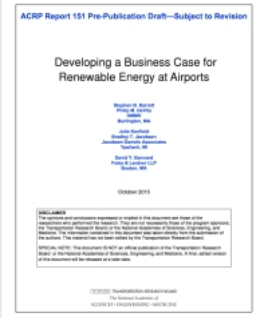

Developing a Business Case for Renewable Energy at Airports

DETAILS

168 pages | 8.5 x 11 | PAPERBACK
ISBN 978-0-309-42939-9 | DOI 10.17226/22081

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Executive Summary

Organizations prepare a business case analysis to engage in a thorough investigation of the alternatives to a proposed project. Increasingly, business value is being measured not only by the immediate and quantifiable financial metrics, but also through consideration of the self-sustainability, environmental and social benefits. Airports are not only self-sustaining businesses and agents of government; they are also critical components of the regional and national transportation infrastructure. This puts them in a unique positon to make credible arguments that support both the financial and policy objectives of an organization pursuing long-term self-sustainability.

This Guidebook provides airports with instruction and tools to help them develop a business case that maximizes the benefits of renewable energy opportunities. It presents the business case as a comprehensive planning exercise supporting a specific objective (e.g., energy stability and reliability) and integrates it into the airport's typical decision-making process. It provides a systematic approach to combine the application of near-term financial measures that are typically considered in business planning along with value for self-sustainability benefits associated with long-term investments and the environmental and social benefits that are important to the airport in its governmental responsibilities.

The research supporting the guidance focuses on identifying and communicating the inherent benefits of renewable energy as part of the business case analysis. To reinforce its practical application, the Guidebook presents direct experience in renewable energy business case development to show both how those attributes are valued differently by different organizations with different missions, and how this broader renewable energy business experience translates to the airport business.

- Section 1 lays out what a business case is, why renewable energy is important, what renewable energy technologies should be considered and when, and what an airport business case for renewable energy looks like.
- Section 2 describes how an airport can justify its renewable energy project by identifying the key objectives and how it fits into the airport's vision.
- Section 3 reviews the criteria used to evaluate a renewable energy project and presents a system for weighting each factor, including long-term self-sustainability and environmental/social considerations, based on the airport's particular objectives.
- Section 4 describes how an airport should integrate the proposed project into its standard master planning and capital programming process.
- Section 5 identifies the key internal and external stakeholders whose participation is central to successful implementation.
- Section 6 walks through a model business case and evaluates the key factors fundamental in the renewable energy business case.
- Section 7 provides examples of similar renewable energy business cases from both an airport's perspective as well as other industries, and the lessons learned.
- Section 8 guides airports in evaluating diverse funding opportunities.

Some practitioners may spend time reviewing the entire Guidebook as it lays the groundwork for the benefits of renewable energy and how these projects can be applied to airports. Others may want to focus on the model business case provided in Section 6 to go beyond the theory and see how a business case for on-site energy decisions is developed. The business case examples provided in Section 7 provide a clear illustration of what different yet familiar organizations are doing in the renewable energy area and why.

Regardless of how one uses the Guidebook, it represents a change in thinking for most in viewing the future where airports will continue to execute their missions of providing safe and efficient air travel to

the general public, while navigating an increasingly unpredictable energy landscape, which is critical to its core functionality. The challenge for airports is to adapt to a business that is far from "usual" to take advantage of opportunities being revealed by technology and a changing energy industry, and address challenges associated with securing airport operations in times of new and unanticipated risk. Renewable energy can be part of that solution.

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1 Introducing the Renewable Energy Business Case

Renewable energy holds a broad appeal for its environmental and local benefits. A Gallup poll conducted in 2013 showed that 76% and 71% of those surveyed expressed a desire to see the U.S. develop more solar and wind power respectively.[1] Advances in technology, which have benefited greatly from the revolution in materials science and the digital economy, have improved system performance and the capacity to generate power. In addition, government polices to incentivize demand for renewable energy resulting in increased manufacturing has dramatically decreased energy production costs, which has led to expanding markets. As an example, the cost of manufacturing a solar panel decreased by 60% between 2010 and 2012.[2] Airports like much of society have been active participants in deploying renewable energy, but their approach to evaluating such opportunities has been haphazard.

In current practice, airports are typically presented with an opportunity to pursue a renewable energy project based on the availability of grant funding programs or inquiries from private entities. In such circumstances, it may not be possible for airports to engage in a thorough investigation of the alternatives to the proposed project and reach an informed decision that optimizes all the benefits including financial, operational, environmental, and social. An effective, objective business case evaluation would assist airports embarking on renewable energy projects to advance future airport planning that targets economic, environmental, and social objectives. With the broad universe of sustainable measures that can be undertaken, renewable energy has often been diluted and de-prioritized due to its higher upfront capital investment requirements when compared with other sustainability options. Yet, as climate change awareness increases, renewable energy becomes the only realistic action available to permit economic growth while reducing greenhouse gas emissions.

The objective of this research was to produce a guidebook to help airports develop a business case to take advantage of renewable energy opportunities.

- Section 1 lays out what a business case is, why renewable energy is important, what renewable energy technologies should be considered and when, and what an airport business case for renewable energy will look like.
- Section 2 describes how the airport will justify its renewable energy project by identifying the key objectives and how it fits into the airport's vision.
- Section 3 reviews the criteria used to evaluate a renewable energy project and presents a system for weighting each factor, including long-term self-sustainability and environmental/social considerations, based on the airport's particular objectives.
- Section 4 describes how the airport should integrate the proposed project into its standard master planning and capital programming process.
- Section 5 identifies the key internal and external stakeholders whose participation is central to successful implementation.
- Section 6 walks through a model business case and evaluates each of the factors fundamental to the renewable energy business case.
- Section 7 provides examples of similar renewable energy business cases from both the airports perspective as well as other industries, and the lessons learned.
- Section 8 guides airports in evaluating diverse funding opportunities.

This project builds on recent research sponsored by the Federal Aviation Administration (FAA) and implemented by the National Academy of Sciences Airport Cooperative Research Program (ACRP):

- ACRP Report 108, Guidebook for Energy Facilities Compatibility with Airports and Airspace
- ACRP Report 85, Developing and Maintaining Support for Your Airport Capacity Project

- ACRP Report 141, Renewable Energy as an Airport Revenue Source

This Guidance will provide airports with a practical and systematic way to evaluate the full benefits of renewable energy to the airport business.

1.1 The Business Case

A business case is a systematic process for solving a problem.[3] It evaluates the various alternatives available to address the problem and assembles the evidence to support the proposed solution. The product of the business case is a presentation of the solution and why it is superior to other alternatives considered in promoting the long-term health of the organization. When the business case for a proposed project has been effectively made, its value will be clearly evident and the process of approving and implementing the project should then proceed efficiently.

The five primary steps of the business case evaluation are presented in Figure 1-1. The business case is rooted in recognizing a problem, identifying a solution, and assessing the solution's benefit to the business.

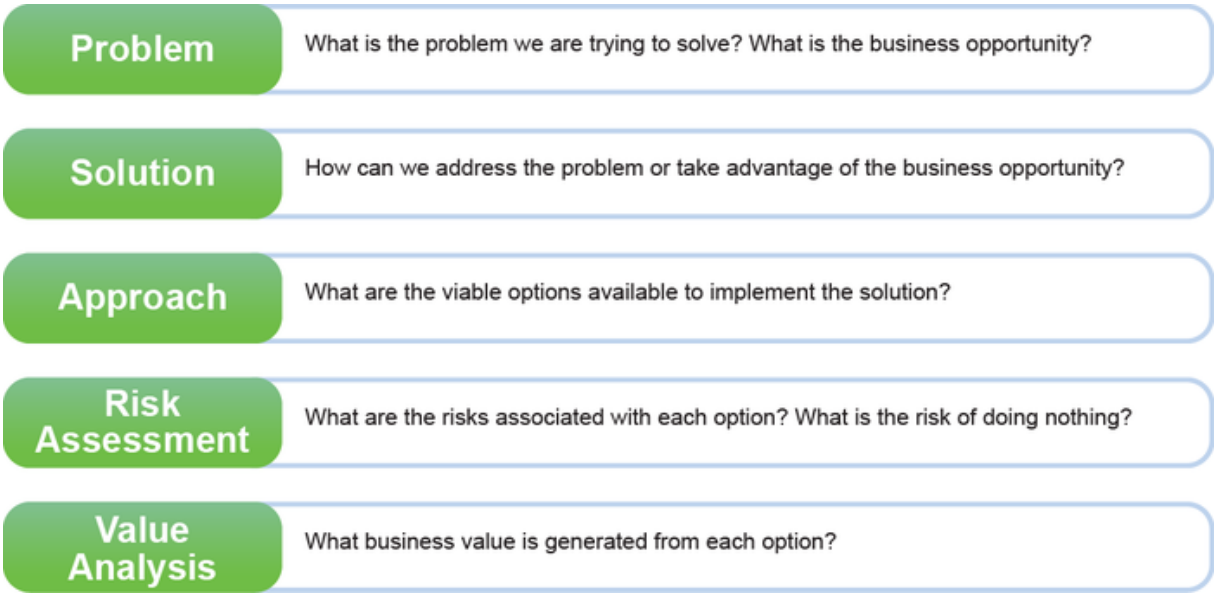


Figure 1-1. Fundamental Steps of the Business Case Process

The following excerpt is from the research scope for this project as prepared by the ACRP panel.

> **A business case explores all feasible approaches to a given problem and enables airports to select the best option. The objective business case evaluation would assist airports embarking on renewable energy projects to advance future airport planning that targets economic, environmental, and social objectives.**

The research scope is consistent with the core purpose of a business case in that it seeks to evaluate various alternatives and arrive at the best option. However, it assumes that renewable energy projects have unique characteristics that could advance the economic, environmental, and social objectives of the airport business. The guidance below identifies and substantiates those unique characteristics and provides airports with the relevant information to help them develop the renewable energy business case.

1.2 The Sustainability Business Case

Sustainability, as defined in U.S. Federal Law under the National Environmental Policy Act of 1969, is "to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations". The three pillars of sustainability are economic, environmental and social, and its objective is to maximize associated benefits[4] – this concept is often referred to as the "triple bottom line." [5]

Figure 1-2 illustrates the triple bottom line concept which relies on a balancing of economic, environmental, and social factors. Each contributes "capital" that must be used effectively and efficiently. The success of each category can be measured by a clear metric: cost of ownership with the objective of keeping it low and comparatively competitive; jobs that measure well-being and quality of life; and emissions which must be limited. Where one of the three factors is deficient, a corresponding challenge will be easily identified.

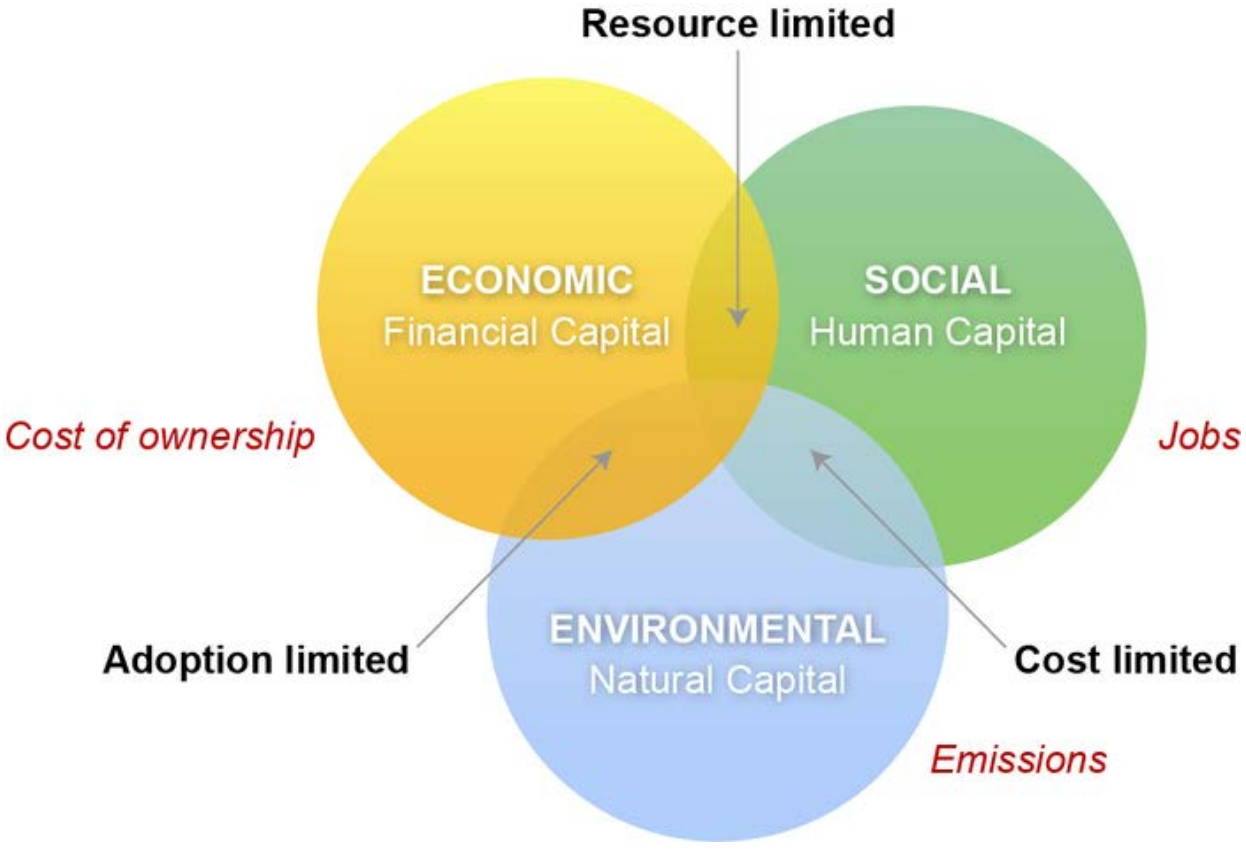


Figure 1-2. Three Pillars of Sustainability Referred to as the Triple Bottom Line

There are a number of independent ranking systems for sustainability and the associated factors that are measured. The U.S. Green Building Council in its Leadership in Energy and Environmental Design (LEED) Program defines the categories as Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality.[6]

The business case for sustainability has been presented in recent years based on evidence prepared by management consulting firms. Goldman Sachs reported that the stock price of firms identified as sustainability leaders outperformed the rest of the field by 25%.[7] An extensive survey of 766 world CEO's by Accenture showed that 93% indicated sustainability as crucial to business success.[8] As the potential business risk from climate change and geopolitical unrest has been increasingly studied, the value of sustainability in mitigating risk has become a primary and pragmatic driver. A Price Waterhouse

Report concluded that businesses that are dependent on resources controlled by organizations located in unstable geopolitical areas have a tremendous exposure to their success.[9]

A useful summary of studies that prove the business case for sustainability was prepared in 2012.[10] The drivers for sustainability that are communicated in the compendium include:

- Natural resource, energy, and operational efficiency: reduce input and overhead costs, militate regulatory sanctions, hedge exposure to volatile prices and supply chain disruptions, mitigate environmental degradation, and conserve capital for implementing a long-term growth strategy.
- Human resources management: retain experienced workers, prevent the loss of corporate knowledge, lower training costs, reduce employee absenteeism, improve worker productivity, and recruit the best talent.
- Financial operations: increase market capitalization and stock growth, improve investor relations, lower insurance premiums, decrease borrowing costs, and Improve access to capital.
- Marketing and communication: expand customer base, differentiate products, improve brand image, and secure customers that are less sensitive to price, have greater brand loyalty, purchase more and more frequently.
- Collaboration with non-governmental organizations (NGOs) and government: gain access to new markets, better supply-chain management, strengthen regulator and community relations, improve brand image, mitigate risks to brand reputation, and militate government sanction.

Renewable energy is a central component of a broader sustainability program given its business benefits supporting the triple bottom line. Energy consumption is a primary indicator of economic development and social stability as evidenced by the fact that 25% of the world's population that lives in industrialized countries account for 70% of world's energy consumption (Pasternak 2000).[11] Using non-renewable energy sources leads to increasing resource scarcity and economic and social instability, as well as climate change and environmental degradation. Replacing non-renewable energy with renewable energy leads to a rebalancing by focusing economic and social benefits locally and restoring and preserving a sustainable environment.

1.3 Renewable Energy Basics

The U.S. Energy Information Administration (EIA), the nation's primary source of energy data, defines renewable energy resources as "energy resources that are naturally replenishing but flow-limited (i.e. not always available). They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action" (See Figure 1-3).[12] Renewable energy (sometimes referred to as "green" power) may be developed and used on-site, developed on-site and exported for use off-site, or acquired from a remote off-site source.

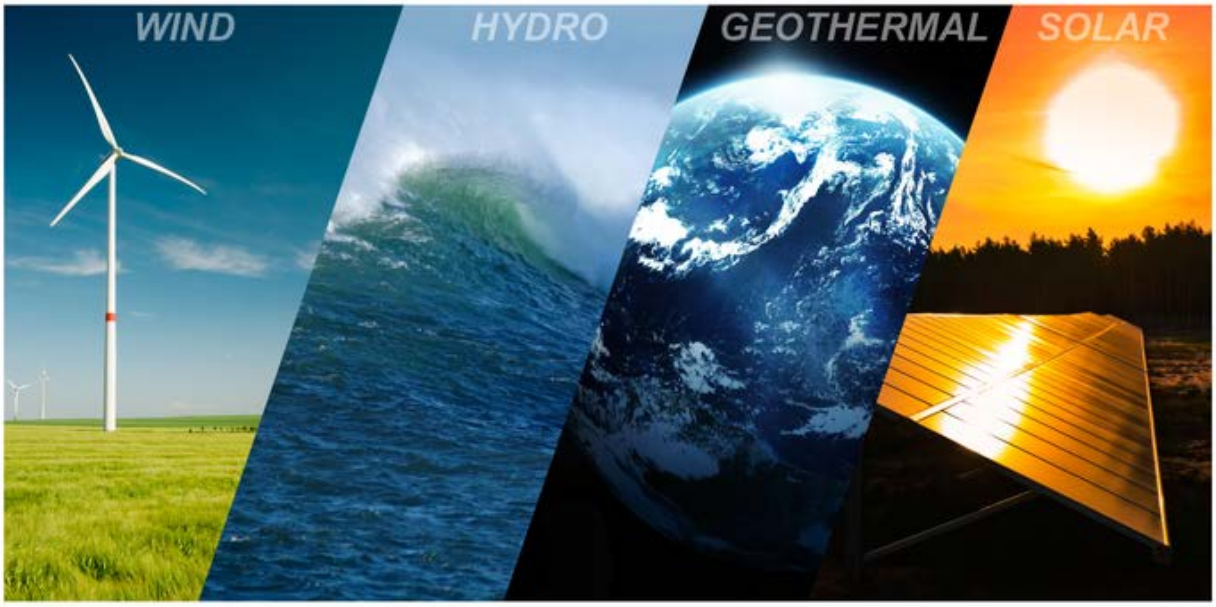


Figure 1-3. Renewable Energy is produced by natural systems

Renewable energy technologies are those that convert renewable energy resources into a useable form of energy for heating, cooling, and electricity. This report does not address renewable transportation from batteries and biofuels though these elements can be integrated into a more comprehensive energy plan.

