SAN DIEGO INTERNATIONAL AIRPORT
LET'S GO.

8/5/2016

STRATEGIC ENERGY PLAN

AN INTEGRATED APPROACH TO ENERGY RESILIENCY

Disclaimer

The Strategic Energy Plan is provided as a summary of current efforts by and future goals of the San Diego County Regional Airport Authority. The information provided in the Strategic Energy Plan has been obtained from sources believed to be reliable but it is not a guarantee as to accuracy or completeness. It is provided for reference only and does not purport to include every item that may be relevant, nor does it purport to present full and fair disclosure with respect to any financial reports, transactions, bonds, notes and other obligations related to the San Diego County Regional Airport Authority or San Diego International Airport within the meaning of applicable securities laws and regulations. Nothing in this Strategic Energy Plan may be construed to imply that specific projects, means or methods have been approved, funded or committed to by the San Diego County Regional Airport Authority or require it to take any specific action in the future.

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EXECUTIVE SUMMARY

Introduction

San Diego County Regional Airport Authority (Authority) is committed to building an enduring and resilient enterprise by effectively managing its financial, social and environmental risks, obligations and opportunities.

As reflected by the achievement of the recent Terminal 2 West Expansion as the first Leadership in Energy and Environmental Design (LEED) Platinum Airport Terminal, San Diego County Regional Airport Authority is widely recognized as a leader in sustainability, both regionally and across the airport industry. As operators of San Diego International Airport (Airport), the Authority recognizes the complex link between energy performance and the security of their airport enterprise, and are keenly aware that this interdependence warrants a bold vision and strategy to ensure sustainability into the future.

The Strategic Energy Plan establishes the Authority's approach of achieving its goal of being a leading, world-class thought leader in the provision of cost effective energy resiliency strategies that are environmentally responsible and fully aligned with Airport operation and development.

An Integrated Approach to Energy Resiliency

The purpose of the Strategic Energy Plan is to provide a framework for rethinking how the Authority manages their energy resources while preparing to accommodate passenger growth, development projects, and the added variability of a changing climate.

Specifically, the plan addresses key issues of energy efficiency and conservation; on-site energy generation and storage; enhanced monitoring of key energy metrics; and mechanisms through which to actively engage the broad spectrum of Airport stakeholders. The plan presents an integrated approach that will enable the Airport to grow its operations while protecting the San Diego region's limited resources.

The Strategic Energy Plan establishes key long term goals and supporting strategies across the broad spectrum of energy programs, while leveraging timely opportunities presented by the Airport Development Plan (ADP) and ongoing Capital Improvement Program (CIP) to minimize the impact of unplanned expenditure on the Airport's budget.

The Strategic Energy Plan is a core element of the Airport's overarching Sustainability Management Program, which directly implements its Sustainability Policy and is aligned with the Authority's five Organizational Strategies.

The Strategic Energy Plan provides a roadmap to help guide the Airport toward energy independence, enhanced operational resiliency, and carbon neutrality, in a manner that is fiscally responsible and aligned with the overall CIP.

Steps to Achieving a Robust Energy Resiliency Program

The Strategic Energy Plan provides a roadmap for the Authority that defines the energy goals of one of the world's most sustainable airports in a manner that balances the provision of specific, operationally aligned actions, with the flexibility to accommodate the inevitable changes in Airport operation, climate, and technology that will occur over the next 30 years.

The Strategic Energy Plan is a "living" document that will be reviewed and updated every five years and will require ongoing engagement with both internal and external stakeholders to ensure that it remains aligned with the overall vision of the Authority.

Through multi-functional meetings and workshops, the Authority has identified five primary goals (see **Figure 1**) that are intended, when combined, to cover the full spectrum of topics necessary to provide a robust, comprehensive energy program. The five goals are summarized below.

Figure 1: Strategic Energy Plan Goals

1 Conservation and Efficiency

- A. Sub-Monitoring
- B. Energy Auditing
- C. Retro-Commissioning
- D. Monitoring Strategy
- E. Provide Incentives to Promote Energy Conservation & Stewardship
- F. Integrate Energy Conservation & Resilient Design in Tenant Improvement Guidelines
- G. Engagement & Education

2 Carbon Neutrality

- A. Install renewable energy generation in a cost effective manner
- B. Green Energy Procurement
- C. Maximize synergies between systems transportation
- D. Complete a Climate Action Plan and participate in Airport Carbon Accreditation Program

3 Interdependence and Resiliency

- A. Install on-site energy generation and storage capacity
- B. Prioritize Airport critical systems to ensure continued operations
- C. Provide redundant systems to minimize disruptions to operations
- D. Balance cost of resilience measures with benefit of undisrupted operations

4 Cost Containment

- A. Demand side management
- B. Funding mechanisms
- C. Identify the most effective metrics
- D. Project assessment, implementation, and evaluation
- E. Energy as a service

5 Regional and Industry Leadership

- A. Third party certification
- B. Share knowledge and best practices to build industry and regional momentum
- C. Engage business partners in energy and sustainability goals
- D. Innovation through Big Data
- E. Periodic Strategic Energy Plan validation
- F. New and Emerging Technology

INTRODUCTION

Creating the Resilient Airport

Introduction

The San Diego Airport Regional Airport Authority is a globally recognized leader in sustainability. As operators of the Airport, the Authority recognizes the critical role that energy plays in present and future operations. The Airport was the first airport to achieve LEED Platinum certification for a major terminal development project, the recently completed Terminal 2 West Expansion, and is the nation's first to issue an annual sustainability report, based on Global Reporting Initiative standards.

The Authority is constantly striving to exceed expectations, enhance the resiliency of Airport operations, and support the stewardship of Airport energy resources. It recognizes that it is important to identify the need to increase energy efficiency; create independent clean power; modernize to meet future demands; prepare for rising costs; and create a more resilient Airport.

The Authority understands its responsibility to combat climate change through reduction of greenhouse gas (GHG) emissions, and ultimately through striving to operate as a carbon neutral facility, while proactively strengthening energy security and maintaining the Airport's commitment to providing quality airport services for the region.

This Strategic Energy Plan provides a framework for developing an energy-efficient and carbon-neutral Airport into the future. It establishes long-term goals and strategies for best utilizing energy and conservation practices while aligning with the vision presented in the ADP and CIP. These goals will ultimately allow the Airport to establish more dependable energy sources while offsetting GHG emissions. The Airport will pursue these goals in a way that appropriately contains costs and that allows the Airport to be financially prudent with energy expenditure, as energy costs rise in the future.

Energy Through The Regional Lens

With an increasing population and need for energy, California is today faced with an unparalleled energy deficit and imports almost 100,000 gigawatt-hours, 32%, of its electricity every year from neighboring states—enough to power more than 14,000,000 homes. Fifteen years of drought have impacted the operating capacity of hydroelectric power generation throughout the State, reducing the amount of energy production by over 30% which, when combined with the recent closure of San Onofre Nuclear Generating Station, further reduces the state's power supply, removing an additional 3,000 megawatts (MW) of power generated in the San Diego region.

To service the energy demands of its residents, California must, in the short term, continue to rely on its neighboring states to import much-needed energy. The longer term vision is to reduce overall energy consumption within the State through aggressive energy efficiency and renewable energy goals that will both reduce the overall demand and increase in-State capacity.

With the signing of SB-350, the Clean Energy and Pollution Reduction Act of 2015, the energy landscape in California has taken a significant evolutionary step. The Renewable Energy Portfolio Standard, to which San Diego Gas and Electric along with the other California Energy Utilities are held, was enhanced to double the percentage of renewable energy sources.

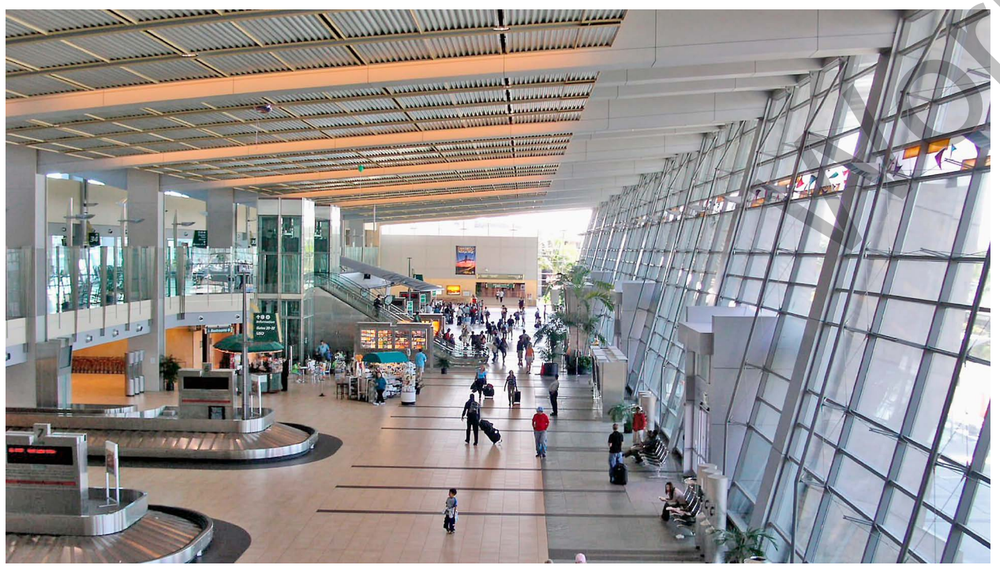
The California Title 24 Energy Code, which outlines the requirements for new construction, is set on an aggressive path towards net zero energy, with the following targets having been approved by the California Energy Commission:

- New Residential Buildings: Net Zero by 2020
- New Nonresidential Buildings: Net Zero by 2030

Locally, the City of San Diego recently prepared a Climate Action Plan (CAP) that emphasizes a reduction in GHG emissions through the implementation of energy strategies. The CAP also discusses San Diego's growing focus on renewable energy and new "eco-districts," and presents several implementation and monitoring goals to meet the City's goal of using 100 percent renewable energy city-wide by the year 2035.[1]

The Airport is actively engaged in multiple local energy and sustainability initiatives, including the SANDAG Energy Working Group which was set up to help facilitate the creation of region-wide energy plans.

1 City of San Diego. Climate Action Plan, December 2015. Available online at https://www.sandiego.gov/sites/default/files/final_december_2015_cap.pdf, accessed on May 2, 2016.



Energy Through The Industry Lens

The airport industry is increasingly recognizing the role of sustainability and the need to reduce GHG emissions. The Airport Carbon Accreditation (ACA) program encourages airports to work together towards not only reducing GHG emissions, but eventually becoming carbon neutral. The ACA was initiated in Europe and was extended to North America, and ultimately globally, in 2014. More than 150 airports are currently accredited, including 16 airports within North America. The program provides four levels of accreditation, and identifies focus areas such as energy efficiency, green energy sources, and green practices to reduce emissions. The growing involvement in this program is evidenced by increasing participation, with over 25 percent of global air passenger traffic traveling from accredited airports in November 2014, five years after the program's start.[2]

As a member of Airport Council International-North America (ACI-NA), the Airport is committed to achieving the ACI-NA energy goal of developing an energy management plan for minimizing the energy demand of their infrastructure and operations, and move towards less polluting modes of energy and fuel use, including generating and using energy from renewable sources. The four sub-goals upon which the Airport is periodically evaluated are:

- **EN-1: Inventory Energy Use and Generation:** Energy baseline inventories identify an airport's opportunities for improved energy management performance.
- **EN-2: Implement an Energy Management Program:** Reduce energy consumption, increase efficiency, increase use of renewable generation, and link to carbon (or greenhouse gas) management plan. The airport develops its own objectives and targets and has a program to move towards these airport-specific goals.
- **EN-3: Optimization:** Engage airport tenants, vendors, and passengers to reduce airport related energy consumption, increase efficiency, increase use of renewables, link to a carbon management plan, and encourage the same from the broader community. To promote business continuity as well as energy efficiency, the airport can undertake a risk analysis or develop an energy strategy.
- **EN-4: Verify and Report Performance:** Verify energy management performance and report to stakeholders in the interest of accountability and continuous improvement.

2 WSP | Parsons Brinckerhoff, Airport Carbon Accreditation website. Available online at http://www.airportcarbonaccredited.org, accessed May 2, 2016.

The Airport is committed to achieve the Airport Council International-North America's energy goal of developing an energy management plan for minimizing the energy demand of their infrastructure and operations and moving towards less polluting modes of energy and fuel use.

Energy Through The Airport Lens

A Memorandum of Understanding (MOU) established between the Authority and the State of California Attorney General recognizes the mutual interest in reducing GHG emissions at the Airport. The MOU sets forth reduction measures for GHG emissions and identifies the need for cooperation with regulatory agencies. Specific measures identified in the MOU to reduce on-ground aircraft GHG emissions include the provision of landside power and preconditioned air at all new gates constructed under the Airport Master Plan; retrofitting of existing gates with landside power and preconditioned air; provision of landside power at new hangars and cargo facilities; retrofitting of existing hangars and cargo facilities with landside power; usage of landside power by cargo and general aviation aircraft; and reduction in energy-using aircraft movements. Green materials and sustainable design will also be implemented through cool roofs, solar panels, cool pavements, and LEED Silver or better certification. Green construction methods and equipment will be utilized and tenants will be encouraged to address GHG emissions.[3]

3 State of California Attorney General. Memorandum of Understanding between the Attorney General of the State of California and the San Diego County Regional Airport Authority Regarding the San Diego International Airport Master Plan. Available online at: http://ag.ca.gov/cms_attachments/press/pdfs/n1556_agreement.pdf, accessed May 2, 2016.

INTEGRATION WITH AIRPORT INITIATIVES

Figure 2: How the Airport Strategic Energy Plan Integrates with Current Airport Policies

Integration with Ongoing Airport Initiatives

Airport Development Plan

The Authority is currently planning for the future. The ADP, currently in draft form and expected to be completed in 2017, will set forth recommended improvements at the Airport to meet demand through 2035. The ADP process involved extensive public outreach and is now undergoing environmental analysis. Focus areas of the ADP include the redevelopment of Terminal 1; placement of the international gates and expansion of the associated Federal Inspection Services (FIS); development of the former Teledyne-Ryan property; and incorporation of plans by the San Diego Association of Governments (SANDAG) to create an intermodal center.[4]

Capital Improvement Plan

The Authority's has a rolling 20 year CIP which identifies upcoming projects, including several projects directly related to the Airport's energy usage. Major construction projects include the Terminal 2 Parking Plaza, the North Side Cargo Facility, and the Bus Fueling Facility. Other future facilities include the air cargo warehouse, and remote processing center. The CIP also includes projects tied to energy conservation and generation, such as the installation of preconditioned air at cargo gates; charging units for electric vehicles; improvements at Terminal 2 East; modernization of the heating, ventilation, and air conditioning (HVAC) system; a sky bridge between Terminal 1 and Terminal 2 East; and upgrades to LED lighting. These planned improvements help the Airport move towards the ultimate goal of carbon neutrality.

The Terminal 2 West Expansion project, also called the Green Build, was the largest project undertaken thus far in the Airport's history, with construction occurring between 2009 and 2013. It was so named because of the Authority's commitment to sustainability, the environment, and positive economic impacts. The project included the construction of ten new gates, a dual-level roadway, enhanced curbside check-in, expanded concessions, and additional security lanes. The project received LEED Platinum certification.[5]

Airport Sustainability Plans

The Airport has developed a robust, multi-faceted sustainability program that spans the breadth of Airport operations. The sustainability program includes a number of related sub-plans, of which this Strategic Energy Plan is one. Others include the Water Stewardship Plan. Given the potential synergies between the sustainable focus areas, it is critical that the plans are not developed in isolation and that the optimal solution is developed that balances overall Airport performance and cost. **Figure 2** shows how the Strategic Energy Plan integrates with current Airport policies.

