper</td>
<td>1113</td>
</tr>
<tr>
<td>Cardboard</td>
<td>1318</td>
</tr>
<tr>
<td>Wood</td>
<td>87</td>
</tr>
<tr>
<td>Food/Compostable Materials</td>
<td>3623</td>
</tr>
<tr>
<td>Wastewater Treatment Sludge</td>
<td>732</td>
</tr>
<tr>
<td>Refuse (landfilled)</td>
<td>2621</td>
</tr>
</tbody>
</table>

### Hazardous Waste Material Disposal Breakdown (2010)

<table>
<thead>
<tr>
<th>Hazardous Material</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaded Paint Chips</td>
<td>200 lbs</td>
</tr>
<tr>
<td>Lead Contaminated Materials</td>
<td>90 lbs</td>
</tr>
<tr>
<td>Corrosive Solids</td>
<td>270 lbs</td>
</tr>
<tr>
<td>Waste Flammable Solids</td>
<td>600 lbs</td>
</tr>
<tr>
<td>Contaminated Soil</td>
<td>357 tons</td>
</tr>
<tr>
<td>Friable Asbestos</td>
<td>14 cy</td>
</tr>
</tbody>
</table>

### Historical Airport Solid Waste Recycling Rate (2002-2010)

<table>
<thead>
<tr>
<th>Solid Waste</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Diverted From Landfill</td>
<td>51</td>
<td>51</td>
<td>51</td>
<td>52</td>
<td>54</td>
<td>58</td>
<td>62</td>
<td>70</td>
<td>74</td>
</tr>
</tbody>
</table>

### Total Annual Solid Waste Generation vs. Annual Passenger Levels at SFO (2002-2010)

<table>
<thead>
<tr>
<th>Solid Waste</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Waste (tons)</td>
<td>6,794</td>
<td>5,942</td>
<td>6,846</td>
<td>9,000</td>
<td>9,394</td>
<td>10,660</td>
<td>10,637</td>
<td>9,568</td>
<td>9,928</td>
</tr>
</tbody>
</table>

### Estimated Composition of Airport Construction and Demolition Recycled Materials

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>FY 2009</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>2370</td>
<td>639</td>
</tr>
<tr>
<td>Wood</td>
<td>17</td>
<td>187</td>
</tr>
<tr>
<td>Mixed Paper</td>
<td>74</td>
<td>32</td>
</tr>
<tr>
<td>Concrete</td>
<td>336</td>
<td>6839</td>
</tr>
<tr>
<td>Mixed Construction &amp; Demolition Waste</td>
<td>1756</td>
<td>2470</td>
</tr>
<tr>
<td>Drywall</td>
<td>0</td>
<td>72</td>
</tr>
<tr>
<td>Other (Aluminum, Plastics, Cardboard)</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>
LEED Gold Certification of Terminal 2
Design and construction of the renovated Terminal 2 to the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) green building standards. Terminal 2 is the first airport terminal in the U.S. to achieve the Gold level of LEED certification.

“Green” Data Center
SFO is designing and building the first of its kind highly energy efficient Data Center Building at the Airport. The data center, a model for innovation and efficiency, will utilize the cool ambient air of the San Francisco Bay Area as the primary source for conditioning the air in the facility, thereby avoiding the use of energy-intensive traditional cooling units.

SFO Hydrogen and Electric Battery Swap Fueling Complex
SFO is planning to lease property for vehicle refueling facilities that will provide hydrogen fuel and fast electric vehicle battery swap services. The facility is set to open in 2012 and will be the first public access refueling complex offering these services at a North American airport.

Real-Time Online Flight Tracking in “3D”
In 2011, SFO released a powerful new user-controlled online flight tracking tool, which provides the public with live flight information for aircraft anywhere in the SFO airspace. This tool can help users identify aircraft location, altitude, operator (airline), flight number, and originating/arriving airport (SFO, San Jose, or Oakland). This 3D flight tracking tool is the first of its kind to be made publicly available.

Green Car Rental Incentive Program
SFO was the first airport in the country to incentivize customers to rent low emission, fuel efficient vehicles. Established in 2009, the three-year program rewarded customers who rented “green” high mileage or alternative-fueled vehicles, such as hybrids, by offering a $15 discount on their rental. This program also provides financial incentives to rental car companies to increase the number of fuel efficient cars (with an EPA rating of 17 or higher) to 15% of their rental vehicle inventory. In FY2010, 25.6 percent of car rental transactions were for “green” vehicles, saving more than 1 million gallons of gasoline for the passenger and reducing approximately 11,442 metric tons of GHG emissions to the atmosphere.
Contact Information:
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San Francisco International Airport
710 N. McDonnell Road
P. O. Box 8097
San Francisco, CA 94128
650.821.7841 | FAX 650.821.5383
email: Sam.Mehta@flysfo.com