- Biomass technologies burn fast growing carbon-based fuels from plants to generate electricity and heat.
- Hydro technologies convert the kinetic energy in moving river water into electricity.
- Geothermal technologies either tap directly into heat sources emanating from the earth or use the constant temperature of the ground (or a water body) to store energy that can be made useful during other seasonal conditions (referred to as Ground Source Heat Pump or GSHP).
- Solar photovoltaic technologies convert sunlight into electricity.
- Solar thermal technologies capture and use the sun's heat for on-site heating needs or to generate steam to power a turbine in a central plant (referred to as Concentrating Solar Power or CSP).
- Wind power converts the kinetic energy from the wind into electricity.
- Ocean thermal uses the heat energy stored in the Earth's oceans to generate electricity.
- Wave power converts the kinetic energy in the waves into electricity.
- Tidal power converts the kinetic energy in ocean currents propelled by the tides into electricity.

Energy in the form of electricity and heating/cooling is a fundamental requirement for commerce and quality of life. Conventional electricity (sometimes referred to as "brown power") is delivered from central power plants primarily produced from combustible fuels like coal, oil and natural gas to customers via the electric grid. Other large components of the electricity generation system that do not produce emissions include nuclear and hydroelectric. Heating is typically produced on-site (in a home furnace or commercial boiler) and generated from combustible fuels such as oil, propane, and natural gas. Cooling is typically powered by electricity, but can be powered by on-site combustion.

Many renewable energy resources are intermittent, meaning that they generate power only when the natural energy is available. Solar power is produced only during daylight hours. Wind power is generated only when the wind is blowing. Therefore, a fully operating energy system powered by renewable energy must manage and dispatch power among a variety of different generating sources operating at different times and conditions. The feasibility of doing so while maintaining a constant and uninterrupted flow of power requires the integration of storage technologies such as batteries, flywheels, and compressed air. Fuel cells are a generating technology where electricity is generated through

chemical reactions within the fuel cell. Fuel cells require an outside source to trigger the initial chemical reactions and this is often provided by natural gas meaning that it is not entirely renewable. Hydrogen fuel cells are an emissions free alternative system, which is technically feasible but difficult to make commercially viable.

Renewable energy technologies have increased in efficiency and are being developed at greater scale for both on-site generation and as a source to the electrical grid. There are utility-scale renewable energy power plants that directly feed the grid using biomass, hydropower, geothermal, solar PV, concentrating solar thermal, and wind power. Each of these technologies can also technically supply on-site electricity, though some, such as concentrating solar power, are not cost-effective at small scale. GSHP and solar thermal technologies can be built on-site to supplement or replace existing heating systems.

As an alternative to building one's own renewable energy technology on-site, organizations can purchase green energy from remote, off-site sources. These are paper transactions where money is paid to procure the power from the remote source but the actual electron flow is unchanged (i.e. once electricity is on the grid, its "green" or "brown" origin cannot be distinguished). Proof of the renewable energy transaction is formalized through renewable energy certificates (RECs) that are provided by power brokers and regulated by law. Alternatively, an organization can enter into a contract with the owner of a specific renewable energy facility to buy power output through a long-term contract or power purchase agreement (PPA) that sets the price to be paid for the electricity. The commitment either through RECs or a PPA to buy the renewable energy serves as a financial guarantee to the developer to help finance design and construction. Organizations like utilities can meet their renewable energy purchasing mandates by either building facilities or purchasing from others, which help drive demand for new projects. Corporations customarily demonstrate their sustainability commitments in part by purchasing renewable energy from off-site producers with the RECs serving as the guarantee that the holder bought green energy.

1.3.1 Unique Characteristics of Renewable Energy

Renewable energy is fundamentally different from non-renewable energy in that the power source is provided by natural systems. Many characteristics of renewable energy provide unique benefits to energy consumers that are central to making the renewable energy business case. Airports whose organizational objectives align with these unique benefits will be able to develop an effective renewable energy business case. The specific characteristics of renewable energy include:

- Energy source is essentially free for most technologies (biomass is the exception in that it requires a feedstock) resulting in a long-term, stable price for the power produced
- Energy source is local (i.e. domestic) providing a measure of control and surety of supply
- Energy production is entirely independent of commodity markets which reinforces its stability benefits
- Energy produced is, in most cases, emissions free, and in other cases, emissions reducing
- Energy provides broad environmental and societal benefits that enhance its value

The key step to make the airport business case for renewable energy is to document and communicate the inherent benefits of renewable energy. This research reviewed airport and non-airport renewable energy projects and evaluated the decision-making process and associated drivers for implementing the projects. Section 7 provides a summary of some of the business cases examples that were reviewed. Each organization listed the same inherent benefits of renewable energy and then emphasized which ones provided the most benefit to solving specific problems based on the particular objectives of the organization and the interests of their constituents. The inherent benefits of renewable energy are presented in Table 1-1 below.

Table 1-1. Core Benefits Supporting the Renewable Energy Business Case

Problem	Solution	Benefits
Electricity price volatility and uncertainty	Build an on-site renewable energy project or procure its electricity through long-term contracts	Allows for accurate forecasting and budgeting of future electricity costs
Inflated electricity prices during peak usage times	Reduce use from the grid during high demand periods through on-site generation (also referred to as peak shaving)	Allows utility customer to avoid high demand charges applied during peak use
High electric utility prices	Renewable electricity can be a cost-effective alternative to other generation sources	Renewable energy may provide short-time price parity and long-term savings
Tight operating budgets due to increasing costs and challenging market conditions	Host a renewable energy facility and purchase the electricity to reduce costs, or simply act as a landlord and receive regular lease payments	Improvement of the business bottom line either through savings or a new revenue source
Challenging regulatory environment for new construction	Provide advance mitigation for future impacts through renewable energy	Facilitates future development and expansion
Aging electric network decreases reliability and control of electricity supply posing risk to airport operations	Invest in generation and distribution projects to improve system reliability which may include renewable energy for back-up generation and battery storage	Advance airport's future operational reliability consistent with resiliency and climate adaptation
Over-reliance on particular types of energy	Procure energy from a diversity of sources including renewable energy	Spread out the operational and financial risk associated with a single energy source
Greenhouse gas and renewable energy policy goals and mandates need to be met	Procure clean renewable electricity	Achieve policy goals
Desire to build a credible green brand	Generate or purchase renewable energy	Will be able to promote green successes and image

1.3.2 Documenting Renewable Energy Benefits

To effectively make the renewable energy business case, one needs to access supporting information on renewable energy benefits. The following section provides context for each of the renewable energy benefits listed in Table 1-1 above.

1.3.2.1 Stabilize Long-term Energy Costs

The US EIA, which is part of the Department of Energy (DOE) and a key agency of the U.S. Federal Statistical System, is a critical source for energy generation and price data. Their website can be searched to obtain national data or by region or state to show the variability across regions of the country. It provides historical data to show the changes in energy sources over time as well as making long-term forecasts of energy production and consumption patterns into the future. The EIA also provides data separately by generating technology and information on the decreasing cost of installing renewable energy systems.

The U.S. EIA Short-term Energy Outlook (STEO), which is produced monthly and available on its Website, provides current statistics on U.S. energy usage.[13] In its September 2015 edition, it states that the U.S. retail price of electricity to the residential sector is projected to increase 1.3% higher than the average price last year with the largest price increases projected to be in New England, where residential electricity prices are forecast to increase by 10.8% in 2015, as electricity distribution companies recover higher generation and power purchase costs incurred during 2014 due to extreme cold weather and associated high demand.

The September 2015 STEO also provides graphical information on electricity prices. Figure 1-4 shows the annual cost of electricity in a line graph and the percentage change in price from the previous year. The bar chart shows the volatility in cost per year that can occur represented most clearly in the 2005 to 2009 period. The example shows the average across the entire U.S. though regional statistics are more useful for assessing specific project considerations. The bar graph shows the increase in energy prices in the mid-2000s prior to the recession in 2007-08 and the subsequent reduction in prices. The lesson is that while prices have not increased significantly in recent years and are not forecasted to increase substantially in the next year, the volatility of energy prices as a result of fluctuating commodity prices is a fundamental characteristic of contemporary energy markets that can be hedged by acquiring long-term, stable renewable energy.

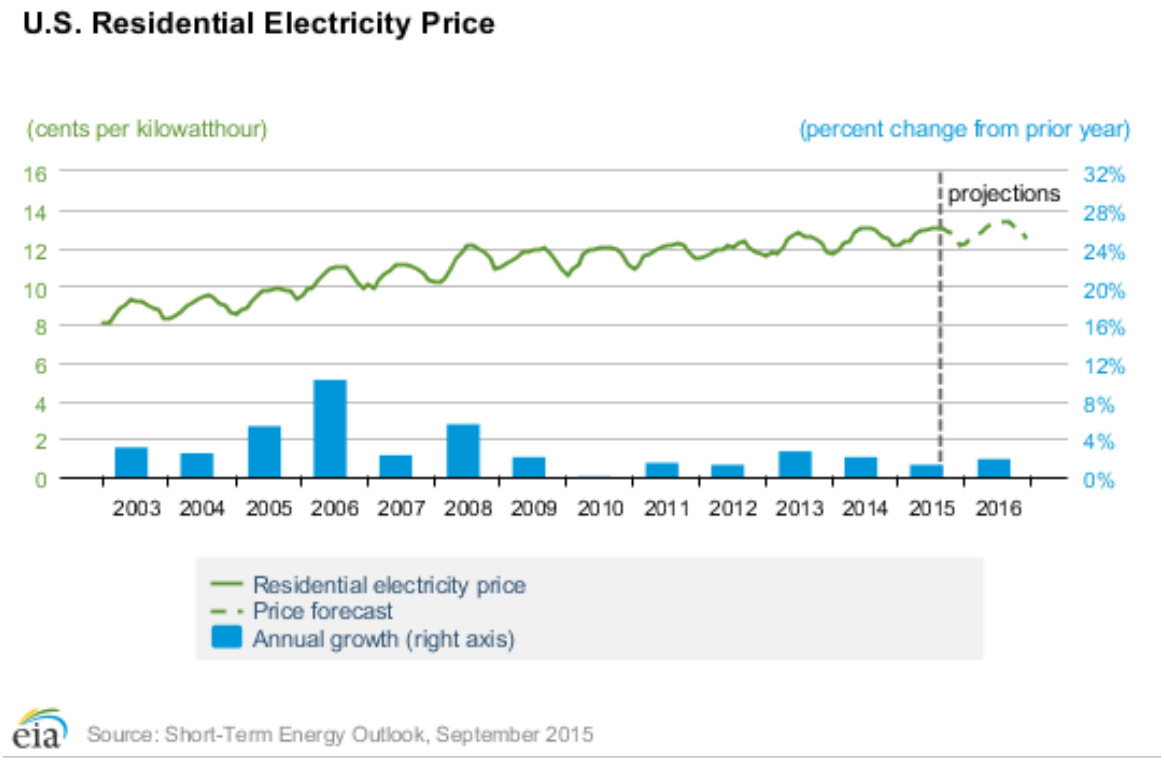


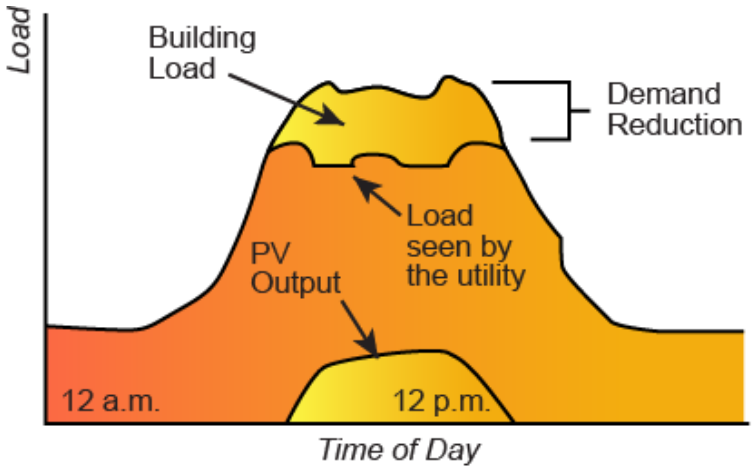
Figure 1-4. U.S. Residential Electricity Prices, 2003-2016

1.3.2.2 Avoid Inflated Energy Prices During Peak Usage

Utilities are increasingly looking to distributed generation, energy conservation, and demand response as means to shift and reduce peak demand, defer capital upgrades to distribution infrastructure, and minimize wholesale energy demand charges.[14,15] At times of peak power usage (such as a hot summer afternoon or winter cold snap), more energy resources need to be deployed to meet the demand. The Independent System Operator (ISO), whose purpose is to manage electricity dispatching and ensure reliability, must access during these peak times generating sources that are not operational for most of the year, but rather stand ready to produce during peak periods. By its nature, the power produced is very expensive and the cost of energy use during peak periods escalates.

Energy users are encouraged by the market (i.e. high prices) to decrease their power consumption during peak periods and minimize their power costs. Utilities and so called “demand response” companies provide additional monetary incentives to large users that make advance commitments to reduce their power consumption during peak periods which both decrease aggregate energy costs and ensure that there is adequate supply for customers.

Any distributed generation source that generates power locally during peak demand periods, including renewable energy, will provide both local and grid-wide benefits. For example, if an airport has a solar facility that is generating electricity on a hot summer afternoon and the airport is consuming that electricity on-site thereby not purchasing electricity from the grid, it will be avoiding paying for the highest priced electricity and maximizing cost savings while also reducing demand on the grid. This effect is illustrated in Figure 1-5. And because renewable energy is fuel free, it is protected from price peaks associated with the energy markets. This is often referred to as "peak shaving."



The correlation is high between commercial load (building) demand and solar availability. Solar provides power when needed, thus displacing peak energy and ***reducing demand.***

Source: NREL/BR-520-31179, September 2001

Figure 1-5. Solar energy generation reduces grid purchases during peak demand periods

1.3.2.3 Increasing Cost Competitiveness

Public policy incentives, such as renewable energy purchase mandates and federal and state grant funding, have increased the demand for renewable energy. As production has increased to meet the demand, competition among manufacturers and installers has led to increased efficiencies as companies seek to expand their business and gain market share. Private capital is invested into research and development to bring a better product to market, which has led to increasing power generation efficiency. All of these factors have resulted in dramatic decreases in the cost of producing power from renewable energy sources.

The economic opportunity of using renewable energy is perhaps best represented by solar PV. A 2015 report released by the North Carolina Clean Energy Technology Center showed that in six of the largest metropolitan areas (in Massachusetts and California), the cost of solar electricity for residential customers is equal to or less than electricity provided by the utility. Over the next five years, solar will reach parity with conventional electricity in many other electricity markets including New York, Chicago, Las Vegas, and Dallas assuming a modest 2% annual increase in electricity rates and a decrease in installed solar costs of 7% annually.[16]

The implication for airports is that cost should be a factor in considering renewable energy today when planning for the future.

1.3.2.4 Need to Diversify Revenue Sources

To attract aeronautical businesses, airports regularly evaluate opportunities to diversify revenue streams to improve their cost structures. The commercial aviation business is dynamic and airports need to be adaptable to new challenges and opportunities. In addition, many airports have land and structures that may be assets for attracting alternative revenue generators.[17]

ACRP Report 141, "Renewable Energy as an Airport Revenue Source," provides detailed information on how renewable energy has become increasingly cost-effective and describes how past projects have resulted in revenues and cost-savings.[18] Often, the best opportunity for new airport revenue is to identify land that has no or little value for alternative uses and lease that land to a private entity which will provide the airport with compensation. The Indianapolis Airport Authority has leased approximately 150 acres of airport land for a solar farm and receives approximately $500,000 each year as a rent payment. Solar power is particularly suitable for such applications as it can be sited in areas relatively close to runways where other uses are not allowed due to height limitations and prohibitions on human occupancy.

1.3.2.5 Mitigating Future Development Risk

Many large development projects, including those undertaken by airports, are subject to comprehensive review under Federal and State environmental laws. As part of its obligations associated with the National Environmental Policy Act (NEPA), the FAA must ensure that projects it funds "use all practical means to create and maintain conditions under which man and nature can exist in productive harmony." Many states have enacted similar broad scale legislation for state permitted projects (e.g., California Environmental Quality Act [CEQA] in California, State Environmental Quality Review Act [SEQR] in New York).

As part of federal and state environmental reviews, agencies and the public are invited to provide comments on project alternatives that will minimize environmental impact. Sustainability measures including renewable energy have become a project alternative that minimizes impacts. The Massachusetts Environmental Policy Act is an example of such an authority and, combined with a statewide Greenhouse Gas Policy, gives the Massachusetts Energy and Environmental Affairs Secretary substantial authority in the absence of a specific carbon regulation. Legal action under state law may be taken to mitigate the air quality impacts of future development as a condition of an approval. This was the case for a settlement that the San Diego County Regional Airport Authority (SDCRAA) reached with the Office of the California Attorney General, which facilitated state approval of airport expansion plans. Another examples comes from projects under the FAA's Voluntary Airport Low Emission (VALE) Program. VALE requires airports to obtain emission reduction credits (ERCs) from the EPA and state air quality regulatory agencies as part of the implementation of emission reducing projects funded under the program. Airports can use the ERCs to fulfil mitigation requirements for future airport expansions reviewed under NEPA.

The regulatory risks of inaction may be difficult to assess. The cost of implementing renewable energy projects voluntarily today versus the cost of being required to do so as part of project permitting in the future can be estimated if certain assumptions are made. There are also the broader benefits of acting voluntarily versus not acting, and the potential project delays (and costs) that result. For example, state's that have been investing in cleaner energy under voluntary carbon trading markets (such as the Regional Greenhouse Gas Initiative or RGGI, which includes nine northeast states) will not be impacted significantly by the Clean Power Plan recently adopted by the EPA. The long-term business benefits suggest making investments to avoid future regulatory risk is a prudent business decision.