4 San Diego International Airport. Airport Development Plan, 2016. Available online at: http://www.san.org/Airport-Projects/Airport-Development-Plan, accessed May 2, 2016.

5 San Diego International Airport. The Green Build, 2016. Available online at: http://www.san.org/Airport-Projects/The-Green-Build#134085-fact-sheet, accessed May 3, 2016.

Existing Energy Infrastructure

Creating An Electrical Microgrid

The Airport is tied into the local utility grid, operated by San Diego Gas & Electric (SDG&E), through three substations, Old Town C-124, Kettner C-457, and Point Loma C-496. The capacity of this existing incoming electrical infrastructure, including recent upgrades, is sufficient to meet all of the Airport's energy needs for at least the next decade.

As part of an infrastructure upgrade program, the Airport recently invested in the provision of a 12 kilovolt (kV) loop throughout the Airport campus in order to provide a robust microgrid distribution network. Use of a microgrid allows for local management of power, both connected to the local SDG&E grid and also disconnected (as in the case of a power outage). This upgrade to the Airport's energy infrastructure provides value for the Airport in terms of increasing efficiency, reliability, and resiliency.

The investment in the 12kV infrastructure provides the main backbone to the energy infrastructure and provides the Airport with a tremendous opportunity to create a campus microgrid that allows for maximum synergies between future energy efficiency and on-site generation efforts. The microgrid provides more control and flexibility in both the mix of the energy sources used as well as the strategy for energy generation.

The automated systems controlling the microgrid allow for shifting loads during power crises, reducing consumption during peak times, and identifying problems in the distribution system. This powerful new system will be a cornerstone of the Airport's energy management actions, allowing for lower operation costs, greater redundancy and thus resilience in the system, and limiting unnecessary blackouts.

Creating a High Performance Building Portfolio

The Airport recognizes that its facility portfolio is both the largest consumer of energy and provides the greatest opportunity for enhancing performance through the deployment of energy efficiency and generation strategies. As part of the Airport's MOU with the State, the Airport is strives to ensure that all new buildings will achieve minimum LEED Silver certification, which is evident in recent building projects that have met or exceeded this goal (Receiving and Distribution Center, FBO, Terminal 2 West and the Smart Curb). Concurrent with the new build program, the Airport has also undertaken a number of efforts to enhance the energy performance of the existing portfolio, having undertaken energy auditing and retro-commissioning efforts in recent years.

> The Airport recognizes that its facility portfolio is both the largest consumer of energy and provides the greatest opportunity for enhancing performance through the deployment of energy efficiency and generation strategies.

The Heart of The Airport

The passenger terminals are currently served by a Central Utility Plant (CUP). Constructed in 1996 and extensively upgraded as part of the Green Build project, the CUP supplies chilled water and space heating hot water to each of the existing terminals. The CUP meets the existing peak cooling demand and has the ability to accommodate some additional capacity that will allow for some of the planned growth within the Airport campus. To ensure that future need will be met, the Airport has identified the potential need for a new satellite CUP to serve the future Terminal 1 once it is redeveloped under the ADP. Thermal energy comprises both a significant demand and significant opportunity in the Airport's energy portfolio and forms a critical area of focus for the energy roadmap.

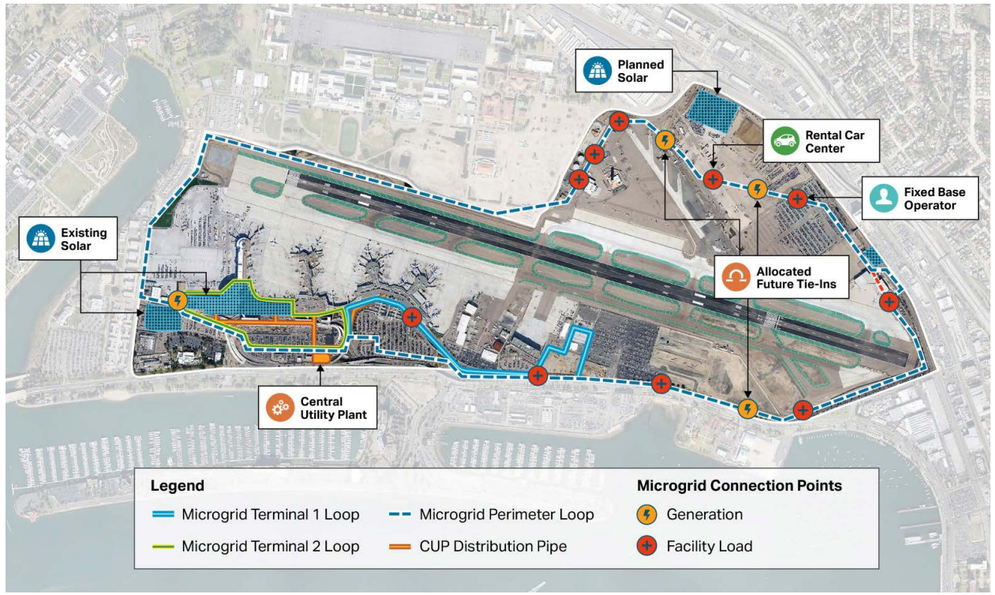
> The Airport is committed to ensuring that all new buildings will achieve a minimum LEED Silver certification.

Embracing a Renewable Future

The Authority has made a significant commitment to on-site renewable energy at the Airport, with over 3.3 MW of solar photovoltaic (PV) energy recently installed on the roof of Terminal 2 West and on shade structures of the adjacent parking lot. These existing installations offset approximately ten percent of the Airport's annual electricity consumption. The Airport has also executed a Power Purchase Agreement (PPA) for installing an additional 2.2 MW at the Northside Economy Parking. Once constructed, the array will increase the Airport's total solar energy generation capacity to 5.5 MW.

There is also the option to increase the Northside Parking lot capacity up to 5 MW, which, combined with a possible 2.1 MW PV array on the Rental Car Center roof, provides the Airport with the potential to generate over 25 percent of annual electricity use. It is however noted that solar capacity beyond 7 MW will likely generate more electricity than can be consumed during the peak sun times, leading to potential wasted energy. **Figure 3** summarizes the existing energy infrastructure located at the Airport.

Figure 3: Existing Energy Infrastructure at the Airport



Airport Energy Use

Annual Energy Use Trends

Despite an increased focus on energy efficiency over the past five years, the Airport's energy usage has increased due to the addition of new facilities and greater passenger capacity, as shown in **Figure 6**. In Fiscal Year 2015, the Airport consumed approximately 5,000 megawatt-hours (MWh) of energy as well as more than 50,000 therms of natural gas during the peak months (September and January, respectively). However, the overall energy use intensity (EUI) has decreased slightly over the same timeframe, likely due to more energy-efficient operations.

Where The Energy is Consumed

Figure 5 shows the energy use at the Airport by facility. Terminals at the Airport account for 70 percent of all energy use at the Airport. This includes the CUP, which generates hot and chilled water to meet terminal air conditioning demands. As shown in **Figure 4**, the majority of energy use at the Airport is derived from process use, such as ground power, jet bridges, baggage handling systems and plug loads (energy used by products like computers, which are plugged into wall outlets). Besides equipment, other primary categories of energy use include lighting, heating, cooling, auxiliary, and hot water.

Figure 4: Energy Use by End Use

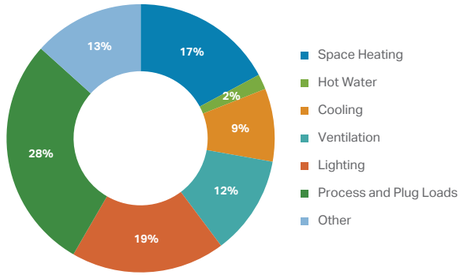


Figure 5: Energy Use by Facility

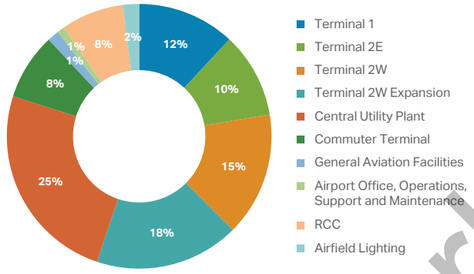
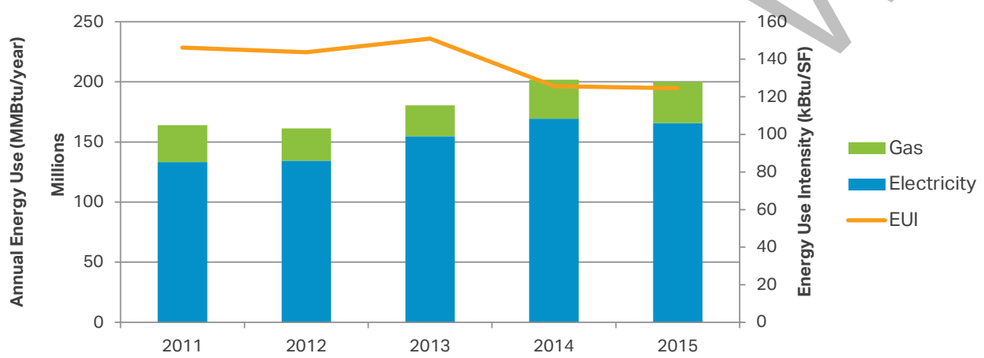


Figure 6: Historical Energy Use Trend



AIRPORT VISION FOR ENERGY LEADERSHIP

Figure 7: Historical Energy Use Trend

Airport Strategic Energy Planning Methodology

This Strategic Energy Plan has leveraged a robust 12-step process, shown in **Figure 7**, that focuses on exploring ideas and synergies centered around four underlying questions:

- Where are you?
- Where do you want to go?
- Where are your opportunities?
- How will you get there?

Through this holistic process, the Energy Master Planning team is able to identify potential strategies that maximize synergies with existing Airport initiatives; are as cost effective as possible; and emphasize progress towards the Airport's overall goals.

The Strategic Energy Plan calls for immediate actions and growth, intentionally capitalizes on existing plans and strategies for the Airport, and allows for growth and refinement as the Airport moves forward.

Focused Energy Goals

The Strategic Energy Plan is comprised of five goals that provide a holistic approach to energy management at the Airport, incorporating opportunities for improvement at every level of energy use. They cover a wide array of project types, ranging from education and collaboration to major capital expenditures. The five goals of the Strategic Energy Plan are:

1. Conservation and efficiency;
2. Carbon neutrality;
3. Interdependence and resiliency;
4. Cost containment; and
5. Regional and industry leadership.

For each of these goals, the Airport has established several potential actions which support attainment of the particular goal. Each goal also identifies one or more metrics that will be used to quantitatively assess the Airport's success in meeting its goals. The Authority has also identified linkages between the Strategic Energy Plan and the ADP and/or CIP.

Finally, an implementation roadmap is presented to clearly identify the steps that the Airport can take to achieve the overall vision of this Strategic Energy Plan.

Stakeholder Engagement

AIRPORT STAKEHOLDERS

Stakeholder engagement has been a crucial part of the Strategic Energy Plan process, with a broad spectrum of Airport stakeholders actively engaged throughout the development of the energy roadmap.

A key mechanism leveraged to create the necessary collaboration and capture stakeholder views and ideas is the creation of a cross-departmental Utility Working Group (**Figure 8**) that incorporated members of the following departments:

- Facilities Management (FMD)
- Facilities Development (FDD)
- Airport Design & Construction (ADC)
- Business & Financial Management (BFM)
- Environmental Affairs (EAD)
- Airport Planning (AP)
- Terminals & Tenants (T+T)
- Information and Technology Services (I+TS)

Meeting on a monthly basis, this group has been actively engaged in the development of the energy strategies and implementation roadmap.

In addition to the regular meetings, the Utility Working Group also participated in a focused charrette that was used to refine and expand the original Airport Authority's Energy goals that form the cornerstones of this Strategic Energy Plan and roadmap.

Beyond the creation of the original Strategic Energy Plan and Road Map, it is envisioned that the Utility Working Group will drive the ongoing strategic engagement and cross departmental coordination required to implement the actions identified and achieve the resilient energy goals outlined.

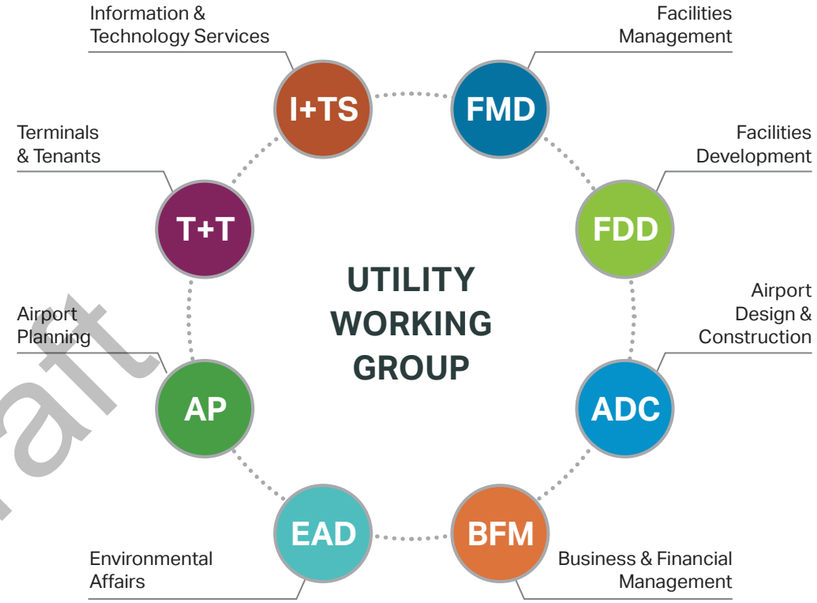


Figure 8: Utility Working Group

AIRPORT TENANTS

Energy usage on the campus is critically linked not only to the Authority but also to all of the tenants, airlines, business partners, and members of the public traveling through the Airport. Effective and substantive engagement, tailored to each stakeholder, must occur in order for the Airport to maximize its energy goals and to successfully achieve its vision of becoming a carbon neutral airport. Each stakeholder plays a vital role in how energy is generated and consumed on the Airport campus. The Authority is uniquely positioned to be a leader in this effort, encouraging and supporting Airport stakeholders' endeavors as the Authority and other stakeholders work together to progressively grow the sustainability of the Airport campus and operations.

IMPLEMENTATION ROADMAP

Each goal in the Strategic Energy Plan contains several actions that, when implemented, will help the Airport realize its potential for strategic energy management. By identifying a diverse array of actions that each help reach these goals, the Airport sets a course leading towards carbon neutrality in a financially feasible manner, consistent with the ADP and CIP. The Strategic Energy Plan calls for immediate actions and growth, intentionally capitalizes on existing plans and strategies for the Airport, and allows for growth and adaptation as the Airport moves forward. The combination of flexibility and commitment contained within this plan ensure the growth of the Airport in terms of sustainable energy, while allowing innovation and other future variables to be integrated into the plan.

1

Conservation and Efficiency

CONSERVATION AND EFFICIENCY

The Airport will actively promote a culture of energy efficiency and conservation through quantifiable metrics and demonstrated energy leadership.

Introduction

The first steps towards an effective and comprehensive energy strategy are to minimize demand through conservation measures and to utilize energy in the most efficient manner possible. Energy conservation generally provides the best return on investment, and the Airport has identified a number of opportunities to better use and manage energy. Reducing energy demand also reduces the demand for energy generation and therefore energy infrastructure, yielding a lower cost of investment. The Airport has effectively enacted energy conservation and efficiency opportunities in the past. This Strategic Energy Plan builds upon these opportunities by identifying additional opportunities that provide room for growth. The implementation of effective energy conservation methods will allow the Airport to select alternative energy generation options that are properly sized for its needs, thereby minimizing superfluous spending. This plan approaches energy conservation from several angles, including influencing the behavior of those who occupy and use the facilities; improving the controls in building systems; and upgrading equipment with new and more efficient replacements.

Metric

Various EUI metrics will be used to measure progress in regards to this goal.

- Energy Use (kBtu) per Square Foot (sf) of the overall airport facility portfolio within the airport.
- Energy Use (kBtu) per passenger who travels through the airport.
- Energy Use (kBtu) per flight arriving and departing from the airport.

In addition to the creation of these metrics, the comparison against the 2015 Baseline year along with year-on-year change will be monitored to address overall program success and identify relevant trends. The energy efficiency targets outlined in **Table 1** were developed as realistic and ambitious targets for the Airport to achieve.

Table 1: Energy Efficiency Target—*(Compare to 2015 baseline)*

Energy Use Intensity Reduction (2015 baseline)	Target Year	Timeframe
10%	2020	Short-term
20%	2025	Medium-term
30%	2030	Long-term

Critical Areas of Focus to Drive Change

A. Sub-Monitoring

B. Energy Auditing

C. Retro-Commissioning

D. Monitoring Strategy

E. Provide Incentives to Promote Energy Conservation & Stewardship

F. Integrate Energy Conservation & Resilient Design in Tenant Improvement Guidelines

G. Engagement & Education

A. SUB-MONITORING

A vital component of effective energy conservation and improvements to efficiency is implementation of a robust sub-monitoring program in order to provide Airport stakeholders and tenants with energy performance analytics. Collecting more specific and detailed information will help apprise the Airport and its tenants of their energy usage and allow for more informed decision-making. Data collected by sub-monitors will cover peak, annual and day time usage trends. The move to the 12 kV microgrid, provides a number of benefits to the Airport in terms of energy management, including simplification of billing for energy through utility meter consolidation. However, meter consolidation provides less detailed information on consumption and usage activities. Generally, the meters located on campus are limited to the main incoming meters at each building.

Installation of sub-monitors will allow the Airport to gather detailed data on energy usage in order to identify the best projects to implement in terms of efficiency. The current structure of most tenant leases does not directly account for the costs of utilities consumed by tenants. Monitoring tenant usage directly will allow for more equitable sharing of costs related to energy use between the Airport and its tenants, discouraging excessive energy consumption and potentially creating incentives to conserve energy. As part of the Airport's Green Build project, sub-monitors were installed in many of the new tenant spaces. However, not all of these sub-monitors are currently active. Implementation of a thorough sub-monitoring program will allow the Airport to better measure and monitor energy usage. Sub-monitors for water, electricity, natural gas, and chilled water are all an essential part of creating a robust and resilient view of energy use at the Airport.

B. ENERGY AUDITING

Energy auditing will provide a mechanism to ensure that all of the Airport's efforts to improve energy efficiency and promote conservation are properly maintained and remain effective throughout the life of its facilities. The energy auditing process will identify potential opportunities for energy performance improvement in facilities. Buildings function as complex machines, and generally become sub-optimal over time in terms of energy consumption. Energy auditing and subsequent retro-commissioning are not a one-time event, but rather a long-term, ongoing maintenance activity, providing periodic "tune-ups" for the facilities. Energy auditing is the first step in recalibrating and optimizing the buildings, ensuring they continue to operate at peak efficiency and that any issues are caught and addressed. Energy auditing provides a diagnostic tool to identify potential savings; further efforts are required to ensure that measures are actually implemented to capture cost and energy savings.

An effective auditing process will include reviewing all facilities at least once every five years, balancing the benefits of auditing with the costs to do so. The review results will be used to implement projects in a multi-tier approach, based on how long a project will take to pay back its cost in savings, with strategies bundled as required to achieve the optimal implementation timeline. This approach will allow small- and mid-scale measures to be implemented quickly through the existing CIP and Major Maintenance protocols.

Initial Investment Payback Period	Implementation Timeline
Less than 2 years	Within 2 years of identification
2 – 5 years	Within 3 years of identification
More than 5 years	Follow standard Airport CIP timeline

Photo courtesy of Flickr Creative Commons © San Diego County Regional Airport Authority

SDG&E offers an energy auditing program that the Airport can leverage to enhance energy efficiency while minimizing costs. It also helps identify all available SDG&E incentives that can be leveraged to help facilitate the implementation of energy conservation strategies. A recent SDG&E sponsored energy audit on the Airport campus identified more than $1.6 million in annual energy cost saving opportunities. This highlights the value of energy auditing and emphasizes the substantial savings that can be obtained through regular and consistent upkeep of the facilities. The auditing process and commitment to follow-up will ensure continual enforcement of the Airport's efforts and continual improvement in efficiency. **Table 2** summarizes the results of the SDG&E audit.

Implementation of projects identified through the recent SDG&E audit, as well as future audit findings, may be best served through bundling of projects based on the criteria described above (grouping projects by time required for payback). In the case of the recent audit, bundling allows for the scope of projects that can be implemented immediately to be expanded from $939,227 in annual savings to $1,517,323 in annual savings. Timely implementation of measures identified in energy audits will allow the Airport to maximize energy savings.

Table 2: SDG&E Energy Audit Results

Project Category	Electricity Savings (kWh)	Electric Demand Savings (kW)	Gas Savings (Therms)	Water Savings (kGal)	Cost Savings	Estimated Net Implementation Cost	Estimated Payback (years)
Immediate projects (payback < 5 years)	5,624,339	373	72,323	428	939,227	2,042,458	2.17
Central Plant Upgrade Projects	447,704	437	4,935	-	109,455	2,559,453	23.38
Alternative Energy Projects	-	529	-	-	253,855	1,452,010	5.72
Other CIP Projects	2,295,009	331	-	1,612	324,241	4,103,724	12.66
Project Bundles							
Bundle 1 (immediate plus other non alt energy or CUP projects)	7,919,348	704	72,323	2,040	1,263,468	6,146,182	4.9
Bundle 2 (all except CUP)	7,919,348	1,233	72,323	2,040	1,517,323	7,598,192	5.0

Notes: kWh = kilowatt-hours; kW = kilowatt; kGal = kilogallons. Source: SDG&E, 2016

C. RETRO-COMMISSIONING

The energy audits discussed above will identify opportunities for new, higher efficiency technologies to be installed as well as for existing systems to be reset and operated in line with their original design parameters. When robustly implemented, retro-commissioning commonly can achieve 10 percent reductions in energy consumption. Applying several recommendations will permit the Airport to maximize the effectiveness of retro-commissioning. SDG&E offers incentive funding to support retro-commissioning (Retro-Cx), an opportunity the Airport will likely be able to leverage as part of its energy efficiency efforts. There is also an opportunity for the Airport to expand its in-house commissioning expertise, developed through its previous efforts with the Green Build project, in order to effectively deploy retro-commissioning throughout the campus. The Airport will develop a robust commissioning program which provides templates usable for any of its needs. These include specifications and plans for commissioning and retro-commissioning, test protocols for major systems both prior to and during regular usage, and holistic test protocols that verify the inherent interactions between the various systems necessary for the effective operation of the airport.

D. MONITORING STRATEGY

In order to continually optimize the energy performance of the Airport campus as part of an ongoing commitment, the Airport must ensure that it has the best information to make effective decisions. This information must be effectively collected, filtered, and communicated to the proper recipients in a timely manner for these decisions to be feasible. The Terminal 2 West expansion, as part of the Green Build project, incorporated the deployment of the Automated Infrastructure Monitoring and Management System (AIMMS), the first step in creating the Airport's monitoring platform. AIMMS captures data from multiple systems in the Airport via more than 2,000 data points, including systems that are critical to implementation of a strategic energy management system. However, recent system upgrades at the Airport have resulted in AIMMS not currently being operational. As part of this Plan, it has been recommended that the energy-related functions of AIMMS be refined, and that the system also be expanded beyond its existing location in order to incorporate the other facilities operating on the campus.

Efforts to monitor and manage energy will focus on two primary areas: tactical activities and strategic activities. Tactical activities are those activities which are associated with the day-to-day operation of Airport energy systems. Tactical energy management efforts are controlled through existing Airport building management systems. These are installed within each facility, allowing Airport staff to monitor alarms through this existing infrastructure.

Strategic activities are related to the overall energy activities, and will be utilized to encourage rollout of the energy program. These activities will also monitor the ongoing success of the program. Implementation of strategic activities will require substantial amounts of data from several systems within the Airport, including passenger transit monitoring, freight transit monitoring, and both primary energy metering and sub-monitoring for all utilities (as described above). This information will be collected and evaluated to better recognize trends and metrics on energy usage, and can be used to better inform decision-makers.

Several groups within the Airport organization will be able to put this data to use for strategic activities. Facilities Management staff will be able to benchmark between similar energy consumers, such as the baggage handling systems and various tenants. Outlier tenants will be identified, allowing for further investigation into energy usage. Facilities Management staff will also be able to better understand the Airport's energy needs, providing guidance on the future plans for CUP improvements (for both optimization of the existing plant and design of any future plants).

Environmental staff will be able to compare the energy usage information, at monthly and yearly levels, for the different end uses that consume energy as well as the types of fuel used to produce energy. They may also evaluate actual performance against the Airport's energy goals and the broader goals of sustainability. Furthermore, this information will be valuable for informing the annual sustainability report for the Airport. In addition, senior leadership will have access to a single portal for metrics and trend information related to energy, allowing them to see a snapshot of the Airport's performance in relation to the goals, and its progress in following the road map to a more resilient energy future. Strategic energy monitoring and management functionality could be deployed via several methods, which are described in **Table 3**. The Airport will solicit bids through a competitive process in order to determine which of the following strategies can provide the needed functionality while balancing costs, for both initial capital investment and lifelong maintenance.

Table 3: Potential Strategic Energy Monitoring and Management Methods

Solution	Solution Strategy	Broad Business Intelligence Solution	Specialist Energy Solution	Expandable Solution	Proven Energy Focused Functionality & Analytics	Customizable Platform	Creation of Cross-functional Metrics	Ability to Sit Within Existing Platform	Ability to Scale Over Existing Portfolio
		Benefits							
Enhanced AIMMS solution	Enhance existing AIMMS solution to provide access to all necessary information and	•		•		•	•	•	•
Fully Customizable Business Intelligence and Analytics solution	Deploy a new business intelligence	•		•		•	•	•	•
Dedicated Energy Management solution	Deploy a specialist energy monitoring and strategic management tool		•	•	•	•		•	•

Source: San Diego County Regional Airport Authority, 2016

E. PROVIDE INCENTIVES TO PROMOTE ENERGY CONSERVATION & STEWARDSHIP

The Airport plans to promote energy efficiency and conservation not only through new technology and smart management of facilities, but also through coordination with stakeholders. The Airport's wide range of tenants depend on energy to conduct business. Current tenant agreements do not emphasize energy conservation, despite the direct influence that tenants' energy consumption has on energy consumption for the whole campus. Rising energy costs make cooperation between the Airport and tenants an essential part of conservation.

A key opportunity to integrate these incentives is during the lease negotiation process (both new and existing). The Authority will work alongside tenants to identify areas where energy efficiency can be promoted without impacting the tenants' ability to perform their main functions. New tenant construction will be required to incorporate the aforementioned sub-monitoring, providing both tenants and the Airport with insight regarding tenant energy usage. This objective source of energy data will promote accountability, ideally permitting the implementation of fairer tenant financial liabilities and incentives for energy management.

The Airport is already exploring ways in which to further develop a green concessions program in conjunction with its existing Water Stewardship Plan. This type of program will reward adoption of sustainability principles in the offering of concessions, and provides passengers with an opportunity to support concessions with sustainable practices on the Airport campus. Energy is as critical as water to this program, and will be a central factor in the Airport's collaboration with its tenants. The Authority will enhance employee awareness about energy use, and recognize and reward tenants and their staff for conserving and using energy wisely.

F. INTEGRATE ENERGY CONSERVATION & RESILIENT DESIGN IN TENANT IMPROVEMENT GUIDELINES & DESIGN REVIEW PROCESS

Beyond incentivizing tenant energy conservation, the Airport will embed its stewardship mission into the design phase of tenant improvements. This represents a crucial time in the tenant process, before any construction occurs, where energy usage can be greatly controlled and limited through proactive design, at relatively lower costs by eliminating the need for retrofits. The tenant improvement guidelines are a central repository for design and operations considerations, and are an ideal vehicle for implementing energy efficiency and control standards for tenant-led projects. Design review teams will be educated on these guidelines and will review tenant projects in light of the Airport's goals for carbon reduction and energy conservation. Equipped with the technical knowledge to review the impact of projects on energy, staff will be able to influence energy usage through their review process.

G. ENGAGEMENT & EDUCATION

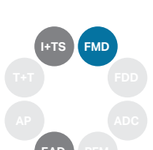
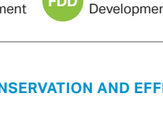
Without its tenants, the Airport will not be able to perform many of its major functions, from moving passengers, cargo, and visitors to providing rental cars and feeding the public. However, the collective environmental footprint of the Airport's business partners is greater than the Authority's own footprint, and they therefore must be fully engaged in the Airport's energy management efforts. The Airport recognizes that in order to use energy in the most efficient way possible, engagement with all stakeholders is crucial. Energy education will be established as an initiative spanning all Airport stakeholders. The previously described sub-monitoring allows tenants to understand their energy consumption and how it relates to campus wide energy use, enabling incentives for integration of conservation measures into their business.

By providing a framework in which tenants can operate more sustainably, the Airport will further improve its energy efficiency by engaging the entire campus. The Airport will also integrate conservation and resilient design principles and specifications into tenant improvement guidelines and the design review process, and provide a green leasing strategy for tenants. As a global leader in sustainability, the Airport is well positioned to provide educational opportunities to all of its stakeholders, enabling them to leverage the energy and cost saving benefits of increased efficiency and conservation.

Tenants range from small kiosk operators to major aircraft maintenance facilities. The Airport will utilize all of its engagement channels to reach its business partners, identifying opportunities where the Airport can make the greatest impacts towards its cumulative energy usage and shared progress towards conservation. The ultimate goal is to foster a strong culture of energy stewardship among all members of the Airport ecosystem, from the Authority's full organization to all of its business partners.