1.3.2.6 Aging Electrical Infrastructure and Decreasing Reliability

The U.S. electric grid is a patchwork of transmission lines and generating systems with some components still in operation that date back to the 1880s. A variety of organizations that use and manage the grid make annual investments to improve the infrastructure and promote its reliability. However, a recent

report card from the American Society of Civil Engineers (ASCE) indicated that the aging grid is subject to regular disruptions that severely impact business and quality of life.[19] More recently, there has been a focus on distributed generation and smart meter technology that not only decentralizes power generation and distribution, but improves delivery and reliability. It is in the long-term business interest of airports to review how power is delivered and consider the risks of grid disruption.

One option that may make sense for some airports is investing in an on-site "microgrid." After a power outage disabled San Diego International Airport (SAN) for a five hour peak operating period in September of 2011, the SDCRAA began making investments to generate electricity on airport property and upgrade the local electrical distribution network to create a self-contained 12 kV microgrid that will allow the airport to continue to operate even when the regional grid is down.

The SAN microgrid, which is still being developed, is shown in Figure 1-6. The SDCRAA has completed the wires part of the project which closed the campus electricity infrastructure loop allowing for the microgrid to be physically separated from the regional grid. It has been installing large solar PV electric generating facilities within the microgrid to provide on-site electricity. Future elements needed to make the microgrid functional will include some type of electricity storage and potentially on-site base load electricity generation sources which will allow the grid to be operational 24 hours a day.

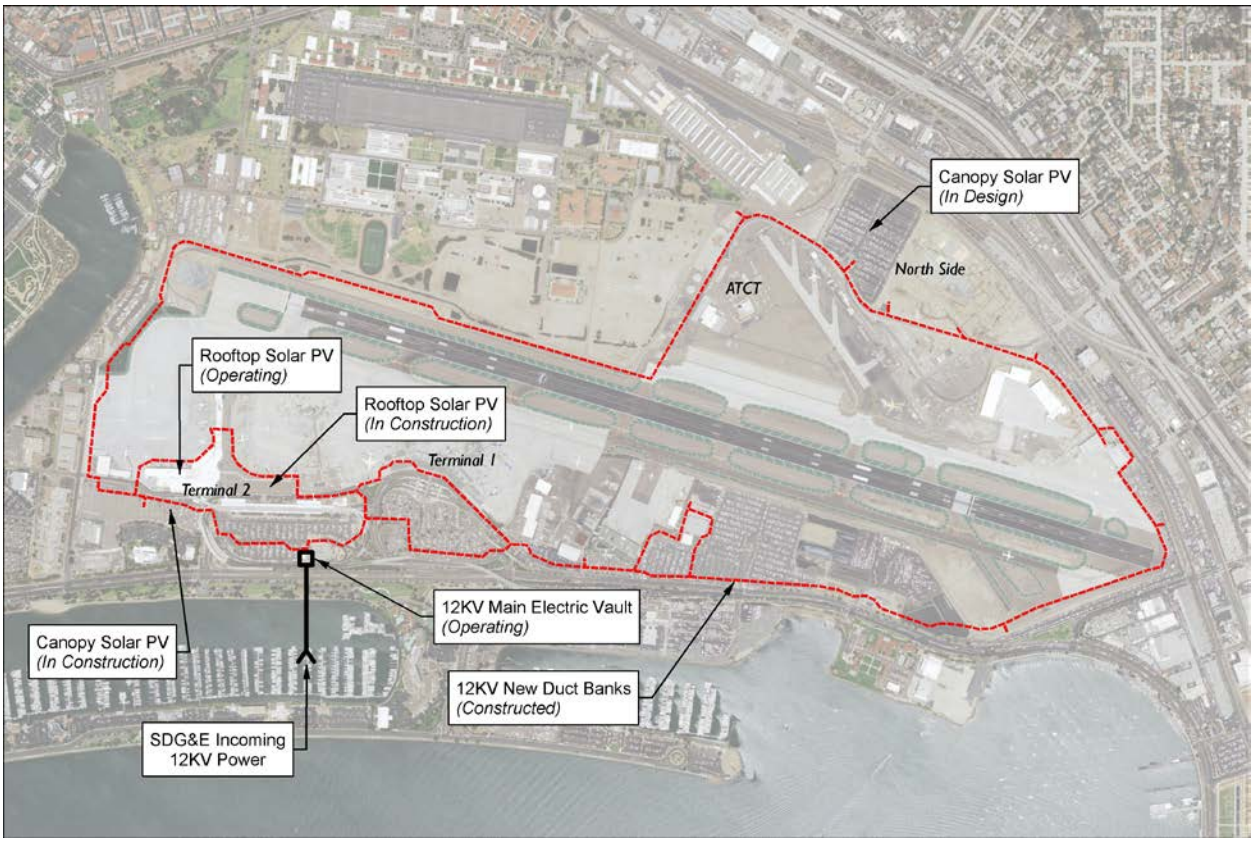


Figure 1-6. San Diego Airport Microgrid

1.3.2.7 Lack of Power Supply Diversity

Diversification reduces risk as any retirement investment professional will state. The same holds true for energy. To reduce potential risks of supply scarcity and price shocks, energy consumers should have access to a variety of energy sources. An example comes from the New England region of the country. ISO-New England, the region's grid manager, has warned of the disproportionate amount of energy in New England that is tied to natural gas and the risk of gas supply scarcity and price spikes, and the associated economic and quality-of-life impacts. This analysis supports practices that increase the

diversity of energy sources. While airports have little control over how their energy is supplied from the electric grid, deploying on-site energy generation provides benefits of diversification and a supply that can be generated on demand and without the need to purchase and import fuel. This logic demonstrates how renewable energy can be part of a risk management program to minimize potential effects of regional energy scarcity.

1.3.2.8 Greenhouse Gas and Renewable Energy Policy Goals

Government policies requiring an increase in renewable energy supply have increased the demand for renewable energy and supported greenhouse gas emission reduction policies. Renewable portfolio standards (RPS) have been the primary mechanism driving renewable energy markets and demand for RECs. RPS programs are established by state laws and require utilities to purchase a specified percentage of their electricity from certified renewable energy sources. These transactions provide producers of renewable energy (including government entities if they own the facility) with an opportunity to obtain additional value through the sale of RECs. In other cases, federal, state, and local governments as well as private entities may establish renewable energy procurement goals which are not tied to a specific law but are commitments that have been communicated publicly. To avoid any negative public consequences of not meeting their own established goals, these entities are motivated to procure renewable energy and gain the public benefit associated with attaining such an objective.

National climate policy has yet to be enacted by Congress. However, carbon trading and regulated reductions have been achieved on a regional basis among the nine northeast states of RGGI and in the California Cap-and-Trade Program. In August of 2015, the US EPA launched the Clean Power Plan which requires states to reduce carbon emissions. With the increasing awareness of the potential impacts of climate change and new mandates and incentives to convert to cleaner generating sources, there will continue to be financial and political drivers for airports to pursue renewable energy.

1.3.2.9 Build a Credible Green Brand

There are many testimonials and rationales from private companies communicating the reasons for pursuing renewable energy including those listed in Table 1-1 above. The rationales cross the full spectrum from very specific and quantifiable short-term financial benefits to very broad and sometimes idealistic concepts such as “being a good neighbor” and “taking care of the planet.” Corporations can readily obtain public relations benefits from their programs because renewable energy is widely viewed by the public in a positive way.

Airports also see a broader benefit to their organizations by deploying new technology and being industry leaders. Airports are gateways to a region and there is mounting political and economic expectation that the airport should present a first impression for excellence that will reflect well beyond the airport’s boundaries. As government entities, airports are subject to broad public oversight, which is why they need to develop a business case for renewable energy projects. The business case must outline the costs and benefits, and also demonstrate the value of renewable energy to improve the long-term interests of the airport business.

1.4 Renewable Energy Business Case

1.4.1 Useful Examples for Airports

Considering that airports are only one type of business that develops renewable energy projects, this study investigated the application of renewable energy in other types of industries including health care and higher education. The manual “Developing the Business Case for Renewable Energy: A Guide for Universities and Colleges” is one reference source that was referred to as a model for this Guidebook.[20] The Project Team identified renewable energy leaders from other industries and selected a group of non-

aviation examples that could provide insight to airports. These examples, discussed in Chapter 7, include representatives from higher education, health care, and technology.

This research found that each industry identifies the same inherent benefits of renewable energy in developing the business case, but then applies greater emphasis on some aspects over others based on the mission of the organization and the interests of its constituents. For example, the higher education sector emphasizes the role that universities and colleges play in conducting new research and being leaders in society to advance a public good. Health care businesses want to promote a healthy future as part of their overall mission and renewable energy is consistent with that. Because renewable energy is a relatively new area with new technology that is helping to solve broader public problems, the universities and hospitals place considerable weight in their business case that they should be demonstrating their support for renewable energy as leaders in society. Airports may also perceive benefits from being societal leaders. However, given their mission of facilitating safe and efficient air travel, airports are more likely to emphasize cost savings, revenue generation, power diversity and the increase in reliability and cost stability offered by renewable energy. A further public-relations benefit may be achieved through green branding, since large airports are visited by millions of travelers each year.

A perhaps less obvious difference in evaluating the business case for renewable energy will occur between organizations in the same industry with generally the same mission. In the airport industry, these differences are influenced by geographic location, airport characteristics, resource capacity, all the way down to personal preferences and management style. Some airports have aggressively embraced renewable energy while others have avoided it. In some cases, an internal champion with an interest in renewable energy has been the catalyst in the development of a renewable energy project. Other times, an airport has responded to an unanticipated opportunity that makes a project a clear low risk choice. This is why developing the business case is ultimately a systematic planning process that draws on the inherent benefits associated with renewable energy and applies them to a particular airport's situation.

1.4.2 Renewable Energy Projects at Airports

As the renewable energy industry has grown and matured across the U.S. and the world, airports have actively participated by integrating renewable energy into their improvement projects. Figure 1-7 provides a map showing renewable energy projects that have been developed and are operating at U.S. airports to date. Solar PV has been the dominant technology deployed; however, biomass, geothermal, and wind has also been developed at airports.

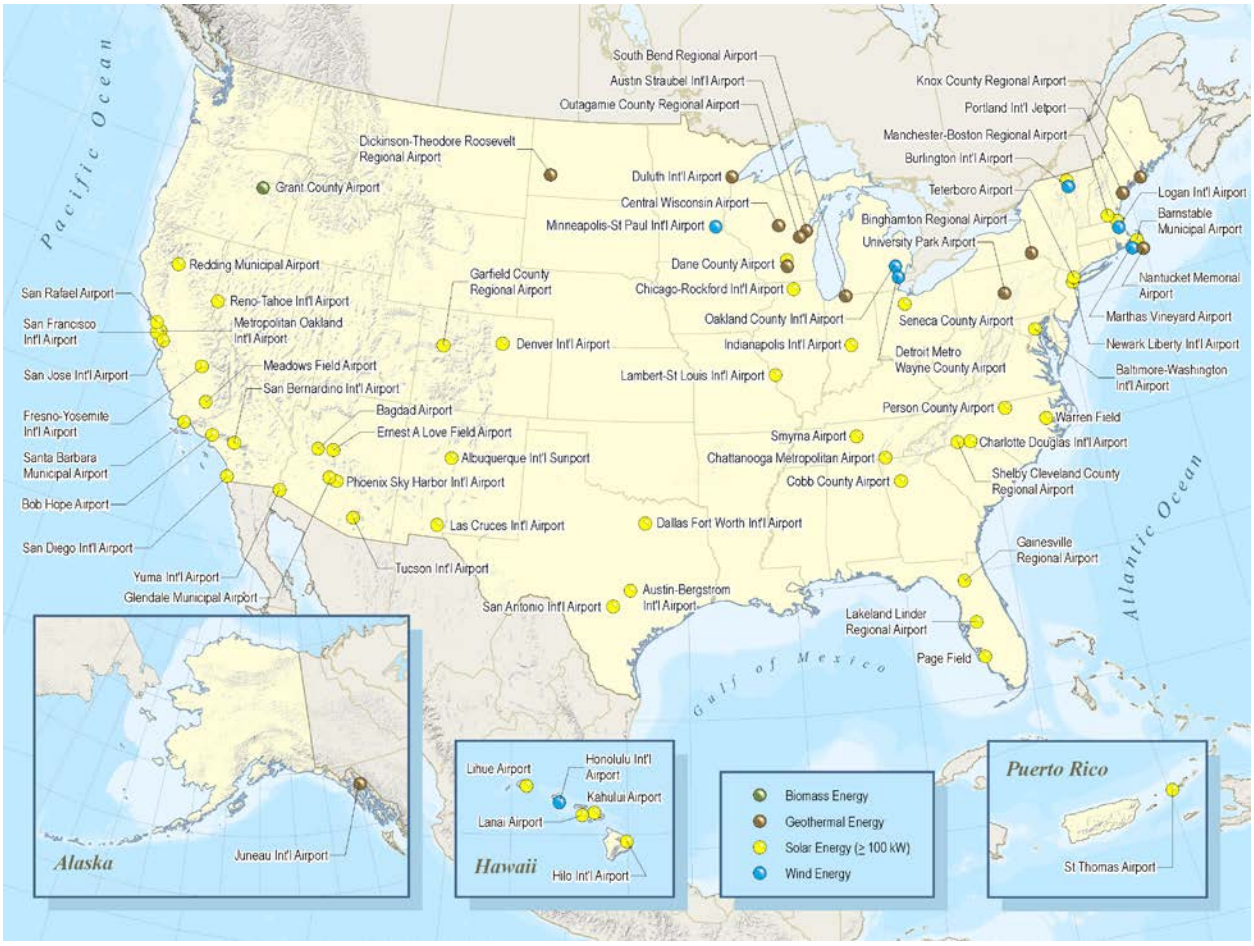


Figure 1-7. Renewable Energy Projects at Airports in the U.S.

Airports have also demonstrated their commitment to renewable energy by purchasing RECs from remote generating sources. The purchase of RECs helps renewable energy developers finance their projects. Particularly given the dramatic reductions in the cost of wind energy, there has been a large supply of renewable energy available for purchase at prices equivalent to market rates for traditional power. The US EPA lists the top renewable energy users in the U.S. on its Green Power Partnership website which is updated on a quarterly basis.[21] Airports currently listed on the website by the EPA include Dallas-Ft. Worth (DFW), Dane County Regional Airport (MSN), and Los Angeles World Airports (LAWA).

Deployment of the airport renewable energy projects shown on the map above have been driven by a wide variety of factors. In some cases, renewable energy has been integrated into new airport construction projects where the airport has sought to showcase sustainability design (see Outagamie, Portland Jetport, San Diego). In other cases, airports have taken advantage of federal grant opportunities to help fund projects (Manchester, San Antonio, Tucson). In other cases, strong state or local solar incentives attracted a private developer market to build projects at airports (Denver, Indianapolis, and Newark). In each case, airports have been able to make the business case for the projects by pointing to the economic, self-sustainability, environmental and social benefits.

1.4.3 Drivers for Existing Airport Renewable Energy Projects

Initial communications with airports about the renewable energy business case suggested that airports did not formally consider the business case when developing their projects. However, airports developed renewable energy projects for different reasons and understanding those reasons would be useful in identifying the drivers that supported the airport's business case for renewable energy.

To collect data on airports' decision-making process and the drivers for undertaking renewable energy, the Project Team prepared a simple web-based survey using Constant Contact. To improve response success rates, the survey was limited to 10 questions to make it easy for recipients to respond. This approach was appropriate as only general information was sought. The survey was directed to airports that had completed renewable energy installations. In addition, the survey was sent to only one contact from each airport to avoid receiving multiple responses for a single installation. Since researchers had worked with the airport respondents on other related industry initiatives, it was anticipated that response levels would be relatively high. A compilation of the survey results provided through Constant Contact is included in Appendix A.

The survey was sent to 91 airport contacts and 22 responses were obtained for a 24% response rate. Here are some of the key findings.

Energy Sources:

- solar = 72.7%
- geothermal = 22.7%
- solar thermal = 9.0%
- wind = 4.5%
- biomass = 4.5%

Source of Initiative:

- internal staff = 50%
- organizational strategic planning = 27.7%
- outside private party = 18.1%

Initiative Leader:

- Director = 31.8%
- Facilities = 22.7%
- Other = 45.4%

Primary Driver

- Economic = 42.8%
- Environmental = 42.8%
- Political = 9.5%

Secondary driver

- Environmental = 42.8%
- Economic = 33.3%
- Social = 14.2%

Most Important Factor (average score on 1 to 5 scale)

- Reducing cost or generating revenue = 4.9
- Demonstrating industry leadership = 4.6
- Locking-in long-term price stability = 4.0
- Diversifying energy supply = 3.4

- Meeting local/state renewable energy policies = 3.1
- Achieving Greenhouse Gas emission reduction targets = 2.6
- Meeting demands from investors and customers = 2.1
- Mitigating permitting obstacles to future expansion = 1.5

Degree to which project has had a broad positive effect on the airport's bottom line:

- Low = 47.9%
- High = 19.0%
- Undetermined = 19.0%
- Medium = 14.2%

Degree to which project has had a broad positive effect on the airport and its business:

- Medium = 42.8%
- High = 23.8%
- Low = 19.0%
- Undetermined = 14.2%

The information in the responses is somewhat conflicting in that it indicates economic factors are the most important drivers for the projects but the economic benefit realized was not as strong. Environmental drivers are also strong. A key response is the importance of being an industry leader which is an indicator of the importance of airports as a gateway for economic development and environmental leadership.

The empirical information from the survey provides evidence that the inherent renewable energy benefits discussed above were drivers for past projects and that they support the airport's business case for pursuing renewable energy.

2 Preparing the Basis for the Business Case

The basis for the business case is specific to each airport and its operational needs. It is essential that airports prepare the basis for the proposed project from which all decisions flow.

Building the business case starts from a broad perspective of how the renewable energy project fits into the overall objectives of the airport organization and narrows down to the execution of the renewable energy project. The four phases of developing the business case are Vision, Evaluation and Selection, Planning Process and Project Implementation. Individual aspects of each of the three phases are shown in the blue boxes in Figure 2-1 below.