IMPACT AND IMPLEMENTATION

Table 4: Conservation and Efficiency—Implementation Plan

Focus Area	Critical Activities		Responsibility	Time Horizon
A. Implement a robust sub-monitoring program 	A.1	Identify sub-monitoring locations, based upon tenant lease lines and major systems energy consumption.	FMD / FDD	2 years
	A.2	Re-connect existing electrical sub-monitors that were installed as part of the Green Build.	FMD	2 years
	A.3	Develop sub-monitoring deployment strategy.	FMD / FDD	2 years
	A.4	Install sub-monitoring across all existing facilities.	FMD	5 years
	A.5	Incorporate sub-monitoring requirements within the Airport design specifications for all new construction projects.	ADC / FDD	0 - 2 years
B. Implement an energy auditing process for all facilities 	B.1	Leverage SDG&E's Energy Auditing program as the primary mechanism to implement the regular audits on a 5-year cycle.	FMD	5 years
	B.2	Refine procurement protocols to facilitate the expedited deployment of energy projects identified through the audit.	FMD / FDD	2 years
	B.3	Deploy energy projects identified through 2016 audit with a payback < 5 years.	FMD / FDD	2 years
C. Retro-commissioning	C.1	Develop standard Commissioning and Retro-Cx process for use within the Airport.	FMD	2 years
	C,2	Leverage SDG&E Retro-Cx incentive program to lessen the cost of implementing retro-commissioning.	FMD / EAD	5 years
	C.3	Incorporate Retro-Cx requirements into tenant lease agreements.	BFM	5 years
	C.4	Incorporate Retro-Cx requirements into Terminal 1 redevelopment requirements	ADC	5 years
D. Execute active energy management and monitoring	D.1	Develop RFI process to explore potential strategies to facilitate the monitoring and strategic management of the Airport's energy performance.	FMD / EAD	2 years
	D.2	Develop RFP based upon information collected through RFI process to procure a new strategic energy management platform that will interact with the broader AIMMS platform.	FMD / EAD	2 years
	D.3	Deploy strategic energy management and monitoring platform.	FMD	2 years
	D.4	Provide education of Airport Authority stakeholders in the strategic energy platform .	EAD	2 years

FMD Facilities Management · FDD Facilities Development · ADC Airport Design & Construction · BFM Business & Financial Management · EAD Environmental Affairs · AP Airport Planning · T+T Terminals & Tenants · I+TS Information & Technology Services

Supporting Team

Table 4: Conservation and Efficiency—Implementation Plan *continued*

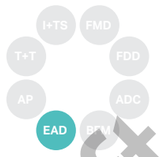
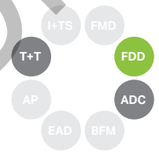
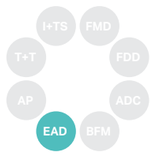
Focus Area	Critical Activities		Responsibility	Time Horizon
E. Provide Incentives to Promote Energy Conservation and Stewardship 	E.1	Enhance energy performance requirements, and incentives for efficient operation into Airport's new green concessions program.	EAD	2 years
F. Integrate Energy Conservation & Resilient Design in Tenant Improvement Guidelines & Design Review Process 	F.1	Incorporate energy performance requirements into Airport Design Standards.	FDD / ADC	2 years
	F.2	Incorporate energy performance requirements into Tenant Design Guidelines.	FDD / T+T	2 years
	F.3	Enhance internal design review process to include evaluation of energy performance of proposed tenant solutions.	FDD / T+T	2 years
G. Enhanced stakeholder engagement to optimize Airport operational efficiency 	G.1	Create and deploy energy education program.	EAD	2 years

Table 5: Conservation and Efficiency—Integration Plan

Focus Area	ADP Integration (L/M/H)	CIP Integration (L/M/H)
Implement a robust sub-monitoring program	Low	Medium
Implement an energy auditing process for all facilities	Low	Medium
Retro-commissioning	Low	Medium
Execute active energy management and monitoring	Low	Medium
Provide Incentives to Promote Energy Conservation and Stewardship	Low	Low
Integrate Energy Conservation & Resilient Design in Tenant Improvement Guidelines & Design Review Process	Medium	Medium
Enhanced stakeholder engagement to optimize Airport operational efficiency	Low	Low

Carbon Neutrality

2

CARBON NEUTRALITY

The Airport will promote the use of low carbon energy sources by the Authority and its tenants.

Photo courtesy of Flickr Creative Commons © Pablo Mason

Introduction

A multifaceted approach to energy usage must be initiated in order to meet the goal of operating a carbon neutral airport. The Airport will generate its own renewable energy where technically and financially feasible, and will take advantage of existing and prospective contracting methods to purchase cleaner and more affordable energy. This increased reliance on renewable power will be complemented by further developing already successful environmental stewardship efforts at the Airport, including the electrification of the airside and landside vehicle fleet.

Participating in the ACA program and developing a CAP specific to the Airport will provide further guidance for its stewardship of the environment. Partnering with the tenants and airlines in maximizing energy efficiency will be critical to the overall success of this goal.

Metric

A key metric for assessing the Airport's progress towards meeting this goal is the percentage of the Airport's energy supply portfolio that comes from renewable sources, both on-site and off-site utilities.

The metrics that will be monitored include:

- % of energy generated by on-site renewable energy sources.
- % of energy generated by off-site renewable energy sources.

In addition to the creation of these metrics, the comparison against the 2015 Baseline year along with year-on-year change will be monitored to address overall program success and identify relevant trends. The carbon neutrality targets outlined in **Table 6** were developed as realistic and ambitious targets for the Airport to achieve.

Table 6: Carbon Neutrality Target

Percentage of Renewable Energy	Target Year	Timeframe
30%	2020	Short-term
60%	2025	Medium-term
100%	2030	Long-term

Critical Areas of Focus to Drive Change

A. Install renewable energy generation in a cost effective manner

B. Green Energy Procurement

C. Maximize synergies between systems (i.e. energy, water, waste, transportation, etc.)

D. Complete a Climate Action Plan and participate in Airport carbon accreditation

A. INSTALL RENEWABLE ENERGY GENERATION IN A COST EFFECTIVE MANNER

Alternative energy is already at the forefront of the Airport's sustainable development initiatives, as apparent in the incorporation of solar PV energy in their existing developments. With 3.3 MW of PV energy already implemented on the Airport campus, and an additional 2.2 MW planned, the Airport is establishing itself as a growing renewable energy user. Nearly 20 percent of the Airport's energy is currently generated by PV, a technology that is both clean and robust, and this will increase further once the planned Northside PV array is active. This technology is a 'zero carbon' power source, and thus a powerful tool to help reach carbon neutrality. The Airport can construct and operate approximately 6 MW of PV generation capacity before it reaches a point of over-generation, where more electricity is created than can be used. The potential for exceeding this capacity is substantial: based on the available rooftops and parking lot areas where PV could be installed, the Airport could generate 15 MW of energy through PV arrays. While this capacity would over-generate if no additional measures are put in place – by 2030 a peak demand of 14 MW is anticipated – there is significant potential for energy storage systems to be installed as well. These systems would capture the Airport's full generating capacity, allowing the Authority to harness and use this power at any time of day.

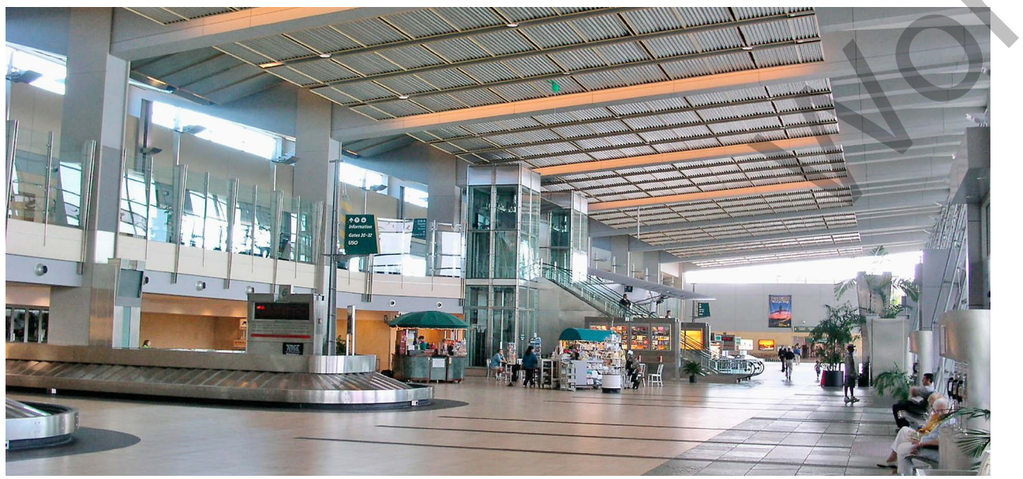
The Authority also has identified the need to have a diverse energy portfolio, and is researching the potential of alternative energy generation options beyond PV to meet the Airport's need. A key technology that has been identified for potential implementation in the near future is fuel cell technology. Fuel cells will be operated on the Airport as part of the CUP and provide clean energy from natural gas or biogas. This technology is unique in that gas is converted into energy through a chemical reaction rather than through combustion. When paired with carbon mitigation, fuel cells would provide a base electrical supply that has a net-zero carbon footprint. These cells would not only support the goal of carbon neutrality, but also will meet up to 50 percent of the demand for electricity each year. Fuel cell technology represents a prime opportunity to integrate on-site renewable energy into the Airport's energy generation portfolio, providing a more diverse, sustainable, and resilient supply of energy to meet present and future needs. Alternative financing mechanisms, such as third party financing or grant opportunities, will enhance the feasibility of implementing this technology in a cost effective manner.

B. GREEN ENERGY PROCUREMENT

A critical opportunity in meeting the Airport's goal of carbon neutrality is strategic leveraging of Direct Access (DA) and Community Choice Aggregation (CCA) programs. DA programs provide the option of purchasing power from marketers and power brokers, known as electric service providers (ESPs). Purchasing through these ESPs provides an alternative to the traditional avenue of purchasing power through SDG&E, thereby providing more options to obtaining energy which may be cleaner, cheaper, or both. DA programs provide potential carbon and energy cost benefits, and the Airport is committed to maximizing these benefits through the purchase of energy from these sources. The Airport is already contracted through such a program with a supplier of natural gas, and are high on the wait list of purchasers for DA electrical power when additional capacity is made available later this year. New DA enrollments have been phased in over the last 4 years, and new enrollments are now capped, with future enrollment subject to a lottery process. The legal framework surrounding DA markets is anticipated to shift if SB-286 is adopted, which will deregulate these markets. This will open the door for the Airport to purchase and utilize more low-carbon electricity as part of an energy portfolio supportive of carbon neutrality.

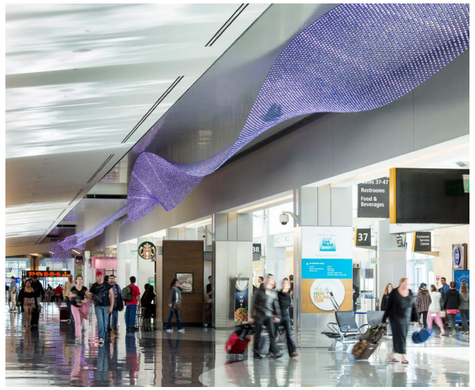
CCA programs similarly represent a strong opportunity for the Airport to diversify its energy portfolio and reduce both costs and environmental impacts. Through a CCA program, a local government— i.e. the City of San Diego or County of San Diego—creates an entity which buys electricity in bulk on behalf of local customers. This allows local residents and businesses to access cleaner, cheaper energy without ties to the standard utility provider, and permits customers to have a say in both the fiscal and environmental cost of their energy. The City of San Diego is reviewing a CCA as a strategy to meet their 100 percent renewable energy goal (set forth in the City's CAP as previously discussed). The Airport is monitoring this prospective option for cleaner energy, and is prepared to participate, not only as a customer but potentially as a supplier to local customers, through the sale of excess generation.

The City of San Diego is reviewing a Community Choice Aggregator program as a strategy to meet their 100 percent renewable energy goal.



C. MAXIMIZE SYNERGIES BETWEEN SYSTEMS (I.E. ENERGY, WATER, WASTE, TRANSPORTATION, ETC.)

The Airport's utility and transportation systems are fundamentally interconnected, and there is ample opportunity to leverage these synergies in order to reduce the Airport's overall environmental impact and carbon footprint. The cooling towers at the CUP are the single largest consumer of water on the Airport campus. The Authority is committed to exploring ways to reduce water consumption related to the HVAC system, and to utilize non-potable water in order to eliminate use of potable water where feasible. The Authority's Water Stewardship Plan further identifies HVAC condensate as a source of non-potable water for the Airport. Specifically, Action 2 of the Water Stewardship Plan describes development of a water reuse infrastructure plan.



D. COMPLETE A CLIMATE ACTION PLAN AND PARTICIPATE IN AIRPORT CARBON ACCREDITATION

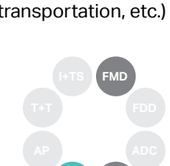
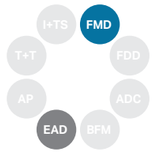
San Diego International Airport low-water landscaping.
Photo courtesy of Flickr Creative Commons © San Diego County Regional Airport Authority

A CAP outlines policies and measures which the Airport will enact in order to address climate change, including specific ways to reduce the emissions of GHGs. The CAP will also evaluate potential impacts from to climate change and measures which the Airport will put into place in order to increase its resilience in the face of climate change. Development of an Airport CAP is a high priority as part of the Authority's comprehensive strategy to pave the way for a sustainable future. The Authority is committed to developing a CAP in 2017.

The Airport plans to join ACA in 2017 and recognizes that this growing trend in the airport industry represents a valuable opportunity. The mission of the ACA (to promote and enforce the management and reduction of GHG emissions at airports) directly parallels the Airport's mission to become increasingly sustainable and ultimately carbon neutral. The annual carbon footprint reporting process complements the Airport's commitment to implement metrics that track progress towards the Strategic Energy Plan's goals.

IMPACT AND IMPLEMENTATION

Table 7: Carbon Neutrality—Implementation Plan

Focus Area	Critical Activities		Responsibility	Time Horizon
A. Install renewable energy generation in a cost effective manner 	A.1	Complete installation of 2.2 MW of additional PV in Economy Parking Lot as part of Borrego Solar PPA agreement.	ADC	2 years
	A.2	Coordinate location of fuel cells adjacent to existing central plant with new parking plaza design.	ADC / FDD / FMD	2 years
	A.3	Procure 1 MW of fuel cells through a Power Purchase Agreement (PPA).	FMD / ADC	2 years
	A.4 (IR A.4)	Install approximately 1 MWh of battery storage to work in conjunction with existing solar installations.	FMD / ADC	2 years
	A.5	Identify set-aside areas for approximately 3 MW of future solar.	AP	2 years
	A.6 (IR A.5)	Procure additional 3 MWh of battery storage to work in conjunction with existing solar installations.	FMD / ADC	5 years
	A.7	Procure additional 3 MW of solar to support the Terminal 1 redevelopment program.	ADC	10 - 15 years
B. Participate in Direct Access and Community Choice Aggregator (CCA) programs. 	B.1	Release RFP for Direct Access providers of electricity, leveraging the protocol used recently for natural gas.	FMD	2 years
	B.2	Monitor and engage with the City of San Diego's current exploration into the viability of a CCA program.	EAD	5 years
C. Maximize synergies between systems (i.e. energy, water, waste, transportation, etc.)	C.1 (CC D.1)	Develop EV Charging Energy as a Service business case.	EAD / BFM	0 – 2 years
	C.2	Optimize cooling tower operation to minimize potable water use.	FMD	0 – 2 years
	C.3	Collaborate with water stewardship team to explore opportunities to leverage HVAC condensate as a non-potable water source.	FMD	0 – 2 years

FMD Facilities Management · FDD Facilities Development · ADC Airport Design & Construction · BFM Business & Financial Management · EAD Environmental Affairs · AP Airport Planning · T+T Terminals & Tenants · I+TS Information & Technology Services

Supporting Team

Table 7: Carbon Neutrality—Implementation Plan *continued*

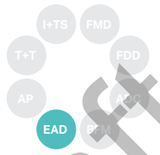
Focus Area	Critical Activities		Responsibility	Time Horizon
D. Complete a Climate Action Plan and participate in Airport Carbon Accreditation (ACA). 	D.1	Calculate carbon footprint associated with Energy program.	EAD	2 years
	D.2	Leverage Energy Master Plan to develop energy section of broader Climate Action Plan.	EAD	2 years
	D.3	Leverage Energy Master Plan to develop energy section of broader Airport Carbon Accreditation submittal.	EAD	2 years

Table 8: Carbon Neutrality—Integration Plan

Focus Area	ADP Integration (L/M/H)	CIP Integration (L/M/H)
Install renewable energy generation in a cost effective manner	High	High
(Green Energy Procurement) Participate in Direct Access and Community Choice Aggregator (CCA) programs.	Low	Low
Maximize synergies between systems (i.e. energy, water, waste, transportation, etc.)	Medium	Medium
Complete a Climate Action Plan and participate in Airport Carbon Accreditation (ACA).	Low	Low

3

Interdependence and Resiliency

INTERDEPENDENCE AND RESILIENCY

The Airport will incorporate a robust energy section within the Airport Business Continuity Plan that describes the interdependence of the Airport with the local community and its infrastructure to support resilient Airport operations.

Introduction

Incorporating the 12 kV microgrid at the Airport has laid the framework for developing a robust and resilient electrical system linking supply and demand across the entire campus. The existing Central Utility Plant (CUP) meets over 70 percent of the Airport's thermal loads, representing a significant energy resource already present on-site.

Capitalizing on the strength of this infrastructure, the Airport will vastly increase the reliability, efficiency, security, and quality of its power supply. For this reason, it is recommended that the existing Business Continuity Plan be expanded to incorporate an energy resiliency component.

The Performance Excellence in Energy Renewal (PEER) program, administered by Green Business Certification, Inc. (GBCI), provides another growth opportunity for the Airport. PEER, which is issued by the same organization which issues LEED certifications, is a system for evaluating power system performance. This rating system measures and helps improve the performance of a sustainable power system, including system reliability and resiliency; energy efficiency and environmental responsibility; operational effectiveness; and customer contribution. Implementing this rating system will not only benefit a sustainable power system but will also validate the Airport's credentials to the industry and the San Diego region.

Metric

The Airport will measure its success in increasing its resiliency by monitoring the number of hours for which it can continue its operations in the event of grid power outages at varying levels of service.

The metrics that will be monitored will include:

- Number of hours of potential operation at each service level (normal, medium, and critical)
- % of normal, medium, and critical Airport service levels airport that can be supported.

In addition to the creation of these metrics, the comparison against the 2015 Baseline year along with year-on-year change will be monitored to address overall program success and identify relevant trends. The resiliency targets outlined in **Table 9** were developed as realistic and ambitious targets for the Airport to achieve.

Table 9: Resiliency Target

Service Level	Duration	SDG&E Reliability Report
Normal	2 Hours	50%
Medium	6 Hours	17.5%
Critical	24 Hours	11.5%

Critical Areas of Focus to Drive Change

A. Install on-site energy generation and storage capacity

B. Prioritize Airport critical systems to ensure continued operations

C. Provide redundant systems to minimize disruptions to operations

D. Balance cost of resilience measures with benefit of undisrupted operations

A. INSTALL ON-SITE ENERGY GENERATION AND STORAGE CAPACITY

The Airport is in a prime position to enhance its facilities to provide a diverse and resilient infrastructure within the campus. The current CUP represents a central nexus for water usage at the Airport. While the CUP is currently in very good condition, it will require replacements/upgrades of some equipment over the next five to ten years. It is also estimated that future peak demand on the CUP will be approximately 50 percent above the current peak cooling demand and approximately 25 percent above the current peak heating demand, based on development plans and the estimated impact of climate change. The CUP presents both an opportunity to significantly enhance Airport resiliency by being the Airport's thermal heart and a challenge due to the space constraints. Furthermore, while it is in good working condition today, improvements and enhancements to the system will be required to maintain its existing capability and meet future demands.

The ability to store both thermal and electrical energy presents the Airport with a strong alternative for using energy that otherwise would be wasted. The ability to store energy on-site will provide considerable flexibility in how and when the Airport uses clean power generated by its PV and potential fuel cell systems. Systems critical to Airport operations could be powered by stored energy if the main power system is down, ensuring that operations will not be interrupted. Creating redundancy in these systems will also help minimize any potential disruptions to operations. The Airport will implement these methods where, and to the extent that, the cost is justified by the benefit of undisrupted operations.

The ability to store energy onsite will provide considerable flexibility in how and when the Airport uses clean power generated by its PV and potential fuel cell systems.

Thermal Energy Storage (TES) will allow the Airport to store thermal energy generated by existing activities at the CUP. This thermal energy could then be used to offset power needs, helping to provide energy during peak times of need. TES could provide additional capacity for chilling, and would increase resiliency by providing an effective backup to chillers. TES could be located near or within the new Terminal 1 in order to

Capitalizing on the strength of this infrastructure, the Airport will vastly increase the reliability, efficiency, security, and quality of its power supply.

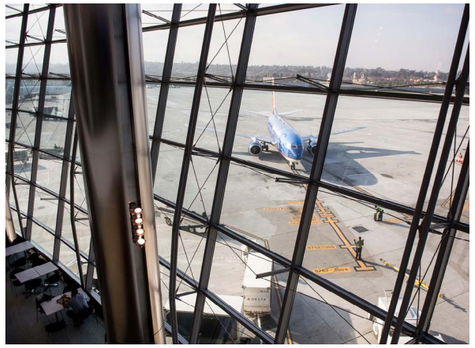
facilitate "trickle" charging at night.

Thorough analysis of the current energy demands and projected future energy demands, the Airport has identified the most advantageous implementation strategy for alternative energy on the campus. The Airport's recommended initial installation includes two MW of fuel cell power, 4 MWh of battery storage, and 5.5 MW of PV solar. This combination of generation and storage provides an excellent investment in the alternative energy base. In the medium and long term, the Airport will further expand its capacity to a total of 4 MW of fuel cell generation, 9 MWh of battery storage, and 8.5 MW of PV solar power.

Photo courtesy of Flickr Creative Commons © San Diego County Regional Airport Authority

B. PRIORITIZE AIRPORT CRITICAL SYSTEMS TO ENSURE CONTINUED OPERATIONS

By reviewing its energy consuming systems, the Airport will identify the facilities based on how critical they are to the overall mission of the Airport. Facilities will be classified based on whether they are life safety, mission critical, mission support, or non-essential facilities. This information will be used to prepare a load shedding strategy that will guide efforts by the demand response system to mitigate demand charges, during normal operations as well as during an emergency event. This prioritization will allow effective continuation of operations should demand exceed capacity in an emergency event, and will be a critical step in the development and measurement of the stated resiliency targets.



C. PROVIDE REDUNDANT SYSTEMS TO MINIMIZE DISRUPTIONS TO OPERATIONS

In addition to providing a diversified portfolio of energy sources, it is critical to provide an appropriate level of redundancy to facilitate the continued operation of the various functions within the Airport.

The proposed use of storage within the energy strategy, both in terms of TES and batteries, not only provides energy cost benefits but also enhances the ability of the energy infrastructure to support the airport's core functions in the event of equipment failure.

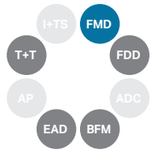
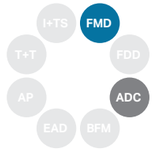
To better understand the overall redundancy required to minimize disruptions to airport operations, it is recommended that a redundancy study be conducted to identify where current spare capacity exists and where it is insufficient within the energy infrastructure. The resulting recommendations would be incorporated into the long term ADP and CIP strategic planning efforts to ensure that adequate budget and space are allowed.

D. BALANCE COST OF RESILIENCE MEASURES WITH BENEFIT OF UNDISRUPTED OPERATIONS

Validating the cost effectiveness of proposed energy strategies is a critical part of the Strategic Energy Plan. In order to do this in a manner that is best aligned with the goal of creating a resilient, environmentally conscious airport, it is proposed that the existing CIP evaluation process be updated to incorporate an evaluation of a project's ability to support and/or enhance the resiliency of the airport operation. It is anticipated that this will likely include the estimated cost of consequential loss in the event of loss of power.

IMPACT AND IMPLEMENTATION

Table 10: Interdependence and Resiliency—Implementation Plan

Focus Area	Critical Activities		Responsibility	Time Horizon
A. Install on-site energy generation and storage capacity	A.1	Finalize location of a chilled water TES tank within the ADP.	AP	2 years
	A.2	Develop a chilled water generation and distribution strategy to support ADP program.	FMD / ADC	5 years
	A.3	Install a chilled water storage tank and reconfigure control strategy.	FMD / ADC	10 years
	A.4 (CN A.4)	Install approximately 1 MWh of battery storage to work in conjunction with existing solar installations.	FMD / ADC	2 years
	A.5 (CN A.5)	Procure additional 3 MWh of battery storage to work in conjunction with new and existing solar installations.	FMD / ADC	5 years
B. Prioritize Airport critical systems to ensure continued operations 	B.1 (CC A.1)	Develop prioritization matrix of Airport facilities and critical systems.	FMD	2 years
	B.2 (CC A.2)	Develop robust load shedding strategy.	FMD / T+T	2 years
	B.3	Develop resilient Airport chapter of Business Continuity Plan.	EAD	2 years
	B.4 (CC A.3)	Implement campus wide energy management and demand response system.	FMD / FDD	2 years
C. Provide redundant systems to minimize disruptions to operations 	C.1	Develop redundancy study to identify where current spare capacity exists and where it is insufficient.	FMD	2 years
	C.2	Incorporate redundancy requirements into ADP project scope.	ADC	2 years
	C.3	Deploy additional redundancy measures to achieve the required redundancy needs.	FMD	10 years

FMD Facilities Management · FDD Facilities Development · ADC Airport Design & Construction · BFM Business & Financial Management · EAD Environmental Affairs · AP Airport Planning · T+T Terminals & Tenants · I+TS Information & Technology Services

Supporting Team

Table 10: Interdependence and Resiliency—Implementation Plan *continued*

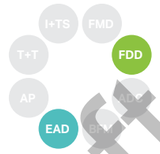
Focus Area	Critical Activities		Responsibility	Time Horizon
D. Balance cost of resilience measures with benefit of undisrupted operations 	D.1	Expand existing CIP evaluation process to incorporate consideration of its ability to support resilient Airport operation.	FDD / EAD	5 years

Table 11: Interdependence and Resiliency—Integration Plan

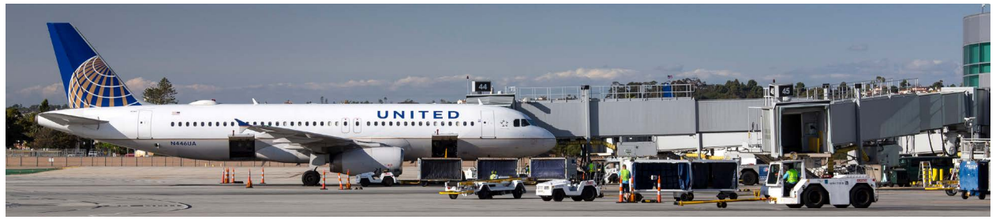
Focus Area	ADP Integration (L/M/H)	CIP Integration (L/M/H)
Install on-site energy generation and storage capacity	High	Low
Prioritize Airport critical systems to ensure continued operations	Low	Medium
Provide redundant systems to minimize disruptions to operations	Medium	Medium
Balance cost of resiliency measures with benefit of undisrupted operations	High	High

Cost Containment

4

COST CONTAINMENT

The Airport is committed to achieving its energy goals in a financially responsible and feasible way.



Introduction

The Strategic Energy Plan has been designed in a cost-conscious manner, assessing the viability of all proposed projects through the lenses of total cost of ownership (TCO), which evaluates cost-benefit over the whole life of a project, and sustainable return on investment (SROI), which expands TCO to include the monetized value of carbon savings. This reduces both ongoing energy costs and overall costs of the Airport's carbon reduction program. This evaluation will help the Airport pursue the goals and actions described in this Strategic Energy Plan in the most fiscally effective way. The Airport will manage every aspect of its energy generation and usage in order to realize efficiencies wherever possible, including proactive and continually adjusted energy demand management as well as strategic leveraging of the various funding mechanisms available to the Airport. The Authority is committed to conscientious planning assessment, implementation, and operational evaluation of Airport projects to ensure energy efficiency is maximized. Intelligent, proactive, and persistent refinement to the Airport's energy strategy will ensure that it minimizes cost overruns and focuses on energy projects and programs that are viable from a cost-benefit standpoint.

Metric

The Airport will measure its success in achieving its energy goals in a fiscally responsible manner by monitoring the energy cost per passenger (ECP), or the annual energy consumption divided by the annual Airport passengers, adjusted for escalation.

The metrics that will be monitored will include:

- Annual Energy Cost per passenger, adjusted for escalation (total and by fuel)
- Monthly Energy Cost per passenger, adjusted for escalation (total and by fuel)

In addition to the creation of these metrics, the comparison against the 2015 Baseline year and year-on-year change will be monitored to address overall program success and identify relevant trends. The cost containment targets outlined in **Table 12** were developed as realistic and ambitious targets for the Airport to achieve.

Table 12: Cost Containment Target

ECP Reduction	Target Year	Timeframe
10%	2020	Short-term
20%	2025	Medium-term
30%	2030	Long-term

Critical Areas of Focus to Drive Change

- **A. Demand side management**
- **B. Funding mechanisms**
- **C. Identify the most effective metrics**
- **D. Project assessment, implementation, and evaluation**
- **E. Energy as a service**

A. DEMAND SIDE MANAGEMENT

SDG&E demand and capacity availability charges, related to the peak electricity demand rather than total consumption, are significant components of the Airport's monthly energy costs. The Airport intends to investigate the implementation of a robust demand response and management system, which will pull from the Airport's various building management systems and utilize predictive logic to reduce peak demand. This system will also limit electricity demand during peak hours, during which the SDG&E consumption charge is higher than at other hours, further reducing charges for electricity use. By measuring factors such as total energy use, time of use, trends for each quarter and year, and more, the Airport will be able to identify where energy and money can be used more efficiently, and where it can augment cost containment efforts. Through active use of the controls at the Airports's disposal, the Airport can continually refine its energy infrastructure to maximize its return on investment.

The Airport can enhance its cost management through implementation of battery storage and TES technologies to capture and utilize energy that would otherwise be wasted. Battery storage would capture energy generated by on-site PV arrays and discharge that energy into the system during peak times, applying this generated electricity at the most cost effective times of day. TES would also allow for usage of chilled water tanks to minimize the use of CUP chillers during peak electrical demand periods. The ability to store and discharge energy has significant benefit to the Airport as the peak electrical demand occurs at approximately 6 am, when direct benefit from the on-site solar generation is not available. This early morning peak is contributed to by a number of factors, predominantly the preconditioning of the terminal facilities and increased landside power demand from airplanes.

Demand side management will not directly generate energy or reduce carbon emissions. However, it will reduce energy costs for the Airport and will increase resiliency by ensuring that energy is used in the most effective manner.