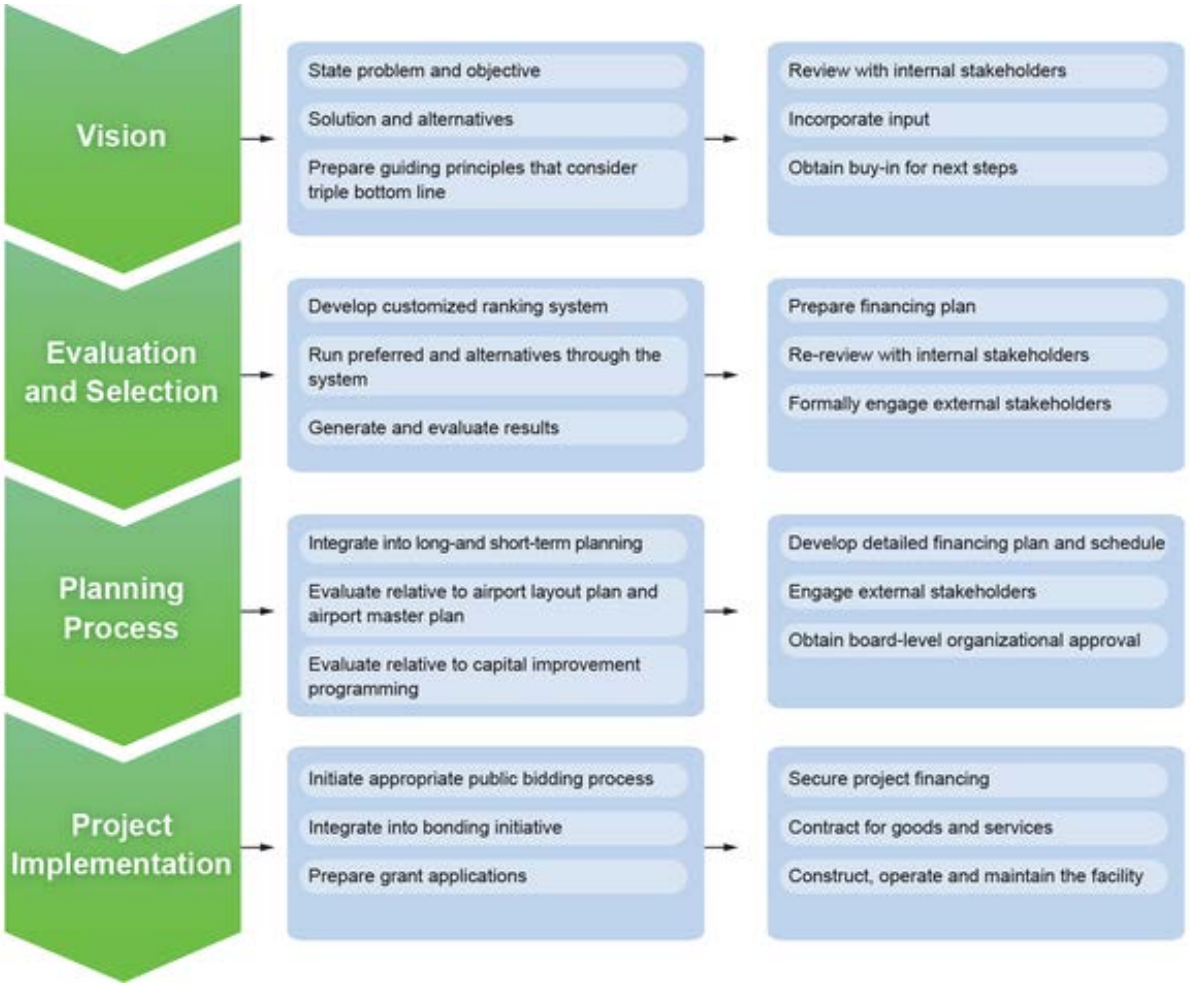


Figure 2-1. Developing the Airport Renewable Energy Business Case Flow Chart

The following sections describe the key steps in creating the project vision shown in Figure 2-1 above.

2.1 Vision Statement

At the outset of any airport project, staff needs to start by reviewing the airport's broad vision and evaluating how the project supports that vision. This step is fundamental to confirming that the project concept has a strong foundation and alignment with the airport's long-term development goals. The airport's vision will be found in a variety of formats (e.g., website, internal planning documents), both clearly stated and implied, where the airport's mission is described. From the vision, the need for the

project can be prepared and communicated, and its alignment with the organization's strategic goals described. The importance of developing a vision as part of a strategic plan to direct project implementation is described in ACRP Report 20: "Strategic Planning in the Airport Industry."[22]

A Vision Statement, taken from the airport's other planning activities, presents the purpose of the airport and its value to the public. The alignment of the renewable energy project to the airport's vision will be developed on a case-by-case basis. However, a renewable energy project is likely to support goals associated with developing and operating a modern and efficient airport that will be capable of mitigating economic and environmental risks in the future.

2.2 Problem and Solution

The business case must be based on a relevant problem that the proposed project will solve. Each airport will have a different objective that can be fulfilled by the renewable energy project as illustrated in Figure 2-2. Here is an example:

Problem: the airport is vulnerable to off-grid electricity disruptions and requires a diversity of on-site generation source.

Solution: a solar PV project designed to provide on-site electricity to key functional areas will enable the airport to operate safely and effectively in extreme external circumstances.

Once a justification for the renewable energy project is identified as part of the airport's strategic goals, the lead staff needs to define the characteristics of the project. This process includes evaluating technologies and sites that are viable and can meet the airport's needs. It will also include an initial financial assessment that addresses both public and private financing options. The concept of financial master planning is described in ACRP Report 49: "Collaborative Airport Capital Planning Handbook."[23] As an early stage analysis based on available information, the financial assessment should be sufficient to support a preferred project as well as alternatives worthy of additional consideration. It is also important at this time to communicate the project concept to internal stakeholders, namely management and decision-making staff, to make sure that they have thoroughly reviewed the early stage project plan, and it has their support.

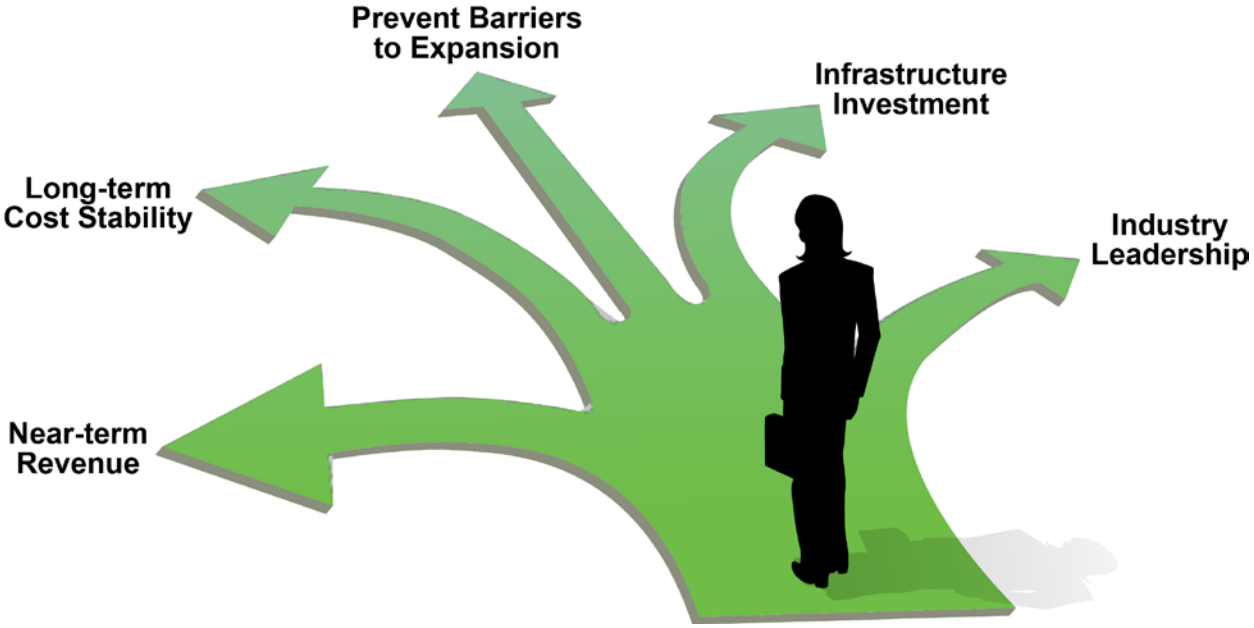


Figure 2-2. Business objectives that can be fulfilled by renewable energy

There are a number of critical aspects to developing the renewable energy project concept. One is identifying a technology that fits both the renewable energy resource and facility needs of the airport. For example, airports located in high elevation areas may be unique locations for airport compatible wind energy systems while those considering the development of a new terminal may consider the opportunities associated with geothermal heat pumps. When evaluating the financing options, airports will want to understand the maturity of their state's renewable energy industry, which may suggest that there could be interest from private investors. If the private market is not well developed, the airport may want to push forward with a FAA funding program, but should also consider how that might affect funding of other airport projects.

2.3 Confirm Justification and Guiding Principles

Next, the airport must confirm the justification for the project and develop its guiding principles. The purpose for preparing this information is to establish the primary importance of the project which can be regularly referred back to when counter arguments are raised during planning and development. This core information about the reason for the project can be used throughout the project's lifespan from the earliest stages to build initial support to later in the project when many issues about the project have been raised. For example:

Justification: Airports are not prepared for electrical grid disruptions and rely on a non-interruptible supply of electricity to operate safely and efficiently. Airports need to start making systematic investments in on-site power generation to ensure that they serve the public under a variety of conditions well into the future.

Guiding principles:

- Project will sustain long-term functionality of the airport
- Project will maximize cost-effectiveness to the extent practicable
- Project provides other social benefits by contributing to local public policy goals
- Project is compatible with aviation operations and does not impact the safety or operations at the airport.

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3 Using Evaluation Criteria and Ranking Methodology

Airports that have identified a problem and solution, and developed the guiding principles behind the solution, must next vet the solution and its alternatives to determine that there is a business case for proceeding. As with the methods of science, a theory is proposed and then tested. In this case, the airport has identified a potential solution to a problem based on a limited amount of information, and now must test the credibility and feasibility of the solution as the best approach and in doing so develop its business case for the project.

In this section, we provide a vetting process, which is central to evaluating the business case for renewable energy. The first step is a fatal flaw analysis to ensure that the most fundamental aspects of the renewable energy solution at an airport are satisfied: namely, can the project be safely located at the airport; is there sufficient natural resource available at the airport to generate renewable energy; and is there infrastructure and capacity to deliver the renewable energy to a consumer?

Next, we must set up the process for critically evaluating the project and alternatives by describing the key evaluation criteria necessary for assessing the advantages and disadvantages of a renewable energy solution. These are categorized under four primary headings: financial, self-sustainability, environmental/social, and other. Finally, we introduce an Evaluation and Ranking Methodology and Matrix for systematically assessing renewable energy and traditional alternatives that attributes value to those inherent benefits provided by renewable energy. The reader can use the accompanying spreadsheet tool to input values for their specific projects and generate results to rank projects being considered. The matrix is not only useful to generating values for ranking and comparing projects, but it also lists the types of data on a project needed for evaluation and can be used to direct the data collection program to support fact-based decision-making. After vetting projects and alternatives through this evaluation process, the airport will have built its business case either for renewable energy or a traditional alternative.

3.1 Fatal Flaw Analysis

A fatal flaw analysis is an initial screening assessment to make sure that fundamental aspects of a project can be satisfied, and support the investment of additional resources. For airport renewable energy projects, the proponent must ensure that the airport and renewable energy project can coexist and prosper without conflict. The primary factors in an airport renewable energy project fatal flaw analysis are airspace compatibility, natural resource availability, and infrastructure capacity.

3.1.1 Airspace compatibility

Airports must operate safely and efficiently to satisfy their mission and be successful as businesses. On the most basic level, the airport must ensure that all activities within its control (and that of the FAA, which is responsible for overseeing a safe and efficient national airspace system) are compatible with airports and airspace.

Airspace impacts include tall structures that could penetrate airspace and obstruct safe air transit, structures and activities that disrupt the radars and other communication systems needed to safely and reliably transit through airspace, and any other activities that might negatively impact pilots and their aircraft. ACRP Report 108 provides a thorough review of energy technologies that can have a negative impact on airports and airspace if not sited appropriately.[24] Tall structures associated with renewable energy that can impinge on airspace include modern wind turbines, concentrating solar power towers, and transmission towers necessary to deliver power from the generator to the consumer. These structures, due to their size, can also block radar communication signals, which is of particular concern to flight training exercises and military readiness. When siting smaller structures on airport property, including ground-mounted solar arrays, planners must keep in mind the location of various ground based radar and other

navigational aids used by pilots. Siting projects to avoid airport communication interference is critical to ensuring safe operations at the airport, though it is not a fatal flaw to the technology. The height of structures is one of the reasons why solar PV is more compatible than wind turbines as shown in Figure 3-1.

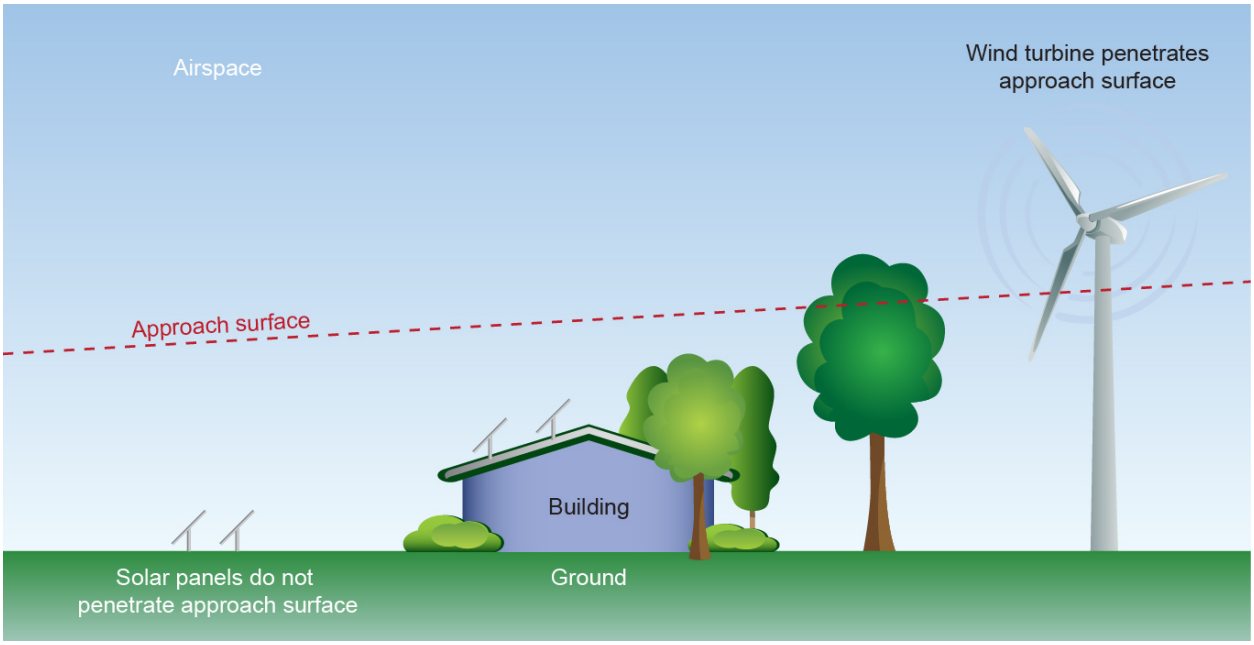

Figure 3-1. Physical penetration of airspace from renewable energy technologies

Glare from solar panels is another type of airspace compatibility issue that has become familiar to solar energy developers and airport hosts. Glare on controllers in the air traffic control tower can have a significant negative impact on their ability to perform their jobs and all solar project proposals on an airport property must assess the potential impact of glare. Glare to pilots on final approach to landing at the airport must also be evaluated and its impact minimized. Glare is typically not a fatal flaw for project siting as it can often times be mitigated through alternative project designs, but it may render a particular site on an airport either technically or financially not feasible and require a search for an alternative site.

Airspace impacts can also result from thermal plumes associated with energy cooling systems that may be a component of a renewable energy system (e.g., concentrating solar power, biomass). However, concentrating solar power is unlikely to be sited on airport property unless a technological breakthrough is achieved and airport biomass projects have been limited in number and scale. Electromagnetic interference has also been identified as producing a potential negative effect on radar although problems have not been documented.

3.1.2 Natural Resource Availability

Renewable energy technologies are fueled by natural resources whose availability will vary based on geographic location and proximity to specific resources. Simply put, if an airport does not have sufficient renewable energy resources to produce power efficiently, this is considered a fatal flaw and the renewable energy project cannot proceed.

Resource availability is a generic term that varies among different renewable energy technologies. For example, solar resources are stronger in Arizona than in Alaska. However, every airport has some sunshine and solar photovoltaic technology can convert sunlight into electricity in both high and low intensity areas though the efficiency in production will impact project economics. Alternatively, the ability to generate hydropower requires a water source and without a water source hydropower is not feasible.

Between the solar and hydro power examples, wind power is "technically feasible" in most places because the wind blows at some time as evidenced by the airport wind sock (see Figure 3-2). However, the emergence of a robust wind power industry is based on the ability to produce electricity efficiently. As power production from wind increases by the cube of wind speed, then incremental increases in wind results in a substantive increase in power. As a result, wind turbines have increased significantly in size (modern turbines are 500 feet tall) and they are located in high wind areas (the Midwest Plains and ridgetops), which has increased generation efficiency. Biomass will be most cost effective in regions where there is a robust forestry industry that produces low cost waste wood as a fuel in close proximity to biomass plants.

Figure 3-2. Wind sock seen at airports

Geothermal comes in two forms: true geothermal and ground source heat pumps (GSHP). Power generating resources associated with true geothermal is very site-specific and relies on proximity to areas where the heat from the earth's core is expressed at the earth's surface. Conversely, GSHPs use the constant temperature below the earth's surface (~50° F) to extract relative coolness in the summer (and replace it with the hot air above) and then extract the previously stored hot temperatures in the winter for heating and replace it with cool temperatures from above. While GSHPs perform best where seasonal ambient temperatures are more extreme, they are feasible most anywhere because the temperature underground remains constant.

3.1.3 Electrical Infrastructure Capacity

Energy projects are typically reliant on infrastructure like the high voltage power lines shown in Figure 3-3 to obtain fuel or distribute the power generated. Truly renewable projects providing on-site power demonstrate the feasibility of unplugging from the grid. In reality, renewable energy projects are sized in accordance with the on-site energy demand profile to limit reliance on grid-supplied power and maximize long-term savings from avoided energy purchasing.