B. FUNDING MECHANISMS

The Airport will leverage alternative financing mechanisms in order to further contain costs. In the past, the Airport has primarily funded energy-related projects either through planned capital improvement projects or through regular operations and maintenances replacement projects. These projects have included efforts such as HVAC upgrades, lighting retrofits, and generator installation. More recently, for installation of PV technology, the Authority leveraged a third-party ownership mechanism called a power purchase agreement (PPA). Under the PPA, a third party is responsible for developing, constructing and maintaining the energy generation technology, allowing the Airport to simply purchase the electricity from the owner at an affordable rate without the capital costs of building the system themselves. The PPA allowed the Airport to obtain sufficient funding to plan and install PV technology without requiring a capital improvements expenditure which would impact the CIP. In order to realize full implementation of this Strategic Energy Plan, the Airport will need to incorporate alternative funding sources as part of its broader capital procurement initiatives.

There are several funding mechanisms that can potentially be leveraged in order to implement energy projects. As described above, the Airport already has experience with PPAs, and these continue to represent a viable method for obtaining renewable energy at or below utility prices, without the significant capital expenditure and risks required to construct and operate PV systems. The Airport will also pursue opportunities from the State of California and SDG&E to leverage incentive programs that may reduce net outlay (reducing the costs of investing in sustainable infrastructure). Incentive programs also include energy saving performance contracts (ESPCs), which allow the implementation of energy efficient projects with no up-front capital costs, leveraging the energy savings over a 10 – 15 year period to fund the initial capital costs. Power Efficiency Agreements (PEAs) present another approach to demand management. These PEAs allow for on-site energy storage to be installed and operated with no up-front capital costs and no customer risk, in exchange for the financier receiving a share of the electrical bill savings.

San Diego Gas & Electric also provides zero percent interest on-bill financing (OBF) for funding energy efficiency retrofits, provided that the simple payback of the measures is less than 1 year. As the findings of the SDG&E audit suggest a significant number of energy efficiency opportunities that satisfy this criteria, OBF is likely to be a key funding mechanism for the airport.

The Airport will further explore the many existing funding opportunities as it continues to enhance its green infrastructure. Appendix F provides additional details regarding funding mechanisms.

C. IDENTIFY THE MOST EFFECTIVE METRICS

Creating robust metrics will facilitate the Airport's efforts to monitor the success of its energy management efforts. These metrics will identify whether the Airport is successfully supporting its core functions and implementing the airport industry's best practices. The energy use intensity metric is utilized in a majority of energy programs and the Airport will adopt this approach. This metric evaluates energy use per square foot, and because of its widespread use, it will allow comparison of Airport facilities to other facilities. However, secondary metrics are needed to account for the Airport's unique functions as an airport. For instance, the energy use intensity metric does not account for increased energy consumption due to increases in the number of passengers that the Airport serves. The Airport will also track and measure energy use per passenger for passenger facilities. To that end, the Airport will also evaluate energy use per flight, looking at both incoming and outgoing freight and passenger flights.

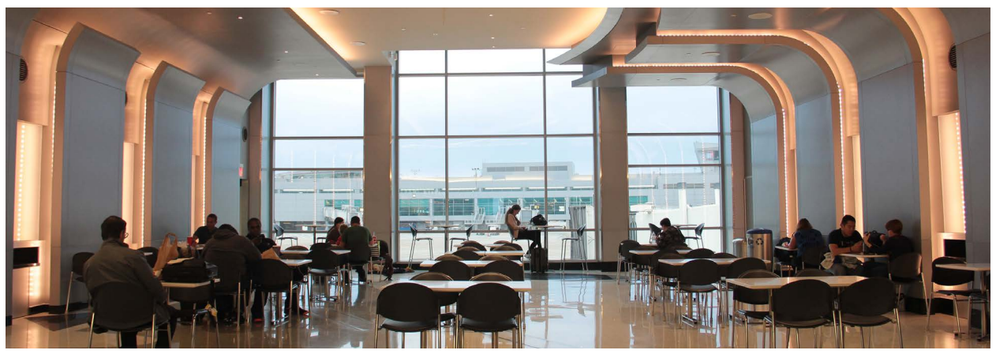
D. PROJECT ASSESSMENT, IMPLEMENTATION, AND EVALUATION

The Airport will drive its project implementation with a robust process that ensures full assessment of projects prior to implementation, and that the road to implementation is feasible. The principle of total cost of ownership will guide the Airport's investments in energy efficiency, taking into account all costs of a project, and the return on these investments made relative to those costs. Taking a whole systems approach to energy management will require effort on behalf of Airport decision-makers. Policies and decisions must consider the whole life cycle of the building or system which is under consideration. This perspective accounts for not only capital construction costs, but also the costs of operations, ongoing maintenance, and even replacement costs over the lifespan of a building, facility, or system. In compliance with the Airport's Sustainability Policy, staff will analyze the life cycle operating costs of facilities, operations, and services, and will base project feasibility and economic sustainability evaluations on this concept. Future actions will also be required to integrate total cost of ownership throughout their decision making process. This commitment will ensure that every step of asset management, from initial planning and budgeting through construction all the way to operations and maintenance, is properly taken into account.

The framework for calculating capital and long-term maintenance costs is readily available through a variety of models. With these flexible tools, the Airport can evaluate the costs of not only its assets and infrastructure but also its best management practices. Airport finance and operations staff and design firms alike will be able to adapt and use these systems to make intelligent project decisions and to prepare budgets in light of total cost of ownership. The end result will be the incorporation of energy as an intrinsic part of financial and operating decisions.

In recognition of the broader environmental benefits of energy projects, the Airport is committed to investigating the potential of enhancing its project evaluation and selection process.

Usage of enhanced project evaluation techniques such as sustainable return on investment (SROI) will help to identify the environmental benefits of projects, and assist the Airport in allocating funding where it is most effective. Traditionally, an energy project's viability has been judged solely on its cost effectiveness through basic metrics: internal rate of return, evaluation of net present value, or simple payback. In recognition of the broader environmental benefits of energy projects, the Airport is committed to investigating the potential of enhancing its project evaluation and selection process. SROI will function as a core component of this larger picture of the value of energy projects and includes, among other factors, the value of carbon reduction as an important aspect of project viability.



E. ENERGY AS A SERVICE

Electric vehicle charger in Terminal 2 parking lot.

The nexus between energy usage and transportation on the Airport campus is growing. Currently there are 10 electrical vehicle (EV) chargers in various Airport parking lots. In total, these account for roughly 50 MWh/year of electricity, or about 1 percent of the Airport's electrical consumption (see **Table 13**). Third party charging companies currently gain a significant profit margin through the provision of EV chargers. This represents a considerable potential funding source, and the Airport will investigate how best to leverage this business opportunity. Options include direct management of EV chargers by the Airport or operation of EV chargers by third parties who pay an infrastructure fee to the Airport. This revenue would be leveraged to fund further energy efforts, such as ongoing energy programs or energy program management. This is a considerable opportunity; for instance, if the Airport receives 10 cents per kWh, it will raise $500,000 of additional revenue each year.

Table 13: Existing EV Charging Station Statistics

Existing EV charging stations: **28**
Number of charging events in 2015: **6,676**
Average plug time: **9 hours, 39 minutes**
Average charge time: **1 hour, 37 minutes**
Total electricity consumed: **46,811 kWh**
Estimated cost of electricity consumed: **$6,975**
Potential revenue:
- Hourly charge ($1/hr market rate):
- Plug time: **$64,500**
- Charge time only: **$11,082**
- Valet Charge (assumes 2x on charge time): **$22,164**
- Unit rate (35c/kWh market rate): **$16,383**

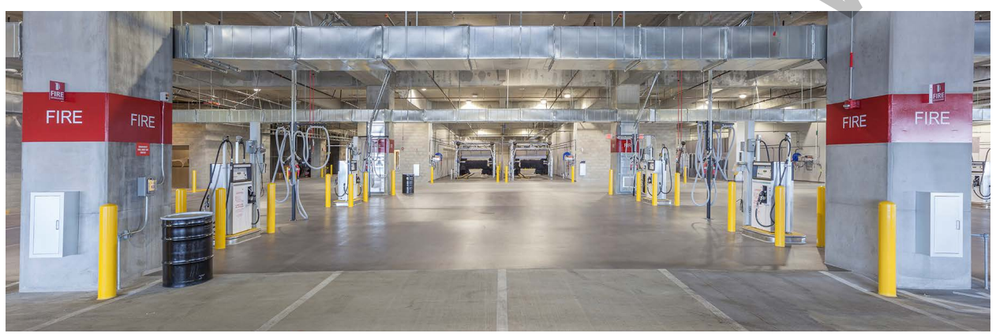


Photo courtesy of Flickr Creative Commons © Pablo Mason

IMPACT AND IMPLEMENTATION

Table 14: Cost Containment— Implementation Plan

Focus Area	Critical Activities		Responsibility	Time Horizon
A. Demand Side Management	A.1 (IR B.1)	Develop prioritization matrix of Airport facilities and critical system.	FMD	2 years
	A.2 (IR B.2)	Develop robust load shedding strategy.	FMD	2 years
	A.3 (IR B.4)	Implement campus wide energy management and demand response system through energy storage and other capabilities.	FMD	2 years
B. Leverage alternative financing mechanisms	B.1	Investigate expanded use of Power Purchase Agreements currently used for the solar projects for other technologies including fuel cells and battery storage.	FMD	2 years
	B.2	Maximize use of SDG&E, local, and state grants and incentives to reduce capital cost of energy projects.	EAD	2 years
	B.3	Investigate potential use of Energy Savings Performance Contracting (ESPC) to expedite implementation of energy projects.	FMD	2 years
C. Project Assessment & Implementation	C.1	Expand existing criteria used to evaluate the benefit of a proposed project to include the whole life performance.	FDD / ADC	2 years
	C.2	Expand existing criteria used to evaluate the indirect benefit of a proposed project to include the whole life performance, such as reduction in carbon emissions, through the use of the SROI metric.	FDD / EAD	2 years
	C.3	Educate project review committee on the value of these enhanced metrics and the overall energy goals of the Airport.	FDD / EAD	2 years
D. Energy as a Service	D.1 (CN C.1)	Investigate potential business models around the facilitation of charging for electric vehicles.	EAD / BFM	2 years

Table 15: Cost Containment— Integration Plan

Focus Area	ADP Integration (L/M/H)	CIP Integration (L/M/H)
Demand Side Management	Low	Medium
Project Assessment & Implementation	Medium	Medium
Energy as a Service	Low	Low

FMD Facilities Management · FDD Facilities Development · ADC Airport Design & Construction · BFM Business & Financial Management · EAD Environmental Affairs · AP Airport Planning · T+T Terminals & Tenants · I+TS Information & Technology Services

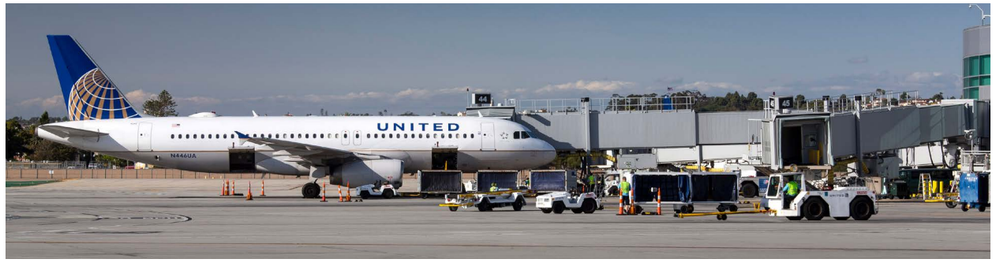
Supporting Team

5

Regional and Industry Leadership

REGIONAL AND INDUSTRY LEADERSHIP

The Airport is committed to leading the region and industry in sustainability through the deployment of a robust, innovative, and cost effective energy program which fully supports Airport operations.



Introduction

The Airport's commitment to and successes in sustainability are validated by the third party certifications already received, such as LEED certification, and the Airport will similarly validate its energy plan through ISO 50001 certification. The Airport's mission is not limited to changing its own campus for the better. As an industry and regional leader in sustainability, the Airport is both responsible and privileged to lead those in its sphere of influence through knowledge sharing, best practices, and lessons learned. The infrastructure and organization of the Airport campus provide a valuable test bed for energy management, which will be used to lead and partner with Airport stakeholders, neighbors, and industry colleagues. The Authority is well aware that it does not operate in a vacuum, and will partner with its sister agencies in making a more sustainable San Diego region. The Airport remains open to revising and upgrading its strategy to ensure it is always prepared to meet the needs of its customers, region, and environment.

Metric

The Airport will measure its continued regional and industry leadership by monitoring the following metrics:

- Number of conference presentations made related to energy and sustainability
- Number of articles / papers written related to energy and sustainability
- Level of engagement with local and regional energy initiatives

In addition to the creation of these metrics, the comparison against the 2015 Baseline year along with year-on-year change will be monitored to address overall program success and identify relevant trends.

Critical Areas of Focus to Drive Change

A. Third party certification

B. Share knowledge and best practices to build industry and regional momentum

C. Engage business partners in energy and sustainability goals

D. Innovation through Big Data

E. Periodic Strategic Energy Plan validation

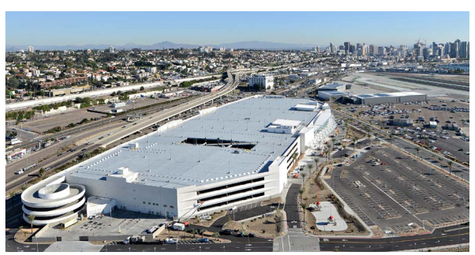
F. New and Emerging Technology

A. THIRD PARTY CERTIFICATION

The Airport will seek to obtain third party certification wherever possible in order to validate the credibility of Airport sustainability practices. In addition to the ACA described previously, the Airport will pursue other third party certifications such as LEED, PEER, SmartPark, Envision, Green Parking Council, and ISO 50001 compliance. The Airport's existing commitment to LEED is well documented in previous actions, with a pledge to obtain LEED Silver or better certification on all new facilities. The Airport will also exceed the energy performance required by code as part of future LEED certification.

The Performance Excellence in Energy Renewal (PEER) program, administered by Green Business Certification, Inc. (GBCI), provides another growth opportunity for the Airport. PEER, which is issued by the same organization which issues LEED certifications, is a system for evaluating power system performance. This rating system measures and helps improve the performance of a sustainable power system, including system reliability and resiliency; energy efficiency and environmental responsibility; operational effectiveness; and customer contribution. Implementation of this rating system will not only benefit the implementation of a sustainable power system but will also validate the Airport's credentials to the industry and the San Diego region.

ISO 50001 specifically focuses on energy management and provides certification that the Airport has adhered to certain standards. The Airport will investigate implementing an Energy Management Program which complies with ISO 50001, providing a strong framework for monitoring energy performance. This effort and its associated certification will move the Airport towards achieving its Strategic Energy Plan goals. The Airport's industry peers are utilizing ISO 50001 more and more frequently, and implementation will help ensure the Airport remains competitive and at the forefront of sustainability in its industry. The Airport will evaluate the approaches used and lessons learned by energy projects at other airports as part of this process.



The new consolidated Rental Car Center is a candidate for LEED Silver certification.

B. SHARE KNOWLEDGE AND BEST PRACTICES TO BUILD INDUSTRY AND REGIONAL MOMENTUM

The Airport is a leader in the field of energy, as shown in its recent investment in critical energy infrastructure. The 12kV microgrid highlights this leadership, and enables deployment of technologies which may not otherwise be economically viable. The campus layout and structure of the Airport allow the microgrid to be robust and effective, and the microgrid in turn creates an excellent testbed for techniques in energy conservation, renewable energy generation, and management and optimization of energy.

The Airport is committed to sharing the knowledge and best practices that it gathers and develops in order to benefit the airport industry and to encourage regional efforts to improve energy management and sustainability. This sharing of best practices and knowledge will occur through a range of channels and in a variety of settings ranging from professional conferences to public outreach. The Airport will develop information packets and other tools to easily communicate this vision, collaborating with its sister agencies in the region to create a common vision for San Diego's future. Widespread public outreach will be critical to assist not only the energy community but also the general public. It is the Airport's responsibility and privilege as a leader in this field to collaborate with other agencies and organizations, as well as the citizens of the region, to assist them in cultivating their own sustainability.

As a major consumer of electricity in the San Diego region, the Airport has both a responsibility and an opportunity to influence the region's vision for its collective energy future, participating in a number of regional initiatives, including:

- CleanTECH San Diego
- SANDAG Energy Working Group
- ACI-NA Sustainability Working Group
- CA Airport Council Environmental Working Group
- San Diego Regional Climate Collaborative
- San Diego Regional Clean Cities Coalition

The Authority is one of the largest single energy consumers in San Diego County and thus plays a key role in meeting local energy goals. The Airport's timeline of carbon neutrality parallels the City of San Diego, whose ambitious goals include reaching Net Zero Energy by 2030. In addition to the City, the San Diego Unified Port District has also set ambitious energy consumption and generation goals. These sister agencies will work alongside one another to ensure their energy goals are aligned and that public outreach messages are consistent and complementary. These agencies have a powerful capability to work together in producing and communicating a unified regional energy goal and encouraging the whole region to join in their sustainability efforts.

C. BUSINESS PARTNERS IN ENERGY AND SUSTAINABILITY GOALS

Through sustainability leadership, the Airport has positioned itself to be a leader in guiding sustainability goals throughout its international sphere of influence. Airport staff and leaders will engage with one another to ensure sustainability remains a high priority. The Airport will continue to refine its goals and involve stakeholders, ensuring effective implementation and imparting of shared knowledge. The Airport is committed to setting industry trends in energy management, capitalizing on its existing global leadership in airport environmental stewardship.

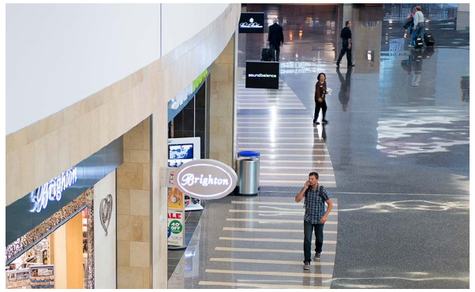
A key component of this leadership will be the facilitation of a robust training program to educate the broad airport community in the various elements of the energy initiative and sustainability program. It is anticipated that this will be a multi-faceted program that leverages certification such as LEED, CEM, and Envision; and actively promotes attendance at SDG&E Energy Innovation Center (EIC) free training sessions.

D. INNOVATION THROUGH BIG DATA

Big Data represents a great opportunity for the Airport to leverage its existing data with inventive tools that will optimize usage and conservation of energy. The existing energy monitoring system is comprised of more than 2,000 data points and will create a constantly growing dataset of energy information. This raw resource of data will provide a valuable tool in innovation and exploration in the field of Business Intelligence and Analysis. The Airport recently supported a "hackathon," and intends to make this an annual event, where specific Airport challenges are presented to hackers each year. The Airport anticipates that the richness of the energy datasets means that this data can be made available during these events, and that energy optimization and opportunity identification can be a core focus of these events. The hackathon will also provide a "farm" from which potential ideas can be harvested and further explored by the Airport's recently established Innovation Lab.

These experimental approaches, which can tap into the experience of local universities and other institutes, will allow the Airport to pilot and evaluate potential new operational technologies and strategies to improve energy efficiency. This commitment to innovation will keep the Airport at the forefront of regional and industry leadership, and will increase the knowledge and best practices which can be shared with collaborators, neighbors, and industry contacts.

E. PERIODIC STRATEGIC ENERGY PLAN VALIDATION



The Strategic Energy Plan will be a living document, with the Authority planning to re-validate this plan every five years, to ensure that the stated goals remain valid and that energy performance is trending in the right direction. Re-validation will also allow the Authority to evaluate emerging technologies and ensure that the current roadmap does not prevent the Airport from using the latest and best technology. The Airport's ongoing stakeholder engagement will be also enhanced through the periodic updates and review of the Strategic Energy Plan.

F. NEW AND EMERGING TECHNOLOGY

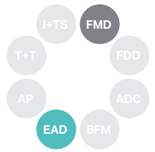
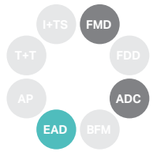
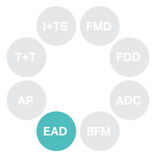
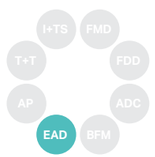
With the continued innovation in the energy generation, storage and control market, it is essential that the Airport actively monitor new and emerging energy technologies to determine their applicability and cost effectiveness for implementation within the Airport.

Technologies that will be monitored will likely include:

- Generation
  - Micro-wind
  - PV solar
  - Sea Water Air Conditioning
  - Fuel Cells
- Storage
  - Battery Storage
- Control
  - Demand response
  - Big Data Integration

IMPACT AND IMPLEMENTATION

Table 16: Regional and Industry Leadership—Implementation Plan

Focus Area	Critical Activities		Responsibility	Time Horizon
A. Develop Energy Metrics 	A.1	Refine Airport aligned metrics to be used to benchmark improvement in energy performance.	EAD / FMD	2 years
B. Seek 3rd party certification wherever possible to prove credibility 	B.1	Develop ISO 50001 roadmap.	EAD / FMD	2 years
	B.2	Implement ISO 50001 program.	EAD / FMD	2 years
	B.3	Develop minimum energy credit requirements for use within projects seeking LEED certification.	ADC / FMD / EAD	2 years
C. Share knowledge and best practices to build industry and regional momentum 	C.1	Actively engage in the local energy initiatives.	EAD	2 years
	C.2	Share lessons learned and energy innovations at regional and industry conferences.	EAD	2 years
	C.3	Create a common vision within the region through collaboration with sister agencies.	EAD	2 years
D. Maximize Use of Big Data 	D.1	Facilitate periodic hackathons that leverage the Airport's dataset to identify and solve problems.	EAD	0 – 2 years
	D.2	Partner with UCSD and other research agencies to investigate opportunities that leverage the Airport.	EAD	0 – 2 years

Regional and Industry Leadership—Implementation Plan *continued*

Focus Area	Critical Activities		Responsibility	Time Horizon
E. Periodic validation of the energy master plan 	E.1	Update the energy masterplan every 5 years.	EAD	0 – 5 years
F. New and emerging technology 	F.1	Leverage relationships with local academic institutions and industry bodies to monitor new and emerging technologies.	EAD	0 – 2 years
	F.2	Investigate opportunities to pilot new technologies at the airport.	EAD	0 – 2 years

Table 17: Regional and Industry Leadership—Integration Plan

Focus Area	ADP Integration (L/M/H)	CIP Integration (L/M/H)
Develop Energy Metrics	Low	Medium
Seek 3rd party certification wherever possible to prove credibility	Low	Medium
Share knowledge and best practices to build industry and regional momentum	Low	Low
Maximize Use of Big Data	Low	Low
Periodic validation of the energy master plan	Medium	Medium

FMD Facilities Management · FDD Facilities Development · ADC Airport Design & Construction · BFM Business & Financial Management · EAD Environmental Affairs · AP Airport Planning · T+T Terminals & Tenants · I+TS Information & Technology Services

Supporting Team

Implementation Roadmap

IMPLEMENTATION ROADMAP

Photo courtesy of Flickr Creative Commons © San Diego County Regional Airport Authority

Status Quo

In the event that the Airport does not implement a robust energy program, the Airport's energy footprint will continue to grow in response to a number of factors, most notably the planned expansion of the Airport and the impact of climate change.

Impact From Planned Airport Development

The latest Airport Development Plan has identified over 5 million square feet of new facilities that will be constructed over the next 20 years, with approximately 750,000 square feet of facilities demolished in the process., as shown in **Table 18**. Despite future improvements to the Title 24 energy code, this increase in the Airport's built environment will result in significant increases in both annual consumption and peak demands, if not offset by energy efficiency measures within the existing portfolio.

Table 18: Airport Development Projects

Project Type	Project Description	Floor Area (SF)	Year
New Construction	GSE Maintenance Facilities (North Side)	50,000	2020
	Temporary Belly Cargo (North Side)	40,000	2020
	SWA Provisioning Facilities (TDY)	15,000	2020
	Field Maintenance Facilities (North Side)	60,000	2020
	Terminal Maintenance Facilities (South Side-NTC Lot)	30,000	2020
	T2 Parking Plaza	900,000	2018
	Air Cargo Warehouse (Northside)	225,000	2022
	T1 Parking Plaza	2,331,000	2022
	T1 (East)	584,000	2024
	T1 (central)	232,000	2028
	T2 West Concourse	146,000	2036
	Belly Cargo	43,000	2036
	T1 (West)	495,000	2037

Airport Development Projects *(continued)*

Project Type	Project Description	Floor Area (SF)	Year
Demolition	Air Cargo Facilities Total	-108,700	2020
	Airport Office, Operations, Support and Maintenance facilities	-62,000	2020
	T1 (East End)	-22,000	2021
	T1 (Remainder)	-235,000	2025
	Commuter	-128,000	2029
	T2E	-225,000	2036

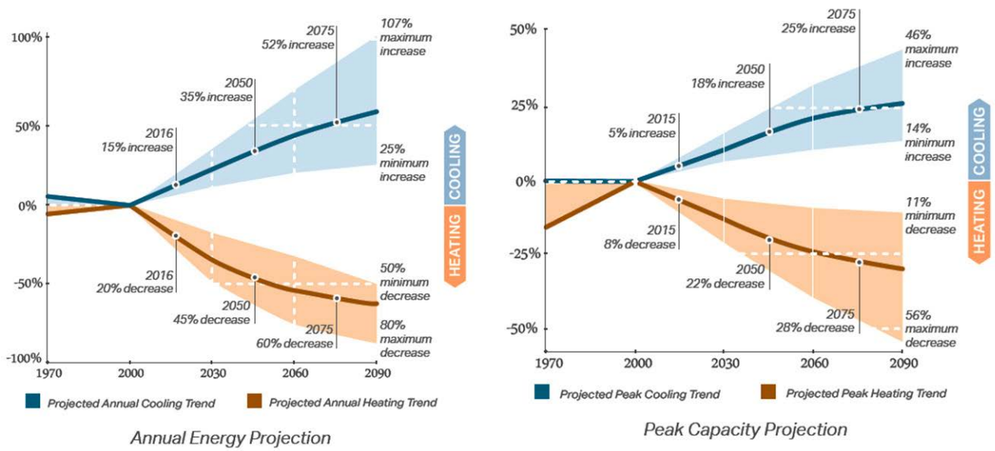
IMPACT OF CLIMATE CHANGE

By leveraging the climate projections developed by the Weathershift methodology, it is anticipated that the Airport will see changes in both the heating and cooling profiles over the next century as a result of climate change.

As **Figure 9** shows, the analysis suggests that by 2050, annual cooling is likely to increase by 35% with an 18% increase in peak cooling demand demand, due soley to climate change. Conversely, there is likely to be a 45% reduction in annual heating consumption and a 22% reduction in peak heating demand.

As such, the Airport will likely experience an increase in capital expenditure for new equipment, and HVAC systems will have to work harder for longer periods of time to meet growing demand, thereby shortening equipment life span. This may also mean that energy efficient solutions have a shorter payback.

Figure 9: Impact of Climate Change



Integrated Stategy

To mitigate the impacts to operation, budget, and the environment of the planned growth of the Airport, and to achieve the 5 overarching energy goals that the Airport has set forth, an integrated strategy has been developed through this energy master planning process that:

- Reduces the environmental footprint
- Reduces operational costs
- Enhances the resiliency of Airport operations

To achieve this, an optimized strategy has been developed that balances opportunities to conserve, generate, and control Airport energy consumers. To best align with the growth of the Airport, a phased implementation strategy has been developed.

The first component of this strategy involves the deployment of various enabling mechanisms through which to manage the deployment and validation of energy strategies and technologies required to achieve the Airport's energy goals. **Table 19** summarizes these energy enabling mechanisms and which Strategic Energy Plan Goals they address.

Table 19: Energy Enabling Mechanisms

Energy Enabling Mechanisms	Frequency	Funding Mechanism	Goal				
			Energy Efficiency	Carbon Neutrality	Interdependance and Resiliency	Cost Containment	Energy Leadership
Implement Energy Master Plan	2016 then every 5 years	Consulting	•	•	•	•	•
Energy Auditing Program	2016 then every 5 years	SDGE Incentives	•	•	•	•	•
Retro-Commissioning	2017 then every 5 years	SDGE Incentives	•	•	•	•	•
Deploy ISO 50001 Energy Management System	2017 then ongoing	Consulting	•	•	•	•	•
Deploy Airport-wide Energy Monitoring System	2017 then ongoing	Consulting	•	•	•	•	•
Incorporate enhancements to the CIP project review process	0 – 2 years	Operating budget	•	•	•	•	•
Route Phase 1 through the CIP process for approval	0 – 2 years	N/A	•	•	•	•	•
Recruit additional Airport personnel to effectively manage delivery of energy projects	0 – 2 years	General Operating budget	•	•	•	•	•

Energy Projects—What / When / How

Having implemented the mechanisms noted above, the Airport will pursue opportunities for energy conservation, generation, and storage. **Table 20** lists strategies that are likely to be most effective for Phase 1 deployment. These projects have been identified as having a payback of less than 5 years and are not in conflict with the long term ADP.

Table 20: Phase 1 Energy Projects

Phase 1 Energy Project	New Capacity	Year	Funding Mechanism	Goal Alignment				
				Energy Efficiency	Carbon Neutrality	Interdependance and Resiliency	Cost Containment	Energy Leadership
Photovoltaic Solar (Ongoing)	2.2 MW	2016	PPA		•	•	•	•
Battery Storage	1 MWh	2017	PEA / Other		•	•	•	•
Central Plant Thermal Energy Storage (Chilled Water)	10,000 ton-hrs.	2017	PEA / Other			•	•	•
Fuel Cells	2 MW	2017	PPA		•	•	•	•
Energy Efficiency projects identifies through auditing process	-	Every 5 years	On-bill financing	•	•	•	•	•

In addition to these initial projects, **Table 21** lists a number of identified projects that will be deferred until either an advancement of technology, escalation of utility rates, or increase in energy demand (such as that associated with the new Terminal 1 development) enhances their cost effectiveness and overall viability.