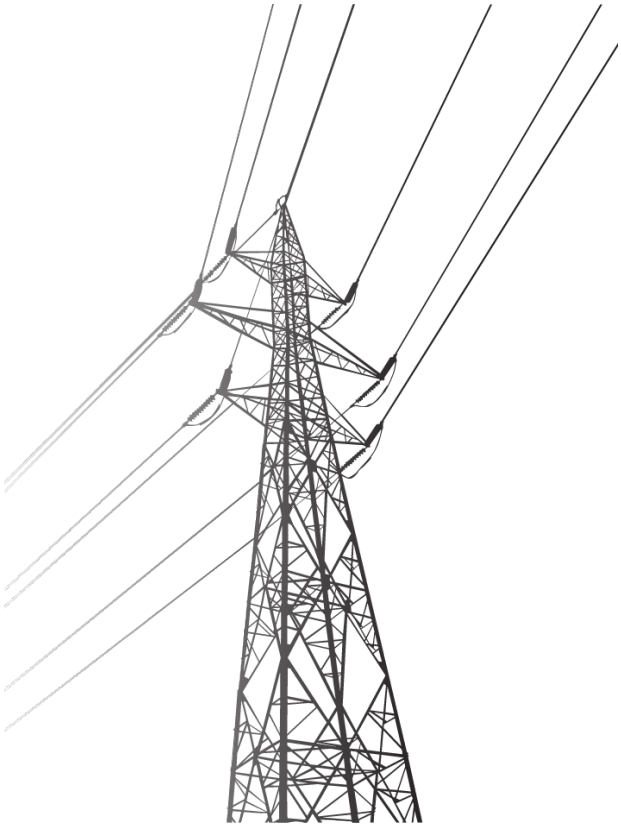

Figure 3-3. Airports purchase electricity from the electric grid

Most commercial airports are large consumers of power and therefore are served by an existing electrical infrastructure network with capacity to supply the energy needed. Smaller airports in rural areas may not have sufficient electrical infrastructure capacity to support a renewable energy generation project without significant upgrades which can be expensive and quickly make a project not cost-effective. Even large airports with existing electrical capacity to the terminal building may have insufficient infrastructure in areas away from the terminal that are suitable for locating a project.

Infrastructure capacity is not necessarily a fatal flaw but will quickly influence if a project location or a particular site on property is likely to be cost-effective. For some airports, this will exclude the renewable energy option when compared to conventional alternatives. For others, it will simply limit the number of options that are feasible on property.

3.2 Evaluation Factors

Projects that pass the fatal flaw analysis are then evaluated against a decision-making matrix developed specifically for this research project. The matrix creates a framework to account for the inherent values of renewable energy projects in supporting the long-term interests of stable, large-scale government infrastructure projects. The specific evaluation criteria are detailed below in Section 3.3. First we introduce the three primary factors from which the specific decision-making matrix criteria are derived in order to set up their importance to project evaluation when developing the airport business case for renewable energy.

3.2.1 Economic

All organizations must operate with a budget where they can generate revenue and pay for costs while making investments for long-term sustainability of the organization. Resources are limited, requiring managers to make decisions about expenses. As a start, managers will assess the costs of the project,

funding sources available, financing options, and metrics to determine costs and benefits. The simple financial analysis is the baseline for any business case. All projects should start at the visioning stage with a general approach to financing the project (e.g., Airport Improvement Program (AIP), bonds, private partner) that can be tested and refined as the project concept is refined and the business case is developed. It is important to note upfront that the pure economics of any energy project will change over time as the result of dynamic market energy prices, changes in the cost to install renewable energy, refinements in the understanding of project costs and the overall political and economic conditions at the time. The following are some of the financial concepts important to establishing the business case baseline and how they are expressed.

3.2.1.1 Project Cost Metrics

The airport can use a number of financial metrics to assess project cost. The most straight-forward measure is the **simple payback** where the airport makes an investment to get the project started and it recovers costs during the project operations and at some point achieves its payback (usually in years). As a simple example, you may pay $10 more for an energy efficient light bulb but it saves you on electricity consumption and the cost of that electricity avoided accrues until you have saved $10 which is the payback period. For a lightbulb, that can be as little as three months depending on how often the light is used. The analysis becomes more complicated for longer payback period since assumptions need to be made for the cost of the electricity avoided in future years, which is not known and is dependent on market prices for electricity. [Most forecasts use 3% annual increases, which accounts for a long-term average over twenty years but does not account for the year-to-year (and seasonal) variability that can result in short-term fluctuations.] **Total cost of ownership** is another commonly-used measure which includes the cost to develop and activate the project as well as the cost to operate and maintain the project throughout its lifecycle. For renewable energy projects, operations and maintenance costs tend to be relatively low because (1) there are no fuel costs (with the exception of biomass feedstock), and (2) some systems require few moving parts and have warrantees for the life of the project (e.g. solar panels typically have a 25 year warranty). As with simple payback, the total cost of ownership analysis must account for energy savings from the avoided cost of buying power from the grid which requires assumptions for future cost of electricity. **Rate of return** is what an investor might expect when investing to capitalize a project and then earning an annual profit from the production and sale of the energy to a buyer. The return represents annual income from the investment, and the return assumes that the investor will later recoup some portion of the investment in a sale of the project. As airports typically accrue financial benefit from the cost savings, the simple payback and total cost of ownership measures tend to be more representative of an airport's roles and uses.

3.2.1.2 Availability of Grants

An airport's ability to access grants to off-set its own total contribution to the project is an important factor in evaluating the pure cost-effectiveness of a renewable energy project. Reducing capital investment will shorten the simple payback period when full project cost recovery can be attained. For example, renewable energy projects funded under the VALE Program between 2009 and 2011 received an AIP grant for between 75-90% of the total project cost. Without these grants, it would have been difficult to justify the long paybacks (20-30 years) but with the grant, the 3-6 year paybacks were very favorable, given that operations and maintenance costs for the project life would be low. With FAA energy grants now transitioned to the Section 512 Program, the effect of the grants on the cost-effectiveness of the renewable energy project is unchanged. However, unlike VALE, which was a specific set aside program, the airport will need to forego funding other projects that may be central to airport infrastructure if they choose to fund the renewable project.

3.2.1.3 Availability of Tax Credits and Renewable Energy Certificates

As discussed elsewhere in this report, the cost-effectiveness of renewable energy projects is strongly linked to government policy and incentives including tax credits and RECs. Federal tax credits for

renewable energy in the form of production tax credits (PTC) for wind power and investment tax credits (ITC) for solar and other technologies have helped to catalyze private markets. These tax credits are authorized by Congress and are allowed to expire which has resulted in market instability. However, the overall decrease in development costs and the value of other incentive programs (e.g., demand for RECs) could stimulate private investment to a point where tax credits are no longer necessary to make project economical. At the time of this report, there is a significant amount of solar development activity as developers look to get solar projects in service by the end of December 31, 2016 when the ITC will decrease from 30% to 10%. At the same time, the wind industry has been developing projects without a surety of a PTC since December 31, 2013. The instability in renewable energy tax policy increases potential risk to private capital minimizing policy effectiveness.

Separately, the demand for RECs helps create demand for renewable energy, which, absent a federal law, is currently implemented on a state-by-state basis. If an airport builds, owns and operates its own renewable energy project, purchase of the RECs that the project creates (and owned and held by the airport) can provide an additional source of revenue to help the airport pay off the project.

3.2.2 Business Self-Sustainability

Airports that receive FAA funding are required to operate in a manner that preserves their long-term self-sustainability. This principle is fundamentally associated with an airport's rates and charges structure whereby the airport is responsible for aligning fees with its costs to maintain its facilities and services. It is also related to decision-making that recognizes the role of airports as a vital component in the transportation network. Airports, as stable and long-lived organizations, are able to maximize the life cycle benefits of renewable energy to support their business self-sustainability objectives.

3.2.2.1 Electric Supply Reliability and Emergency Preparedness

If the power goes out, then all commerce and activity ceases. As society increasingly relies on technology and digital information, the importance of uninterrupted power is even more evident. While many airports have backup power in the form of diesel generators and batteries, in some cases, to serve critical functions at the airport, greater planning is being directed to improving the reliability of the airport's electrical supply.

The need to invest in reliability and backup systems has become more evident in recent years relative to the effects of severe storms and international terrorism. Superstorm Sandy was an example of how increasing national investments in population centers along the country's coasts, in particular, are more and more vulnerable to severe storms and the potential complexities of sea level rise. Many large commercial airports are located on coastal locations exposed to ocean storms, and as such infrastructure improvements to adapt to changing climatic conditions are being considered. Such improvements need to consider the option of generating power on-site and investing in microgrids so that airports can serve as critical infrastructure and remain operational during regional events, and also to preserve the continued operations of airport businesses at risk to disruption.

Enhanced reliability is achieved through investments to augment and diversify supply, increase the diversity and capacity of delivery options, and improve control and management systems. Investments to modernize the on-site grid will minimize business risks associated with power disruptions and could be achieved, in part, with renewable energy generation.

3.2.2.2 Price Stability and Cost Control

Electricity and heating/cooling costs are typically affected by the cost of fuel. For electricity, power is supplied through the electric grid by large power plants fueled by coal, natural gas, and oil. Some areas of the country have a large portion of electricity supplied by nuclear while the Pacific Northwest has a significant amount of hydroelectricity. Heating costs are affected by the price of natural gas, propane, oil, and electricity. In the majority of the country where power is derived from fossil fuels, the costs can vary

dramatically from season to season and year to year as well as by geography. A good illustration of this is natural gas that fuels both utility-scale electric power plants and commercial and residential heating as shown in Figure 3-4. In the mid-2000's, natural gas was in lower supply and more expensive than dirtier burning alternatives including coal and oil. Environmental regulations were requiring new power plants to be built with cleaner burning natural gas which led to broad increases in electricity prices across the country. Soon thereafter, hydraulic fracturing ("fracking") technologies for extracting oil and gas locked in shale deposits became commercially cost-effective resulting in a domestic oil and gas boom. The increased supply drove down electric prices across the country. New England was an exception to this because it had a high demand for gas but constrained infrastructure to deliver it from production areas in the central U.S. The oversupply in natural gas has produced a glut whereby there is no incentive to increase drilling capacity. This condition will likely result in a corresponding decrease in supply and increase in prices thereby starting the whole cycle over again.

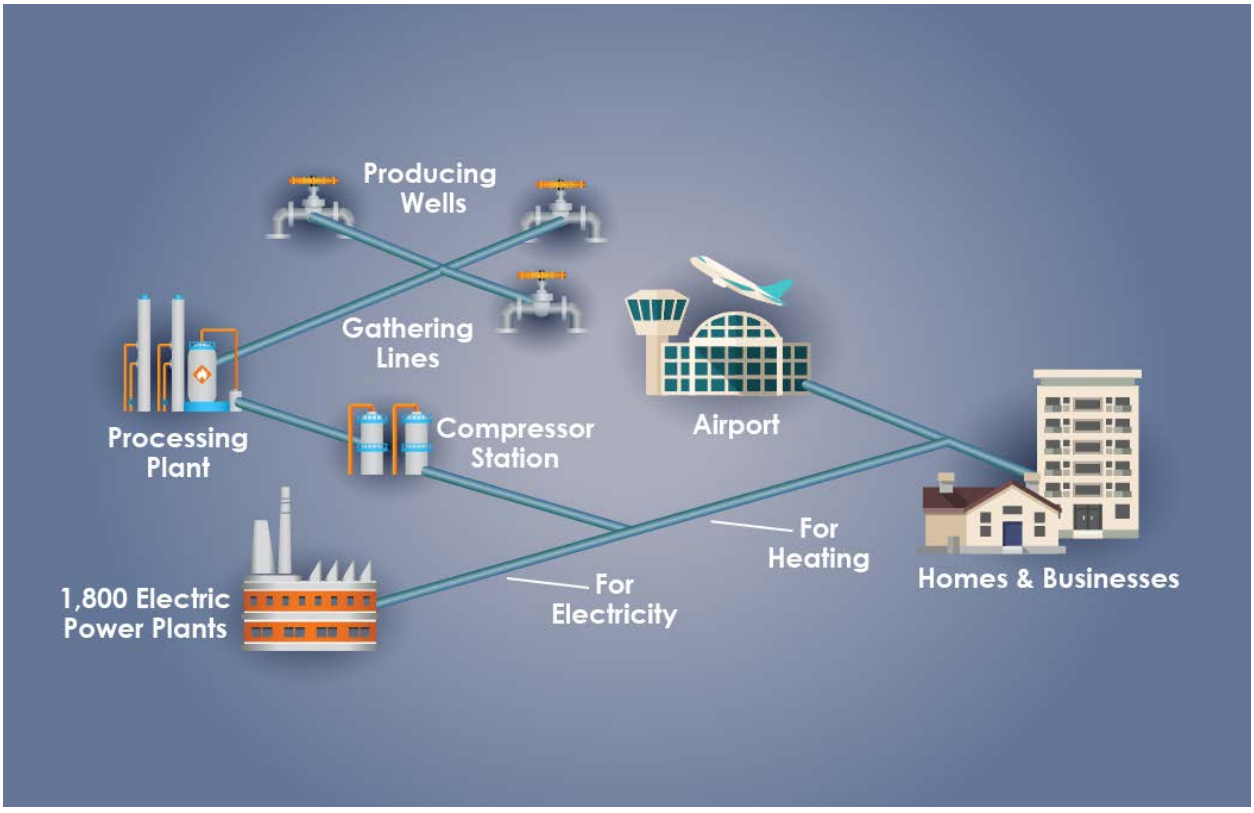

Figure 3-4. Natural gas fires large electric power plants and building heating systems

One of the benefits of renewable energy is that the total project cost over the life of the project is principally in the initial start-up. Costs of operation and maintenance are relatively low and highly predictable. As a result, the total project cost can be reliably predicted and funded by a stable price of electricity produced over a 20-25 year period. Airports can either obtain this stable electricity price by executing a long-term contract to buy the output from a private facility or by building their own project and funding it through long-term bond payments that are at or less than the existing costs of electricity. When they are able to lock in electricity prices at a set and reasonably stable rate over a long-term period, airports can more accurately budget to those energy costs and not have to react to unpredictable and uncontrollable annual costs.

3.2.3 Environmental and Social Costs Avoided

Environmental laws enacted over the past 50 years have improved quality of life and expanded business opportunities in many areas. Tourists ply the waters of urban harbors that were not long ago the dumping

grounds for the city residents' waste. Greater participation of communities around such projects has also expanded the social benefits. Yet, those investments had short-term effects on proposed development activity that had to pay for past problems and invest in protection to prevent future problems.

Similarly, airports of the future are at risk of constraining growth if they do not make environmental investments to mitigate potential environmental impacts of that growth. The following environmental and social benefits from renewable energy projects are easily identifiable and the environmental and social investments made have had a direct financial benefit to society. However, assigning a specific economic value to these environmental and social investments to a single project is difficult. Each airport will place a value on these factors when developing their renewable energy business case and this can be achieved by assessing the information provided below and applying site appropriate weighting when using the decision-making matrix.

3.2.3.1 Greenhouse Gas Reduction

Greenhouse gases (GHGs) including carbon dioxide and methane are known to trap heat in the earth's atmosphere and enhance the warming of the earth. Many public policies, business commitments, and changes in individual behavior have led to reductions in GHGs, yet carbon levels in the atmosphere continue to rise. Airports, through their work with affiliated local government agencies and in partnership with industry and the federal government are taking actions to reduce their contribution of GHGs. Implementing renewable energy programs, either through the construction of on-site renewable energy facilities or through commitments to purchase renewable energy from off-site sources, are credible and measureable ways that airports are taking action despite the complexity of calculating the local benefits of such actions.

3.2.3.2 Environmental Risk and Liability Reduction

As airports seek growth to meet demand, augment their businesses, and contribute to a regional economy, they are at risk that their growth plans will be constrained by concern about environmental impacts. Airports are more routinely responding to this challenge by incorporating sustainability elements as a central part of their development programs. Generally, sustainable design is considered to come at a premium upfront cost, but with returns through cost savings over time. The same is true for renewable energy. However, as the focus of environmental protection further pivots away from reuse and recycling (as those goals are attained and maximized) and more toward reducing carbon emissions, there will be a need for all airports to generate their own sources of clean power. Airports that take such actions in the near-term will avoid the risk that environmental regulation will slow down expansion plans due to a lack of on-site clean energy.

3.2.3.3 Achievement of Public Policy Goals

Airports are often part of a larger government network that has established goals and even mandates associated with environmental protection. Airports must be able to respond to such directives and demonstrate the achievement of public policy goals. While, in some markets, there may be no specific economic value to the airport in doing so, attaining goals related to clean energy usage will be critical to the long-term stability of the airport business.

3.2.3.4 Mitigating Community Impacts

Communities near airports are often active participants in the day-to-day actions of the airport. Because airports have a relatively large effect on surrounding communities as a result of aircraft activity and its visibility, airports are often challenged to meet the demands and interests of the surrounding community as well as to show a positive contribution. Renewable energy has a broad appeal and most polls show that people support its adoption. The development of a renewable energy project or the purchase of renewable energy on the open market can have a direct and positive impact on an airport's relations with its neighbors.

3.3 Weighting and Ranking System

A primary objective of this research was to develop a weighting and ranking system that could be used by airports when evaluating the business case for renewable energy. A unique feature of the weighting and ranking system is that it would allow airports to attribute value to both easily identifiable financial measures as well as sustainability factors. The latter has broader benefits to sustainability of the airport business as a community participant and critical component of the regional infrastructure network.

The result is a decision-making matrix, which is provided in a digital spreadsheet format for use with this Guidebook. The criteria that form the basis for the decision-making matrix are described below under four fundamental categories: economic, self-sustainability, environmental/social, and other. The previous section describes how these factors provide benefits to airports. Section 6 presents a model business case as an example of how the decision-making matrix can be utilized. The following section describes the nuts and bolts of the system.

3.3.1 Basis and Customization

3.3.1.1 Categories

The matrix includes four categories that airports can use to evaluate renewable energy projects and alternatives and generate a score for each project evaluated. The four categories are:

- Economic
- Self-Sustainability
- Environmental & Social
- Other

Economic information provides the critical baseline for any business, including an airport's needs for understanding requirements and sources of financial resources. The self-sustainability component recognizes the airport's position as a stable and long-lived facility with the need for investment to support its position as critical infrastructure and as a long-term business enterprise. The environmental and social attributes recognize the airport's positon as an agent of government and its role as a leader and a team player in the community of stakeholders. In addition, there are other factors that cut across all three areas which are specific to its position as a federally-obligated entity.

3.3.1.2 Required information

Before the matrix can be a decision-making tool, it is first a process for identifying required data necessary for informing the business case. Some of the information it requires, such as whether the project consistent with the Master Plan, will be readily at hand or known to airport staff. Other information, such as the cost of electricity, will require coordination with other departments at the airport or within the broader government administration. Other data will require outside expertise from energy consultants and local advocates. The data collection effort can also develop the comprehensive network of stakeholders who will have an interest in the project. As information is collected, the matrix will more accurately produce results that are reflective of the airport's situation and interests.

3.3.1.3 Customization to Airports Goals

The matrix provides the airport with a structure for evaluating renewable energy projects and alternatives including key criteria and a system for generating results based on desired attributes. Because each airport will have different goals and objectives and points of emphasis in pursing energy projects, the matrix is meant to be customized by the airport. For example, if an airport has a strong public policy mandate from its governing authority, the airport can increase the points attributed to that factor. Or if the airport is in the process of developing a climate adaptation plan, the airport will want to increase the value of ranking associated with reliability and resiliency.

3.3.2 Renewable Energy Evaluation Criteria

The following criteria included in the weighting and ranking decision-making matrix are summarized below. Refer directly to the matrix spreadsheet that accompanies this Guidebook to follow the discussion and use of the matrix.

3.3.2.1 Economic

There are seven factors in the economic category.

- Capital cost: this is simply the total cost to construct the project from conception to commissioning. As a start, the National Renewable Energy Laboratory provides example costs, which are provided for use by readers in Section 6.
- Capital cost leveraging: this factor provides value to options that can attract public and private partners.
- Operations and maintenance costs: this factor considers the potential burden the project may place on the airport for system operations and maintenance (O&M).
- Life cycle costs: this factor addresses the potential costs throughout the project life from cradle to grave.
- Revenue enhancements: if a project is able to provide the airport with a revenue source, additional points are gained.
- Benefit/cost: value is measured based on the perceived benefits vs. costs.
- Energy costs: the change in the cost and stability of energy from the project is afforded weighting value.

3.3.2.2 Self-Sustainability

There are four factors in the self-sustainability category.

- Meeting energy demand: there is value to the airport infrastructure in generating and supplying power on-site.
- Continuation of business resiliency: the energy project adds value to the airport if it can continue to produce power even when regional sources are disrupted.
- Mitigation for proposed development actions: the project has added value if it mitigates potential impacts of future airport development, thereby facilitating infrastructure expansion to accommodate future growth.
- Enhancement of future opportunities: if the project can foreseeably open up new opportunities at the airport by demonstrating innovation that may be replicated in the future, it could receive additional points.

3.3.2.3 Environmental/Social

There are six factors in the environmental and social category.

- Local or regional environmental or sustainability goals: if the project will help the airport achieve goals and policies it has set in the areas of environmental and sustainability, it will receive enhanced weight.
- Permanent job creation: projects that create jobs receive widespread value.
- Greenhouse Gas Emissions: projects that result in a decrease in greenhouse gas emissions will receive higher value.
- Air quality impacts: beyond greenhouse gas pollutants, projects that avoid other air pollutants will also be favored.
- Enhances customer experience: should the airport perceive that the proposed project will be received positively by visitors to the airport, additional weight will be gained.

- Consistency with airport's sustainability plan: should the airport have in place a sustainability plan and the proposed project is a component identified in the plan for implementation, it will obtain additional value.

3.3.2.4 Other

There are four factors in the other category.

- Consistency with master plan: projects that are consistent with the master plan will show that the airport has long considered the need for the project and that it works in harmony with the airport's primary mission.
- Ease of implementation: projects that are expected to be developed in a relatively straight-forward manner without any pitfalls will be preferred.
- Impact due to construction: should the project be perceived to have potential complications during construction, it will not receive additional weight.
- Project risk: where project risks are identified, these will be noted in the ranking assessment. The level of risk perceived can be accounted for in the weighting.

3.3.3 Review Options and Select Approach

The ranking system should be used to evaluate both renewable energy and non-renewable alternatives. Each project type should be run systematically through the matrix. Where insufficient information is available, follow-up research should be conducted. In this way, the matrix can be used to develop the business case for renewable energy and if the case cannot be made, the alternative approach can be selected.

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4 Integrating with Planning and Decision-Making

As renewable energy projects become more prevalent and desirable, it makes sense to consider and include them into the capital planning and decision-making process at airports. Planning for renewable energy projects, like other airport capital projects, allows an airport to identify and respond to opportunities to develop such projects when physical requirements, strategic objectives, capital availability, policies, and other circumstances make the projects desirable and viable. All airports have basic capital needs that they must plan for including planes, runways, terminals and parking as depicted in Figure 4-1. Renewable energy must align and be consistent with these basic needs.

Early capital planning often consists of master plans or similar comprehensive planning documents such as land use plans and, more recently, sustainability plans. These documents typically have a longer-range outlook and consist mostly of broad concepts for capital development. Similarly, the business case for a master plan is usually focused on the overall plan and its ability to meet the airport's goals without overburdening the users by its cost.

Figure 4-1. The Basic Infrastructure Needs of All Airports

The early plans provide a critical foundation for the subsequent Airport Capital Improvement Programming (ACIP) that is more detailed and usually includes schematic level concept development, operational and construction sequencing plans, refined cost estimates and schedules, and environmental analysis. The business case for ACIP projects requires additional detail in order to provide the justification needed to garner stakeholder support. This chapter first addresses considerations for incorporating renewable energy projects into higher-level master planning, and then how those broad plans are further developed during capital improvement programming.

4.1 Master Planning and the Renewable Energy Context

Ideally an airport should address the need for evaluation of renewable energy projects, similar to other major capital development needs, as part of an initial planning effort such as a master plan. This would document conditions and identify variables to set the framework for future detailed planning, including business case formulation. As with other capital development planning, the airport sponsor should consult various departments and stakeholders regarding the desired outcomes for proposed renewable energy planning in conjunction with developing the goals and objectives and prior to engaging a planning team. This will result in a more accurate scope, focused planning team expertise, and more successful analyses.

As stated in FAA Advisory Circular (AC) 150/5070-6B, Airport Master Plans, "An airport master plan is a comprehensive study of an airport and usually describes the short-, medium-, and long-term development plans to meet future aviation demand. The goal of a master plan is to provide the framework needed to guide future airport development that will cost-effectively satisfy aviation demand, while considering potential environmental and socioeconomic impacts." As such, the master plan is typically a high-level study that frames the current conditions, anticipated activity changes and opportunities to accommodate those changes. Master plans define the intent, anticipated improvements, and phased development that embody the long-term vision of the airport. Therefore, incorporation of renewable energy elements within a master plan provides a logical context to long-term energy and sustainability goals.

Focused planning related to specific areas of interest or need is common in master plans, and renewable energy logically could be one such focus area or could be discussed as part of a sustainable master/management plan. As airports' demand for energy grows, it becomes natural to incorporate an evaluation of potential renewable energy projects. However, because renewable energy projects impact land use and have potential to impact operations if not planned and implemented carefully, planning for such facilities takes on a larger focus than the traditional master plan analysis of power utility adequacy.

Typical areas of analysis in a master plan include airfield and airspace, terminal, roadways and ground access, parking, support facilities, air cargo, general aviation, utilities, land use, fueling and environmental considerations. Renewable energy could be addressed under a new category of "Energy", which would encompass analysis of energy for the entire airport campus or specific focus areas. It would not be a stand-alone category but would support and envelop all other areas of analysis.

4.1.1 Existing Conditions

The inventory portion of a master plan captures the existing conditions at an airport to support the subsequent analyses. Information typically collected in the master planning process – land use, topography, environmental setting, airfield critical areas, and utility infrastructure to name a few – would be used in the later analyses and business case for renewable energy. However, additional information would be required specific to potential renewable energy projects. The airport diagram, an example of which is provided in Figure 4-2, shows the primary aeronautical infrastructure that must be considered when siting and designing the renewable energy project.

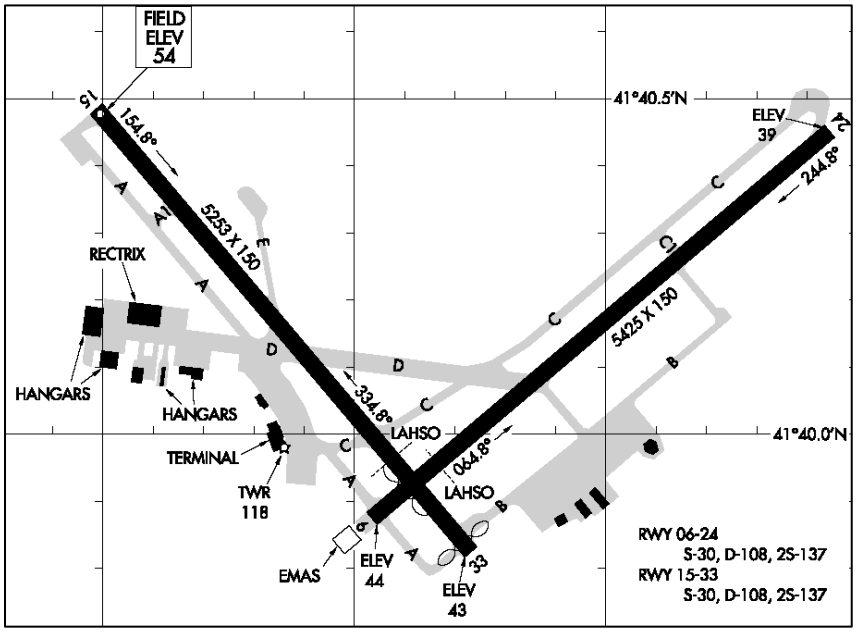

Figure 4-2. Airport Diagram shows the fundamental components of aeronautical infrastructure

For renewable energy projects, the scope needs to include exploration of existing energy use and needs, as well as local/regional setting and energy or sustainability policies. Also, more specific information is needed regarding electrical utilities, rates, and infrastructure.

The airport and its planning team will need to answer the following questions to obtain information needed specifically to support a business case for renewable energy projects:

- Does the regional setting lend itself to certain types of renewable energy – solar, wind, geothermal, wave/tidal?
- What is the cost of power and rate structure paid by the airport?
- What other sustainable initiatives have been undertaken at the airport or in the region? What regional sustainable energy initiatives are underway or established – wind farms, capture of gas flaring, solar farms, reuse of waste products from wastewater treatment facilities, geothermal?
- What policies does the local utility have for interconnection to the power grid?
- Has the local power authority developed other renewable power sources? If so, are there policies in place for development and some technical expertise within the utility to coordinate an airport installation?
- What energy conservation policies are in place or anticipated in the future that would direct or support implementation of renewable energy projects? Does the airport or governing authority have a vision statement for renewable energy or sustainability?
- Is excess land (outside the "mission-critical" areas) available for non-aeronautical renewable energy uses? Are there height and use restrictions associated with those tracts? Are there line-of-sight or glare (in the case of solar) concerns?
- What infrastructure is in place that could support a renewable energy project? Are substations nearby for interconnection?
- What is the reliability history of the power grid serving the airport; what number and duration of outages has the airport experienced in the last five years? Are there other projects underway by the utility to remedy the situation?
- What is the air quality status of the region? Is the airport in an attainment or non-attainment area?

While it may not be possible to capture all data required for a later business case analysis, the existing conditions study should endeavor to document as much as possible along with the sources of the information for follow-up as needed.

4.1.2 Demand/Capacity Analysis and Facility Requirements

Typically in an airport master plan, demand is a function of passenger, aircraft, and cargo activity. Renewable energy projects may reflect increased power needs associated with these activities, but may also be independent of such activity and based on other considerations such as reliability of power, cost savings, environmental policies or social factors.

The objective of the demand/capacity analysis is to determine when and how much of an improvement is needed within the planning period, in other words, to justify any future improvements and identify timing of need. Because there may be some elasticity of need in implementing renewable energy projects, it is important to document the variables that are considered in the analysis.

To help define demand and requirements, planners should consider 1) the state of the power grid and standby power, 2) the potential risks of outages and risks of consequences due to outages, 3) potential growth in activity that would result in increased power demand, 4) whether land that is currently available for renewable energy projects would still be available in future years, and 5) whether renewable energy projects could be incorporated into other future projects (e.g., solar panels on the roof of a garage or future building). Quantifying questions may include:

- Is the power supply and standby power adequate and reliable at the airport? Would a microgrid (a local energy system capable of balancing captive supply and demand resources to maintain

stable service within a defined boundary) provide significant benefits to maintain system integrity?
- What is the continuation plan in case of natural or other disaster that would affect the power grid? Would it be enhanced by a renewable energy source?
- What other factors exist that could create demand for power and support renewable energy sources – terminal, other tenant facilities, maintenance/operations, off-airport functions?
- At what point would a renewable energy project be needed and/or supported? Is additional power required to meet peak or more frequent demand periods? Would the project help mitigate other development impacts and provide benefits beyond just the power generation?

4.1.3 Alternatives/Preferred Concept

The priority of planning in an airport master plan is to first consider those elements that are critical to the mission of the airport: airfield and airspace, the terminal complex, ground access, cargo, general aviation, parking, fueling, and support facilities. Elements needed for growth of aviation override other uses. Renewable energy projects that need open land could be considered only after aviation needs were satisfied. Projects that would be incorporated into existing or proposed facilities, such as roof-mounted solar panels, could be considered within the alternatives for terminals, garages, and other structures.

The alternatives planning process develops preliminary alternatives (concepts) to meet the projected demand, screens the alternatives (through rounds of qualitative and quantitative evaluations) and refines the concepts to reach a recommended preferred alternative. Typically this is done for the primary elements of the airport first, that is airfield and terminal areas, and then the process is repeated for secondary elements. For instance, a second round of evaluations may focus on developing concepts for replacement and growth of airline support facilities displaced by terminal or airfield expansion. As the analysis progresses, preferred concepts for the individual elements would be integrated into an overall recommended development plan.

Renewable energy concepts should be defined in terms of their ability to meet power demand or reliability requirements, their physical requirements, and the general timing in which they would be needed. Using these factors as a basis, planners can further define:

- Siting of the facility: Physical location and constraints, including airspace, visual obstructions for pilots, access for operators, topography (related to cost to prepare the site), proximity to fuel source (biomass)
- Potential energy generation in terms of overall load and variability
- Proximity to substation or grid integration point, and challenges to making a connection
- Potential environmental impacts and benefits associated with implementation in accordance with FAA Orders 1050.4 and 5050.4 and the NEPA. This is discussed further in Section 4.1.5.
- Utility engagement – will size, configuration or location of renewable energy project change engagement policies? Is there benefit to scale?
- Utility rate structure and regulations
- Potential risks to implementation, pricing, and other factors
- Public sentiment/public policy
- Other types of projects, including conventional energy alternatives that could satisfy the demand

Renewable energy projects that require stand-alone land and facilities could be carried as stand-alone elements in the analysis while those that are incorporated into other elements would be addressed as part of those elements.

Concepts should be developed with the business case and evaluation criteria in mind to enable a thorough evaluation and comparison of alternatives that support the business case. The evaluation criteria presented in Chapter 3 can serve as a guideline, tailoring the evaluation criteria and measurements to

correlate with the focus of the airport and the information available. Selected criteria may be used for preliminary screening to cull a larger list of options into a few superior concepts.

A variety of initial alternatives may be identified. As alternatives are evaluated and screened, some will drop out while others will be further developed and subject to additional evaluation and screening to determine the best options to fit the needs of the airport. These will become part of the Preferred Concept of development.

Projects will need additional environmental analysis before development, so planners should discuss environmental considerations and provide documentation of alternatives considered, as well as the renewable energy criteria and evaluations that lead to a specific concept recommendation. Coordination with the FAA Airports District Office will help determine the level of environmental analysis required.

Renewable energy projects have varying compatibility, permitting and environmental considerations when sited on or near an airport. Table 4-1 identifies some of these that should be explored and evaluated when planning for a renewable energy project.

Table 4-1. Airport Compatibility and Permitting

Type of Project	Airport Compatibility Considerations	Permitting considerations
Solar	Reflection impacts to pilots. Should be sited on land not needed for aviation purposes. Are existing structures able to accommodate installations? Can future structures incorporate solar installations?	FAA Form 7460-1 – Notice of Proposed Construction or Alteration FAA Land Lease Review (if third party project) NEPA Categorical Exclusion
Wind	Height of wind generator will be limited based on Part 77 and other surfaces. Avoid sites that impede operation of navigational aids.	FAA Form 7460-1 – Notice of Proposed Construction or Alteration NEPA Categorical Exclusion
Geothermal Heat Pumps	Avoid sites in which structures may impede operation of navigational aids.	FAA Form 7460-1 – Notice of Proposed Construction or Alteration NEPA Categorical Exclusion
Biomass/Biofuels	Siting so that plumes from generation do not create a line of sight issue for air traffic control tower. Stack height will be limited based on Part 77 and other surfaces. Avoid sites in which structures may impede operation of navigational aids.	FAA Form 7460-1 – Notice of Proposed Construction or Alteration NEPA Categorical Exclusion

4.1.4 Implementation and Financial Planning

Implementation planning and the plan of finance for master plans essentially form the business case of the master plan, and are intertwined and generally performed in concert. The implementation plan assigns timing to the individual projects that make up the preferred alternative to create a recommended development plan. Timing is initially based on demand and interrelationship of the various projects. The plan of finance is performed to prove the financial feasibility of the set of projects proposed in a master plan, given assumptions about revenue streams, project funding, and project costs. It analyzes the capital costs, timing of projects, and sources and uses of funds. As such, the timing and phasing of projects is typically adjusted based on availability of funding for overall financial commitments. Renewable energy projects would be factored into the implementation plan and plan of finance with all other master plan and capital projects.

The analysis is performed at a high level, generally addressing the near-term elements (1 to 5 years) in more detail than mid-term (6 to 10 years) or long-term (11 or more years) elements. The analysis is based on the budgetary cost estimates and assumptions developed for individual projects in the master plan. Typically there has been no architectural or engineering design performed to further define the projects. The financial analysis may assume a range of activity growth to determine revenues, and relies on

reasonable assumptions regarding the use of state, federal and other potential grant funds to leverage airport funds. So, while the financial plan tests the reasonableness of the development program proposed by the master plan, much more specificity should be developed as a precursor to implementation of any of the master plan projects. The same would be true for a renewable energy project proposed in a master plan.

In defining implementation of the plan, development projects are subdivided into phases. Enabling and subsequent projects supporting the renewable energy project would be identified, further defined, and slotted into the schedule with dependencies noted. A high-level cost estimate would be prepared for each element or phase of the projects.

Timing for implementation for traditional master plan projects is based on demand triggers, such as number of annual passengers, volume of peak-hour passengers, annual operations, or peak-hour operations. Triggers for renewable energy projects may not be as specific if the project is not needed to meet immediate energy demand but is proposed to reduce overall cost and improve reliability. Timing of those types of projects may be tied to the availability of funding, including rebates, loans and grants. Alternately, a project that would be installed in conjunction with a traditional project such as solar panels on top of a proposed structure would be tied to the timing of that structure. The solar installation could not be implemented prior to the garage construction, but ideally would be constructed concurrently or in some cases could be constructed subsequent to it.

Planners need to develop a realistic schedule for all of the elements of a renewable energy project, as would be done for a conventional project. These include the environmental process and approvals, procurement, permitting, design, implementation/construction, commissioning and activation, up to generation of power. Timing data can be gathered from other airports that have pursued similar projects, from utilities that are partnering on the project or other agencies, from the planning team's experience, and from industry or other publications. Assumptions for timing should be documented in the planning study, along with a discussion of risks or uncertainty associated with each step.