Table 21: Phase 2 Energy Projects

Phase 2 Energy Project	New Capacity	Year	Funding Mechanism	Goal Alignment				
				Energy Efficiency	Carbon Neutrality	Interdependance and Resiliency	Cost Containment	Energy Leadership
Battery Storage	3MWh	2021	PEA / Other		•	•	•	•
Existing Central Plant Upgrade	1,100 tons	2024	CIP	•		•	•	
Fuel Cells	2 MW	2024	PPA		•	•	•	•
Photovoltaic Solar	3 MW	2024	PPA		•	•	•	•
Satellite Thermal Energy Storage (Chilled Water)	10,000 ton-hrs.	2028	On-bill financing			•	•	•
Battery Storage	3 MWh	2036	PEA / Other		•	•	•	
Photovoltaic Solar	1.5 MW	2036	PPA		•	•	•	
Energy Efficiency projects identifies through auditing process	–	Every 5 years	On-bill financing	•	•	•	•	•

Integrated Roadmap

Photo courtesy of Flickr Creative Commons © San Diego County Regional Airport Authority

Figure 10 is a demonstrates the Airport's anticipated energy profile over the next 25 years, or energy roadmap. The projection takes into consideration:

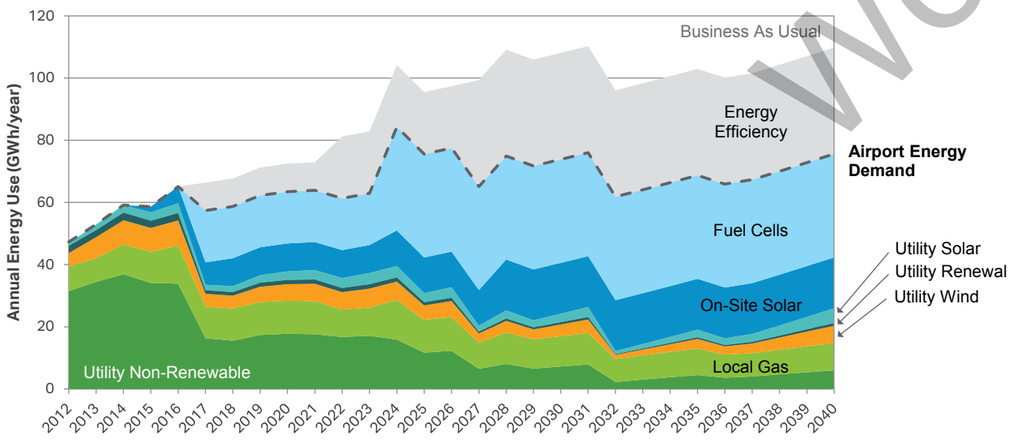
- Planned new construction
- Planned demolition
- Recommended energy efficiency and conservation measures
- Recommended onsite generation projects
- Impact of climate change
- Change in grid power source composition

The roadmap shows the Airport meeting the goals outlined in the Strategic Energy Plan.

As shown by the gray shadow, a 25 percent reduction in annual energy consumption from the status quo scenario can be achieved by 2030 though energy efficiency, onsite generation and a commitment to the ongoing optimization of the energy systems.

The implementation of the on-site power generation systems outlined in this Plan contirubute to a significant reduction in non-renewable energy use.

Figure 10: Integrated Roadmap



Enhanced Resiliency

The proposed energy roadmap combines the savings from an aggressive commitment to energy efficiency with the deployment of various on-site generation and storage technologies that provide a greater level of control over the energy infrastructure and supply.

Through the phased deployment of the identified projects, the Airport can further refine the existing SCADA controlled load shedding protocols and will significantly improve its ability of the energy systems to support the core Airport functions. While a detailed energy prioritization effort is required to optimize how the energy is best used to serve the Airport, the initial analysis undertaken as part of the Strategic Energy Plan suggests that 50% of the Airport's peak energy demands and over 60% of its peak day energy consumption can be maintained in the event of a grid outage.

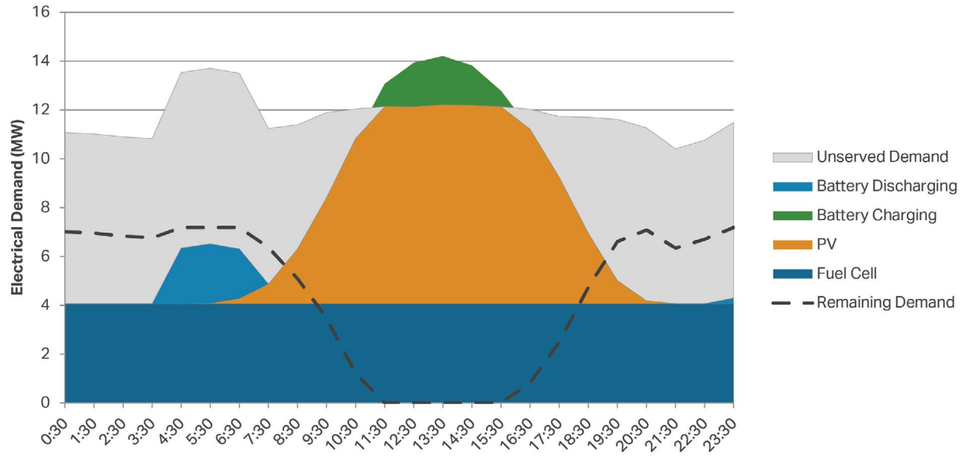
Figure 11 shows the projected peak day electrical demand profile in 2030, and how the strategies identified for implementation can work together to increase resiliency. The system would meet a demand of 4 MW, 24 hours a day without grid connection. On-site solar and storage can work together to further increase the ability to meet the critical demands on-site.

65%

of the Airport Development Plan served by on-site generation

It is important to note that the analysis supporting the future energy use projections has concentrated on developing a view of the Airport's future demand, but does not serve as a power supply study. As such, the demand projections outlined in the Strategic Energy Plan do not match those of previous load assessments undertaken to inform future infrastructure planning, but instead build upon them to highlight key operational considerations of future Airport energy use.

Figure 11: Energy Resiliency



Enhanced Cost Control

The preliminary cost benefit analysis undertaken as part of the Strategic Energy Plan development suggests that there are significant operational cost savings that can be achieved as a result of implementing the proposed roadmap.

The timeline of strategy implementation is combined with ADP implementation and passenger growth in **Figure 12**. Avoided costs are primarily tied to enhanced energy efficiency, less expensive energy from cleaner sources both on- and off-site, and the mitigation of demand charges through optimized demand management and energy storage.

The roadmap implementation is estimated to result in:

- Total operational cost saving of $20 million by 2030.
- Limited capital outlay by leveraging other financing mechanisms such as PPAs and on-bill financing to fund the implementation of the recommended projects

50%

reduction in operational energy costs

The mitigation of peak demand, and therfore of peak demand charges of Airport energy use is shown in **Figure 13**.

Figure 12: Energy Cost per Passenger

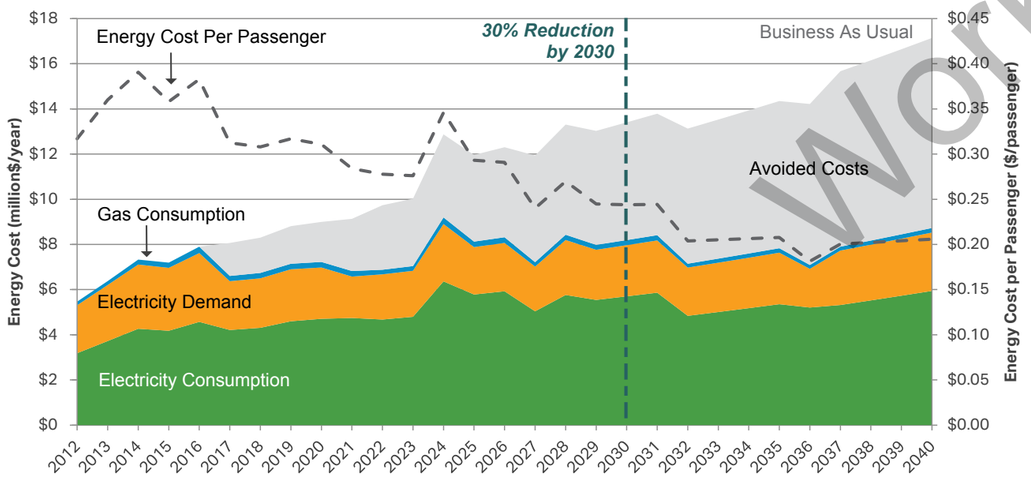
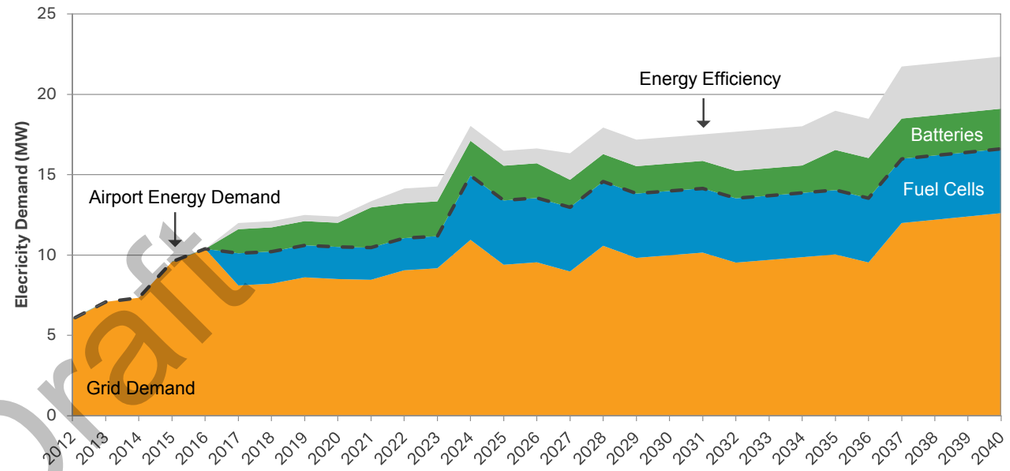


Figure 13: Peak Demand



Enhanced Monitoring

In order to achieve the estimated benefit of leveraging the identified synergies between the various strategies identified through this energy master planning process, it is imperative that the Airport has a robust energy monitoring platform that will allow the Airport's performance against its strategic goals.

This monitoring system will also facilitate the automatic generation of multiple metrics that will provide the ability to benchmark performance with regional and industry peers.

As this is a key enabler of the effective deployment of the energy conservation and generation projects, and also critical to the ongoing success of the overall energy program, it is recommended that the creation of this platform is seen as an immediate focus, either by fixing and expanding AIMMS or deploying a new solution.

"You can't manage what you can't measure."

This enhanced monitoring capability will also serve as a core component of the future ISO 50001 certified Energy Management program, which is becoming commonplace for airports seeking to monitor and control their long term energy performance.

Reduced Environmental Footprint

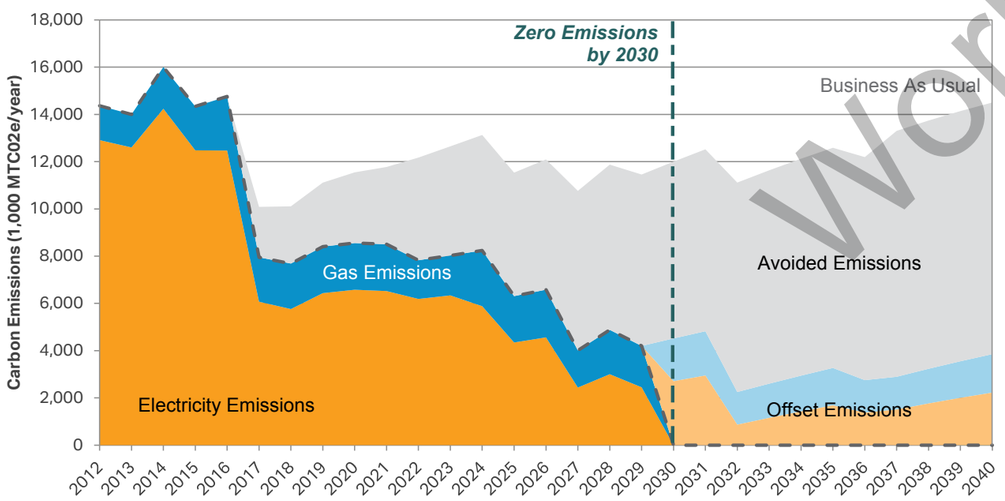
Through the phased deployment of the projects identified above, the Airport will be able to significantly improve its environmental footprint, achieving a 23,000 metric tons reduction in carbon through the enhanced use of carbon neutral fuel sources. This equates to the carbon footprint of a 747 airplane flying 373,000 miles a year, and reduces the overall carbon footprint of the Airport by 48%[6] from its business as usual scenario. Taking into account the minimum requirements of the Renewable Portfolio Standard (RPS) on the electrical grid emissions factor, this results in a on-site carbon footprint reduction of Airport facilities by over 60% by 2030.

60%

reduction in building energy generated carbon emissions

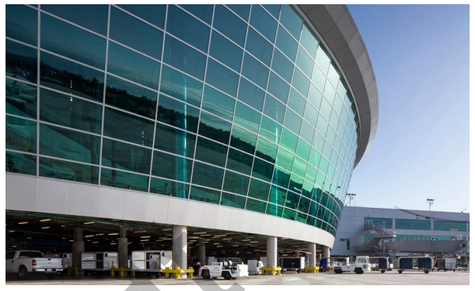
Figure 14 shows the result of the project implementation and the RPS on the on carbon emissions associated with Airport energy use over the next 25 years. In order to meet the Airport's goal of being 100% carbon neutral by 2030, what emissions have not been mitigated by on-site strategies and the RPS will be offset by the purchasing of green power and biogas credits.

Figure 14: Energy Carbon Emissions



6 (0.06153 MTON CO2 PER MILE).

Integration With Airport Development Plan



As **Table 22** outlines, the recommended roadmap to enhanced energy security requires integration with the broader ADP in a number of ways, including:

- Allocation of space adjacent to the existing CUP for a new chilled water TES tank; a fuel cell yard; up to 1 MWh of battery storage; and the expansion of the existing cooling tower yard.
- Allocation of space for a future satellite plant that will provide additional cooling and storage capacity.

Table 22: Integration with the ADP

Energy Project	Space Allowance	Recommended Location	Required Coordination
Phase 1 Thermal Energy Storage Tank	5,000 SF	Adjacent to existing central plant	Parking Plaza
Phase 1 Battery storage	1,000 SF		Parking Plaza
Phase 1 Fuel Cell	2,000 SF		Parking Plaza
Phase 2 Existing Central Plant Upgrade	0 – 2,000 SF		Parking Plaza
Phase 2 Photovoltaic Array	3 MW: 100,000 SF 1.5 MW: 50,000 SF	Parking Areas or Termial Rooftop	Terminal 1 Redevelopment
Phase 2 Satellite Central Plant	Up to 2 Acres	Adjacent to Terminal 1 and existing chilled water and 12kV infrastructure	Terminal 1 Redevelopment
Phase 2 Thermal Energy Storage Tank			
Phase 2 Battery storage			
Phase 2 Fuel Cell			

Immediate Actions

The following actions are identified as immediate next steps:

- Continued engagement with the ADP team to ensure that the required space is allocated within the Terminal 1 redevelopment area.
- Continued engagement with the Parking Plaza team to identify the location necessary for the Phase 1 equipment identified above.
- Develop an RFP for the enhancement of the Airport's monitoring program, with the goal of implementing the selected solution by 2017.
- Develop an RFP to deploy the energy conservation measures identified through the recent energy audit that, when bundled, will achieve a payback of less than 5 years, with the goal of implementing the projects in 2017.

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