Procurement methods should be considered in terms of schedule and desired project outcome. Typically, because of the technology involved, a conventional design-bid-build (DBB) method would not be chosen for delivery of a renewable energy project. For a renewable energy project, like some other conventional projects, the owner may want to evaluate the technical experience of the proposer's key personnel, understand the technology options being offered, review the proposer's business practices and past performance, and weigh other factors that would be included in the solicitation to select a provider that gives the owner the "best value".

Timing should consider that Request for Qualifications/Request for Proposals (RFQ/RFP) would be used to solicit design, construction, or operation services, or a combination of these. RFQs are used for professional services only, where a qualifications-based (rather than price based) selection is expected. RFPs are used where price is a consideration for selection or the consideration for selection. Procurement and delivery options are discussed in more detail in Section 4.2.

Project costs should include capital costs (land acquisition, design, construction, commissioning and activation) and operational costs (maintenance, renewal, and major replacement) through the projected economic life of the facility; that is, the life over which the project can perform the function for which it is intended. Anticipated income generated from power sales, ground leases, or other revenues, should also be estimated.

Master plan cost estimates are prepared at a high level because the details of the project are not fully defined. For instance, while the square footage and general functional areas of a terminal building may be described by a master plan, detail on the structure, finishes and other elements are not defined. The details of a proposed renewable energy project may be similarly vague at this point. In the case of a terminal, further program definition and design would be needed to refine the details and costs. For a renewable energy project, further detail could be developed as part of a programming or preliminary design study supporting the business case analysis. Although the scope of the master plan seldom allows

for development of the detailed metrics described here, by documenting all of the knowns, unknowns and assumptions within the master plan documentation, subsequent studies can build upon the master plan work.

The plan of finance will determine the sources from which the capital and O&M costs will be drawn – whether capital improvements, operating funds or capital renewal funds, as well as the cost centers to which revenues and costs are assigned. The plan of finance would consider the use of rebates, grants or loans; whether a portion of the construction would be funded by others; potential lost revenues during development; and the timing and amount of revenue generated after the project is operational. For renewable energy projects, consideration should also be given to the impact on monthly energy costs after the project becomes operational.

As the renewable energy project is being refined in concept throughout this phase, an initial quantification and qualification of the non-monetary benefits should also be undertaken. These may include:

- Creation of permanent jobs on the airport staff and in the community
- Potential of the project to mitigate the impact of other proposed projects, whether directly through offsetting environmental impacts, or indirectly through creation of goodwill and community and stakeholder support
- Improvements to air quality (which could be quantified through modeling) and reduction in greenhouse gas (GHG) emissions
- Improved electrical grid efficiency and reliability resulting in improved business continuation for the airport in case of outages
- Potential for economic development or collateral development due to implementation of the project
- Customer experience enhancement
- Leadership in sustainability and ability to meet local or regional sustainability goals

While the scope of work for planning may not allow full quantification or discussion of these factors, the identification of non-monetary benefits will support subsequent environmental and business planning as well as stakeholder outreach.

4.1.5 Environmental Considerations

Environmental considerations associated with renewable energy project planning should be integrated into every step of the planning process. The planning work will be used as the basis for environmental analyses. So understanding what environmental analyses will be required and developing the information needed to support those analyses will make the most efficient use of time and airport funds. Clear definition of the project's purpose and the airport's need for implementing the project are keys to success of the environmental process.

Environmental analyses are generally conducted subsequent to planning. The findings of the planning process inform the level of environmental analysis needed. There are a number of "federal actions" that trigger implementation of environmental analyses. These include the FAA's conditional, unconditional or mixed approval of:

- Federal funding for airport planning and development projects, including separate funding plans and specifications for those projects
- A new or changed Airport Layout Plan
- An airport sponsor's request to release airport land from a Federally-obligated, public use airport when the land would be used for non-aeronautical purposes, including entering into long-term leases

For environmental analyses, the airport's project would be identified as the "proposed action." It would be assessed against a no action alternative as well as other reasonable alternatives. For guidance on

environmental processes, airports and planners can utilize the current version of FAA Order 1050.1, *Environmental Impacts: Policies and Procedures* and the associated *Environmental Desk Reference (EDR)* and the FAA's Office of Airports supplement Order 5050.4, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* and its associated *EDR*. These Orders and EDRs provide a discussion of the FAA's requirements for implementing NEPA and the Council on Environmental Quality (CEQ) regulations, and clarify requirements to facilitate timely environmental reviews.

Airports that are under a State Block Grant Program must still comply with the environmental requirements if using state funding. The FAA may participate with the state in review of environmental processing, and the provisions of FAA Orders 1050.1 and 5050.4 will apply.

It is good practice to coordinate early with the FAA on proposed development projects, whether conventional or renewable energy. The airport sponsor can explain the project's scope, need, and anticipated timing while the FAA can provide guidance on environmental and agency coordination requirements as well as federal funding opportunities. The airport sponsor will gain insights into project approach, including potential refinements to the project to minimize environmental impacts. This coordination will help the airport develop and implement an appropriate environmental process strategy.

Understanding site impacts and the potential alternatives to minimize those impacts will also help streamline the environmental process. Planning should inventory and consider site impacts, documenting whether there are known environmental sensitivities on a site such as wetlands, cultural resources or threatened or endangered species. In addition, projects affecting floodplains may require special agency coordination, analysis and permitting. Early identification of these factors will improve the understanding of risks to implementation, timing and costs associated with the implementation. It will also aid in determining the appropriate level of environmental analysis. Preliminary coordination with local, state and federal agencies during the planning process may allow environmental planners to streamline the review processes during environmental scoping, and identify key decisions that each entity will need to address.

Planning should recognize both state and federal policies that may affect implementation. Some states have regulations that require state environmental review for some projects in addition to federal review. Recognition of this may allow the state and federal processes to be performed simultaneously.

Levels of NEPA processing for Federal actions at airports include:

- Categorical Exclusion (CatEx), which are approved for types of actions that the FAA has found do not normally have the potential for individual or cumulative significant impacts on the human environment, per FAA Orders 1050.1,and 5050.4. CatEx processing can occur quickly with the appropriate documentation and coordination with FAA. Depending on the complexity of the project and the prior coordination with FAA, approval could be obtained in a few weeks or a few months.
- Environmental Assessment (EA), prepared under FAA oversight, is a "concise document" that describes the purpose and need for the proposed action, identifies reasonable alternatives including a no-action alternative, and assesses expected environmental impacts. It should allow the responsible FAA official to determine if either an Environmental Impact Statement (EIS) is needed due to significant environmental impacts or a Finding of No Significant Impact (FONSI) can be issued. It also needs to comply with applicable special purpose laws and requirements and identify any permits, licenses and other approvals or reviews that apply. The timing for completing an EA is longer than that of a CatEx. Depending on the complexity of the project and the prior coordination with FAA, the analysis could be completed in as little as three to four months after initiation. Or, for a project with some impacts it could take a year or longer. The investigation and coordination done during the planning process should provide the airport with a reasonable understanding of the timeframe anticipated.

- Environmental Impact Statement (EIS) prepared by the FAA for the project when one or more environmental impacts of a proposed action would be significant and mitigation measures would not reduce the impact(s) below significant levels. While it is unlikely that a renewable energy project would trigger the need for an EIS, the project may be part of a larger group of projects considered in an EIS. An EIS generally requires several years to complete. Some, for very complicated projects, have taken a decade to complete.

The City of Rockford identified the Chicago-Rockford International Airport (RFD) as a suitable location for a city-hosted solar facility given the large amount of underutilized land on airport property. It identified a number of potential sites at RFD and assessed each for suitability. The City was awarded federal stimulus money from the US DOE through the American Recovery and Reinvestment Act (ARRA), which triggered an EA. As part of the EA, the City prepared an alternatives analysis to demonstrate that the preferred site was the least environmentally damaging alternative. Figure 4-3 shows the three primary sites evaluated. In 2012, the airport completed construction of a 3.6 MW project at the preferred location.

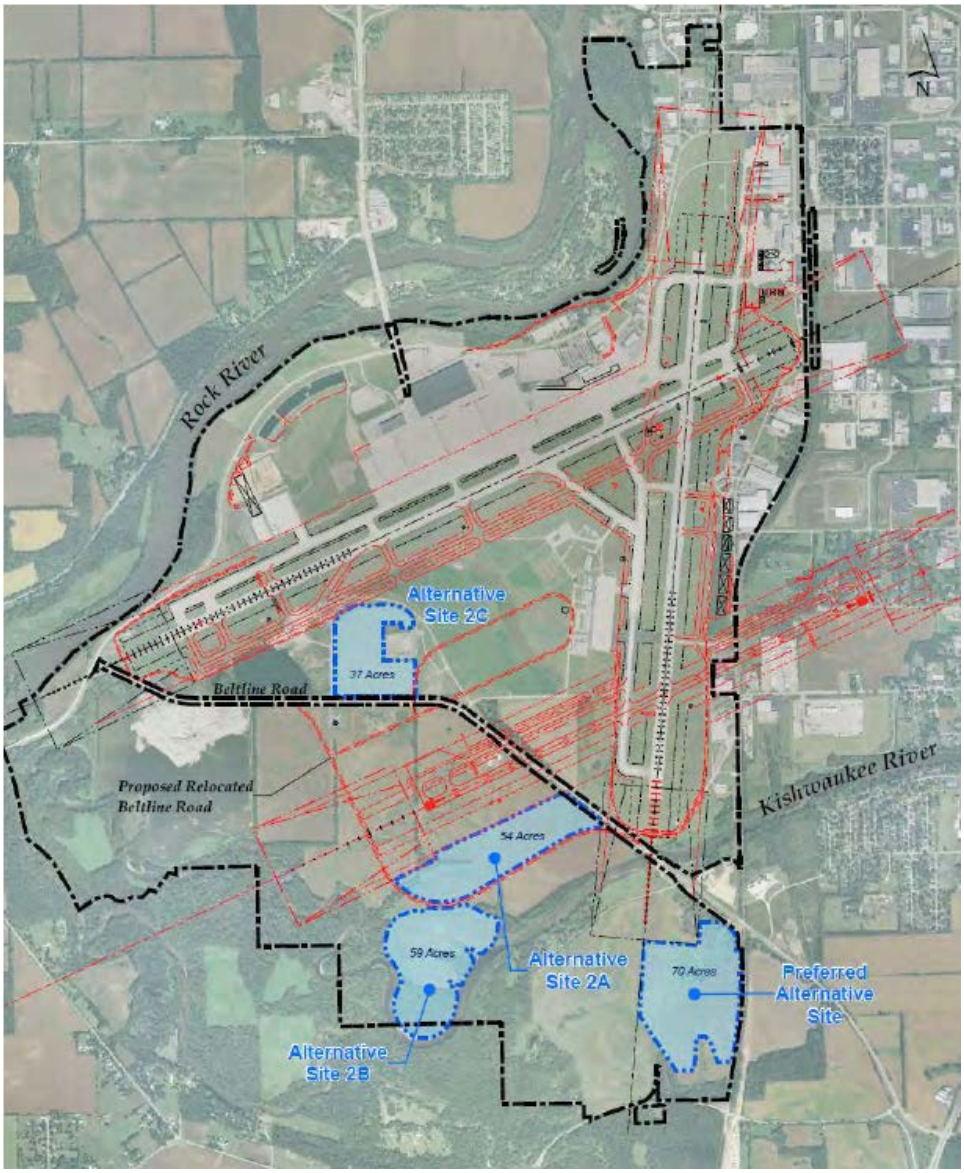

Figure 4-3. Solar sites evaluated at Rockford Airport

Consultation with the FAA Orders and the FAA Airports District Office in the airport's FAA Region will identify the appropriate course of environmental action and provide the airport with a direction on the focus and timing of the environmental study. Timing and cost of implementation must include allowances for the environmental analysis needed for project approval. For renewable energy projects in which the environmental process may be drawn out, availability of funding sources should be verified to ensure that assumptions are still valid given the anticipated timing of implementation.

4.2 Capital Improvement Programming and the Renewable Energy Context

Airport capital improvement programming (ACIP) further develops the conceptual master plan into a better defined development plan consisting of a project or series of related projects needed to meet the overall objective. This phase of planning would provide information needed to finalize the business plan, gain required stakeholder support, and prepare the project/program for design and/or procurement.

Programming could be performed in conjunction with the environmental process if timing is critical. Or, programming could be initiated after the environmental process was completed if some type of mitigation or a significant change were expected to be incorporated into the project due to the environmental analysis findings. However, the airport should not make a significant change to the project that could affect the environmental impacts after the environmental process is complete.

4.2.1 Review/Update the Project Assumptions

During the capital programming phase, the following elements of renewable energy projects would be defined, or if initially defined with the planning process, they would be reviewed and updated:

- Electrical generation and performance goals
- Site selection and siting issues (glare, reflectivity, airspace clearances)
- Further evaluation of alternative sites or project parameters, if needed
- Major elements of the project(s) including enabling projects
- Permitting and regulatory requirements, including preliminary agency approvals based on consultations
- Procurement methods for each project element
- Costs, benefits and revenues, including capital costs, O&M costs, and decommissioning/salvage or renewal costs
- Financial structure of the project, including draft power purchase agreements and public entity funding arrangements, if any
- Project/program timeline
- Overall and individual project budgets, including contingency allowances
- Understanding of operational impacts during construction, if any
- Commissioning and activation plan outline

This information will allow the airport to request formal approval from its governing body (city, state or authority) as well as obtain airline approval.

4.2.2 Identification of Funding Options

Assumptions made in the financial portion of the master plan would be re-evaluated and updated in this phase of project planning which would reassess funding options available at the time that the project is to be implemented. Because renewable energy incentives, grants and tax credits vary from state to state and both federal and state opportunities change frequently, the airport should update and confirm funding assumptions. If some time has passed, additional incentives or tax credits may be available which could improve feasibility or timing.

With an update on funding, the structure of project financing should also be re-evaluated. Questions to consider may include:

- Does the business case support airport ownership or private ownership?
- What funding options are available for the airport vs. a private entity?
- What is the window of opportunity for funding sources? Do some expire before the project can be initiated? Are other sources anticipated in the timeframe of the project?
- What criteria are attached to public or private ownership in terms of project development, procurement, construction, operations?
- What impact on airport staff (both numbers and expertise) would the project create?
- If private, what lease terms are appropriate? This may entail benchmarking practices at other airports and/or consultation with FAA.
- How does the project fit into the airport's Capital Program? Is there financial capacity? Do overall funding requirements necessitate accelerating or delaying the project?

Section 8 describes the funding options for projects including airport-owned and funded arrangements and third party owned and financed structures.

4.3 Implementation

Private partners must be identified, evaluated, and selected through a public procurement or bid process. An open and transparent bidding process is necessary to ensure that the airport engages the most qualified private partners at the best price given the type of procurement process most applicable. A central premise of public procurement is maintaining the public's confidence in a fair and open bidding process. Keys to this process include preparation of bid or proposal documents that provide a clear description of the goods and services required, the selection criteria and standards to be used, and the process to be followed. The airport will then follow the procurement process it has outlined including distributing the bid opportunity broadly, accepting questions and providing answers to all interested bidders, selecting a bidder using the established selection criteria, and negotiating a contract with the selected bidder. Procurement vehicles and process are described both in ACRP Legal Digest 16, "Procurement of Airport Development and Planning Contracts"[25] and ACRP Report 87, "Procuring and Managing Professional Services for Airports".[26]

There are a number of different goods and services that may be procured for a given renewable energy project and airports need to select the appropriate procurement process. Initial investigations associated with site and technology selection may be completed as a consulting service. The airport may seek a turnkey contractor to engineer, procure equipment and construct the facility based on an internal design prepared by the airport's engineer. Or the airport may seek to enter into a contract with a private party who will engineer, procure, construct, own and operate the facility through a long-term lease agreement, which may also include a contract to purchase electricity. Each procurement package and process must be developed to conform to the airport's contracting intent.

As noted previously, the conventional DBB method of procurement is not appropriate for renewable energy projects due to the technology aspects. In addition, the funding options selected may direct that the system be developed by a public or private entity to take advantage of financial incentives. During implementation planning, final decisions should be made on the procurement method that best suits the goals and objectives of the airport and the project.

Common delivery methods used for conventional projects include:

- Competitive Sealed Proposal (CSP) is a method used for selection of technology and conventional project providers in which both price and qualifications are considered. Proposals may be based on 100% designs or somewhat less complete designs however the scope should be well developed. Firms can be interviewed and the selected firm can enter into negotiations with

the owner to adjust the price of the work based on negotiations. Selection can take 1 to 2 months longer than the traditional DBB selection.

- Construction Manager at Risk (CM@R) selects a general contractor that is on-board during the design phase to work with the designer and owner to identify streamlining and cost savings. The CM@R is responsible for completing the construction work, hiring subcontractors working to an agreed upon price and schedule. Use of a CM@R may increase the design time and fee due to the collaborative approach. The CM@R is typically paid a negotiated amount for design collaboration and a negotiated fee based on construction cost for the construction of the project. Selection can be a multi-step process through solicitation, interviews, selection, negotiating and contracting, taking an additional 4 to 6 months. A CM@R approach might be used in an overall program of which a renewable energy project is included.

There are also several types of Public/Private Partnerships, commonly referred to as P3, which may be undertaken for both conventional and renewable energy projects. These include:

- Operate and Maintain (O&M) in which the public entity contracts with a private partner to operate and maintain the project. The airport would maintain ownership of the project as well as responsibility for financing and collection of revenues. The airport would also be responsible to manage the project. An example of this would be an airline consortium that provides O&M on jet bridges or baggage systems for an airport. Services would be procured prior to completion of the project so that the O&M contractor could engage in commissioning, activation and training prior to the project becoming operational.
- Operations, Maintenance & Management (OMM) is similar to the O&M model, but also includes private management of the project. The airport would retain ownership, financial responsibility and revenue collection. The private partner could invest capital in the project, which would be balanced by savings in efficiency. Services would be procured prior to completion of the project so that the OMM contractor could engage in commissioning, activation and training prior to the project becoming operational.
- Design, Build, Operate, and Maintain (DBOM) procures a contractor that integrates the design and construction responsibilities with operation and maintenance of the facility through the contract period. The airport would secure the financing and retain the operating revenue and risks as well as ownership of the project. The DBOM provider's detailed knowledge of the project's design, construction and technology elements allows them to create a tailored maintenance and operation program. Procurement is accomplished through an RFP process in which submittals are reviewed and ranked, firms are interviewed, and the selected firm would enter into a contract with the owner. Preparation and evaluation of proposals is quite detailed, therefore, the procurement would add 4 to 6 months to the traditional selection process.
- Design, Build, Finance, Operate, and Maintain (DBFOM) is similar to the DBOM process however the provider takes on responsibility of financing the project and collection of revenues. Future revenues are leveraged to cover the cost of construction and financing. This type of procurement is used frequently by departments of transportation, toll road authorities, transit agencies and local governments. There is a wide variation in contract terms in DBFOM projects and a variety in how the financial responsibilities are transferred to the private sector provider. The procurement process is similar to that for the DBOM.

State and local laws govern the types of procurement methods that can be used by public entities. The airport should evaluate available methods along with the pros and cons of each to determine which best meets the airport's needs for each renewable energy project.

In some cases, a private party may approach an airport to lease land to develop a renewable energy project. In this case, the airport may not need to follow a competitive procurement process, as the situation would be similar to a general aviation developer requesting to lease land for hangar development. Regulations governing ground leases would be followed. However, the airport may also

negotiate the purchase of energy from the project through a power purchase agreement that sets a price over the contract term. Power purchase agreements are discussed in more detail in Section 8.

4.4 Permitting

The permitting stage is where the detailed project concept developed with stakeholder input during the planning phase is filed with regulatory agencies for formal approval. Primary permitting steps include filing applications with the FAA for airspace and NEPA reviews as well as those associated with other federal, state, and local authorities. The FAA and other agencies should be apprised of issues in the planning stage which will allow for changes to be incorporated in order to avoid any pitfalls that might slow up approvals during permitting. In addition, applications necessary for AIP funding need to be filed if applicable to ensure that project funding can be obtained consistent with the proposed project schedule. The permitting process for airport projects is also summarized in Improving the Quality of Airport Projects[27].

Permitting of renewable energy projects on airport property requires close coordination with the FAA with the primary issues addressed during the planning phase. Each energy technology and the associated construction activities require review for airspace impacts, notably physical penetration of the Part 77 surface and potential glare impacts from solar projects. Most renewable energy projects have received a Categorical Exclusion under NEPA due to the limited amount of environmental impact. The exception would be if a project is located in an environmentally sensitive location like those inhabited by sensitive natural resources. State and local permits are also expected to be limited but would be dictated by the sensitivity of the project site. An effective planning process will have identified and excluded sites with environmental and cultural resource value. More information on the siting and permitting of energy projects is included in ACRP Report 108: "Guidebook for Energy Technologies Compatibility with Airports and Airspace".[28]

4.5 Construction

The construction phase begins with the development by the contractor of a construction process and schedule which can be used by the construction team to designate responsibilities, communicate expectations and identify milestones. The airport project manager will use the plan to track construction progress. Regular meetings will be identified in the plan to formalize coordination and tie each meeting to the project schedule and expected progress. Throughout the construction period, compliance with regulatory approvals must also be checked and confirmed, and periodic stakeholder engagement exercised to maintain communication with interested parties, particularly affected tenants and neighbors. Upon project completion, the contractor will run through the commissioning process to demonstrate that the facility has been installed in accordance with specifications, and it will prepare an operations plan to direct oversight during the initial operation stage. Chapter 5 in ACRP Report 49: "Collaborative Airport Capital Planning Handbook" addresses construction best practices.[29]

Construction activities for renewable energy projects should not be substantively different from typical airport projects with the exception that some contractors may not be as versed in airport construction procedures as contractors for typical airport projects (Figure 4-4). Regardless, airport staff manages the training process and all contractors irrespective of past experience should be equally trained at the time of construction.

Figure 4-4. Energy contractors may not be familiar with airport construction procedures

4.6 Operations

Once the facility has been formally commissioned, it then enters the operations phase. While commissioning validates that the facility has been constructed and is operating per specifications, there are many factors associated with airport energy use and environmental conditions that might require that the operations of the facility be adjusted during the early operating phase to optimize its performance. Contracts are structured such that the manufacturer and installer continue to be involved during early operations phase to ensure that the facility operates as specified. Service contracts will also be put into place to guarantee technical support to the airport for a longer operating term. Chapter 5 in ACRP Report 49: "Collaborative Airport Capital Planning Handbook" also addresses operations best practices and important aspects of project close-out.[30] In conjunction with the assessment of system performance, the airport will also want to publicize its accomplishments associated with developing the project through press releases and educational information on the airport's website.

Because the equipment associated with renewable energy projects is relatively specialized, it is important that airports execute contracts for technical support and for staff training to ensure that the airport has the capabilities to address problems effectively. In addition, experience with geothermal heat pumps has shown that performance of the system changes substantially over the year depending on changes in seasonal weather. Airports need a complete year of operational experience before they can optimize performance and maximize the financial benefits of the geothermal system. Such operational experience has been less critical for other technologies; however, with any new system, glitches are not uncommon and it is important to have staff and third party contractors who are trained and available to recognize problems and act on a solution to minimize operational and financial impacts.

5 Engaging Internal and External Stakeholders

The business case provides a justification for a proposed project or undertaking based on its expected commercial benefit. The business case must be credible and convincing to internal and external stakeholders or its likelihood for success will decrease. The primary project stakeholders for an airport renewable energy project are shown in Figure 5-1. This section summarizes the internal and external stakeholders that must be engaged as part of the renewable energy project development, their interests in a renewable energy project, and the extent of their influence in facilitating a successful project.

Figure 5-1. Airport Renewable Energy Project Stakeholders

5.1 Internal

Internal stakeholders in this overview are considered entities that are involved in day-to-day airport operations. They include the airport authority, FAA, airlines, and tenants.

5.1.1 Airport Authority

The airport authority is the staff and organizational structure responsible for managing the airport. The composition of the airport authority varies widely based on the size and ownership of the airport but generally includes a staff with a designated leader and a board of overseers with a chairperson. The staff conducts the planning and operations of the airport including budgeting to ensure that the airport fulfills its mission and serves its customers in conformance with its obligations to the FAA and affiliated local

governments. The airport staff meets regularly with its governing authority to review activities and budgets, and gain formal approval of actions necessary for the sound operation of the airport.

Engagement with the airport authority on a renewable energy project, as with any airport initiative, is critical to ensure that the project is consistent with the airport's strategic plan and is determined to be in the long-term interests of the airport. Engagement within the airport authority should start at a focused point at the earliest stages of the project with a few key staff members to define the project and assess its business case. If the focus team determines that there is a strong business case for the project, then the concept will radiate out in stages to involve other staff and eventually the governing authority. In many cases, the governing authority will inquire about the viability of the business case for a project and direct staff to investigate further and report back. Once the governance and upper levels of airport administration become involved in the discussion, it is important for other stakeholders beyond the airport administration to be engaged.

5.1.2 FAA

The FAA has broad oversight of activities at federally-obligated airports to ensure safe and efficient air transportation, and to protect the long-term viability of the air transportation system. For renewable energy projects, the FAA's involvement focuses primarily on preservation of airspace, protection of aeronautical uses, oversight of property rights and value, and authorization of federal funding.[31]

Airports should initially contact their FAA representative at the ADO. The discussion should begin with appropriate planning staff to confirm that the project is consistent with the Master Planning and ALP, and that it does not obstruct the future development of aeronautical uses. At the same time, the air traffic division should be consulted about the location of navigational aids and the proximity of the project to FAR Part 77 surfaces to determine that the project will not negatively impact airspace safety. If a lease is being considered, the FAA property division should be engaged about the lease approval process and procedures for documenting fair market value for any lease. For FAA funding through the Airport Improvement Program (AIP), VALE or Section 512 Program, the airport will need to discuss its ACIP and include the renewable energy project in its ACIP when filed annually with the FAA regional office.

5.1.2.1 Policy Considerations

The executive branch of the federal government under the Bush and Obama Administrations both took actions that encouraged the development and purchasing of renewable energy by the federal government. These actions have affected airports and the FAA.

President Bush signed Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, on January 26, 2007 which set goals including that half of the renewable energy consumed by federal agencies in a fiscal year come from new renewable energy sources, and that agencies generate energy on-site to the extent feasible.

President Obama signed Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance on October 5, 2009 which required federal agencies to assess greenhouse gas emissions and set sustainability targets. The President issued a follow-up memorandum on December 5, 2013 which provided additional direction for federal agencies and specified that 20% of all energy consumed by federal agencies should come from renewable sources.

On March 15, 2015, President Obama signed Executive Order 13693, Planning for Federal Sustainability in the Next Decade, which includes more specific energy efficiency and renewable energy requirements on federal agencies. The targets for clean energy for building electric and thermal energy that must be met through alternative and renewable sources are listed in Table 5-1.

Table 5-1. Alternative and Renewable Energy Annual Targets for Federal Agencies

Fiscal Year	% Clean Energy
FY 2016	10%
FY 2017	10%
FY 2018	13%
FY 2019	13%
FY 2020	16%
FY 2021	16%
FY 2022	20%
FY 2023	20%
FY 2024	25%
FY 2025	25%

Under these policies, the FAA has been carrying out its responsibilities to meet the renewable energy targets under various executive orders and federal policy directives while also ensuring these projects do not negatively affect airspace operations. The FAA has regulatory authority to ensure that renewable energy projects abide by relevant legislation and adhere to certain evaluation criteria. Moreover, as many energy technologies have evolved in recent years and installation of certain technologies (e.g., wind, solar, geothermal) has increased significantly, the FAA is continually updating review requirements. Stakeholders must be aware of recent developments to ensure compliance.

5.1.2.2 Grant Assurances

When airports accept federal funding from FAA sponsored programs, they must agree to grant assurances. AIP provides grants to airports for funding projects and within the funding mechanisms are grant assurances to ensure the airport is using the funding consistent with the AIP funding obligations as contained in latest version of FAA Order 5190.6, Airport Compliance Manual. For example, AIP grant assurances include public procurement for services, buy American clause, and use of airport revenues. As part of the grant assurances, the FAA could impose monitoring requirements to meet grant assurances and has the right to conduct on-site compliance inspections. If there is no FAA grant funding because the project will be implemented by a third party, the grant assurance review will be conducted as part of the FAA's review of the property rights transfer.

5.1.2.3 Planning

The renewable energy project concept will initially require input from planning professionals internal to the airport. They will review the type of technology proposed, alternatives for siting relative to the master plan, and consistency with existing and future infrastructure. The planning group will be familiar with other projects that have been undertaken at the airport, along with issues that have arisen in project planning and construction. Their input can be used to verify that potential fatal flaws of the project such as conflicts with the ALP and master plans, potential sensitivity to navigational aid (NAVAID) interference or glare impacts, and environmental impacts.

5.1.2.4 Funding

AIP is the primary source of funding for many planning and development projects at public use airports. Renewable energy projects are funded by the FAA through AIP, VALE or Section 512 of the FAA Modernization and Reform Act of 2012. These funding mechanisms typically cover 75 percent of the eligible costs for large or medium hub airports and up to 95 percent of eligible cost for a small primary, reliever, or general aviation airport. Improvement projects related to airport operations, enhancing safety and environmental concerns are typically eligible for AIP grant funding and will generally receive a higher priority than renewable energy projects. Nationally, grant requests exceed AIP fund availability and the FAA evaluates requests for funding based on national priorities and objectives. Renewable energy projects proposed for funding under AIP and Section 512 will be competing with funding requests

for runway and terminal improvement projects making competition for scarce funds challenging. VALE funding (through the AIP and PFCs) is also available for renewable energy projects that off-set locally generated emissions at airports located in EPA designated maintenance or non-attainment areas. VALE funding is allocated from discretionary funds and grant proposals are evaluated against other types of projects that are designed to reduce air emissions at the airport (i.e. gate electrification, hybrid vehicles).

5.1.3 Airlines

Airlines are the biggest tenants at Part 139 certificated airports. They provide a large revenue stream to the airport which is used to operate the airport and sustain amenities to its passengers. For commercial service airports, airlines must be consulted on any projects that may affect their rates and charges. Airlines evaluate the short-term financial benefits of such investments and determine whether cost savings will be provided. Investments in reducing emissions at an airport could also benefit the airlines. An example would be upgrading the infrastructure at the gates to include pre-conditioned air (PCA) and ground power units (GPUs) which provide heating and cooling for the aircraft while parked at the gate. These units allow aircraft to minimize use of the auxiliary power units (APUs) thereby saving fuel costs for the airlines and reducing emissions at the airport.

Airlines may also benefit if an airport implements a renewable energy project that mitigates the impacts of development that the airlines support. For example, installing PCA and GPUs to reduce emissions may support future environmental approvals to construct additional gates needed for airline growth. Near-term benefits and paybacks on investment may be more likely to garner airline support than projects with longer-term returns. This is a function of the difference between the agile airline business model and the more long-term development planning of an airport.

Airlines also contribute to discretionary funding through taxes on airline tickets, fuel usage, freight and international departures. One example is the Airport and Airway Trust Fund (AATF) which is another mechanism FAA uses to fund airport improvement, airport repair and air traffic control systems through airline taxes as mentioned above. Therefore, airlines have a vested interest in airport improvement projects and are a potential airport funding partner for renewable energy where the airline could benefit from reduced electricity costs.

5.1.4 Other Tenants

Other tenants also are affected by infrastructure upgrades and are vital to the revenue stream of the airport. These tenants include concessions, rental car operators, third party parking operators, fixed based operators (FBOs), corporate entities with hangars, hotels, gas stations, and convenience stores. Tenants, both aeronautical and non-aeronautical, should be informed about a proposed renewable energy project as part of the regular tenant communication programs implemented by the airport. These tenants will be interested in proposed airport improvements and how they may affect their businesses as well as the potential for any rate increases in future lease agreements. Tenants may also be interested in partnering with the airport on a renewable energy project if such a project can provide a mutual benefit.

5.2 External

Stakeholders in renewable energy projects at airports are not limited to airport tenants (e.g. internal), but include groups outside of the airport that can be affected by the project. Renewable energy projects can produce a positive result for the community in that it contributes to the local economy and creates jobs while also reducing local air emissions. Local governments and agencies are equally interested in renewable energy projects since they generally share the same policy and goals of reducing greenhouse gas emissions that contribute to climate change.

5.2.1 State and Local Government

A number of different state and local government agencies may be interested in the proposed renewable energy project depending on the airport's location and political geography. Most airports are a division of municipal, county or state government or are a separate regional or state authority. Regardless of the specific governing structure, the sister agencies of the airport will be most affected by the activity particularly if they participate in intergovernmental coordination such as implementation of master planning and shared public policy goals. Those that are most relevant to a renewable energy project include sustainability, renewable energy generation, and greenhouse gas emission policies. Other government agencies may be part of the approval process. Examples include natural and cultural resource agencies authorized to review and approve development projects and their potential effects on wetlands and historic resources. Meeting with agency representatives early in project planning will help avoid any permitting fatal flaws and build support where alignment with government policy goals can be demonstrated.

5.2.2 Utilities

Utilities, as owners and managers of the electrical distribution network, are key stakeholders for any electricity generation project. They should be consulted at the project's earliest stages of planning and will be required to make a final approval of project once commissioned and put into operation

Any electric generation project that interconnects with an existing electrical system that is physically connected to and is served by the electrical grid must be designed in accordance with National Electric Code standards and is subject to oversight by the utility owner. This is fundamentally an issue of safety and compatibility to protect the grid and the people who are managing it. The generation system may at times export electricity to the grid and therefore must be designed with a voltage shut-off control accessible by grid managers should they need to temporarily prohibit passage of electricity to perform maintenance on the infrastructure downstream. Some generation projects may also require the design and construction of new infrastructure to deliver the electricity to the existing grid. The infrastructure may be proposed and funded by the developer (e.g., airport and its partners), but once constructed the infrastructure will become an asset owned and managed by the utility. For these reasons, the airport should engage the utility in a collaborative manner throughout the project.

5.2.3 Flying Public

The airport is a gateway for all sorts of residents and visitors which generally comprise the flying public. While airport users are predominantly focused on getting through the airport with limited delays and using available amenities to make best use of down time, the airport also provides a broader experience to travelers. It is in the airport's competitive interest to be the best experience possible.

As part of the broader context of this research, it was noted that there is a broad positive appeal for renewable energy as technologically advanced and good for the future. Airports that have implemented sustainability programs that include renewable energy have sought to locate projects in areas that are widely visible to travelers as long as the areas fit other compatible siting criteria of the airport master plan. Airports also incorporate public education displays about sustainable design and have constructed electricity generation kiosks about renewable energy projects that have been constructed. At such kiosks, the public can see in real time how much electricity the airport's facility is producing and the environmental benefits accrued in cars removed from the roadways or trees planted. While members of the general public are not likely to be detailed reviewers and commenters on an airport's renewable energy project, informing them about a proposed project demonstrates the airport's leadership, forward-thinking, mindset and commitment to sustainability.

5.2.4 Community

Airports convene regular public meetings to discuss airport activities and authorize future work as necessary. Airport sponsors can use these regular meetings to introduce renewable energy project concepts and provide status reports throughout project life during planning, construction, and operations. These meetings will afford the airport with a high level of transparency and help identify any issues that may be raised by neighbors, tenants, or other affected or interested parties. As questions or issues are raised, the airport can respond to the issue either immediately by answering questions or at a future meeting should additional research be required. The public engagement will help to solidify support for the project.

Engagement with local community groups may often be addressed adequately through the regular airport public meetings. However, in some circumstances, the airport may choose to engage these groups through separate meetings to ensure that their members are sufficiently informed about a particular airport project or activity. In other instances, individual meetings may be arranged after some initial level of information exchange occurs at the regular airport meeting to expand the level of outreach. Typically, renewable energy projects are not likely to cause a concern for neighbors given their relatively non-obtrusive nature. A utility-scale wind turbine proposed on airport land is a logical exception, given its large size, and might warrant additional outreach depending on its proximity to residential areas.

Other external stakeholders such as environmental groups may have interest in the proposed renewable energy project. These groups may be interested in particular resource impacts issues (e.g. birds and wind turbines) or carbon mitigation benefits of the project. Involvement of these external groups will depend on the type of renewable energy project and the airport's relationship with the public or organization. Understanding public sentiment on previous renewable energy and sustainability projects in the community will help the airport shape its message.

6 Reviewing a Model Business Case

The following section presents a model business case for airport renewable energy that readers can use to conceptualize and develop their own business cases. This model presents how an airport might make the business case for a solar PV project. Solar PV was selected due to demonstrated success in its application at airports; however, other technologies could be filtered through the same business case process.

In this section, it was determined to model the hypothetical case in which an airport is evaluating a solar project to be self-funded and owned – the decision for the airport to own the system is arrived at during the fatal flaw screening step as described below. While the technology and ownership structure may not be that which is being pursued by all readers, the information required and process of evaluation will be similar for all renewable energy projects being explored by airports. Furthermore, the cost of electricity and evolving technology is dynamic, and the numbers used throughout this section are a snapshot in time. What remains unchanged is the process of developing the business case and the information required to support that case, an example of which is presented in Figure 6-1 below.

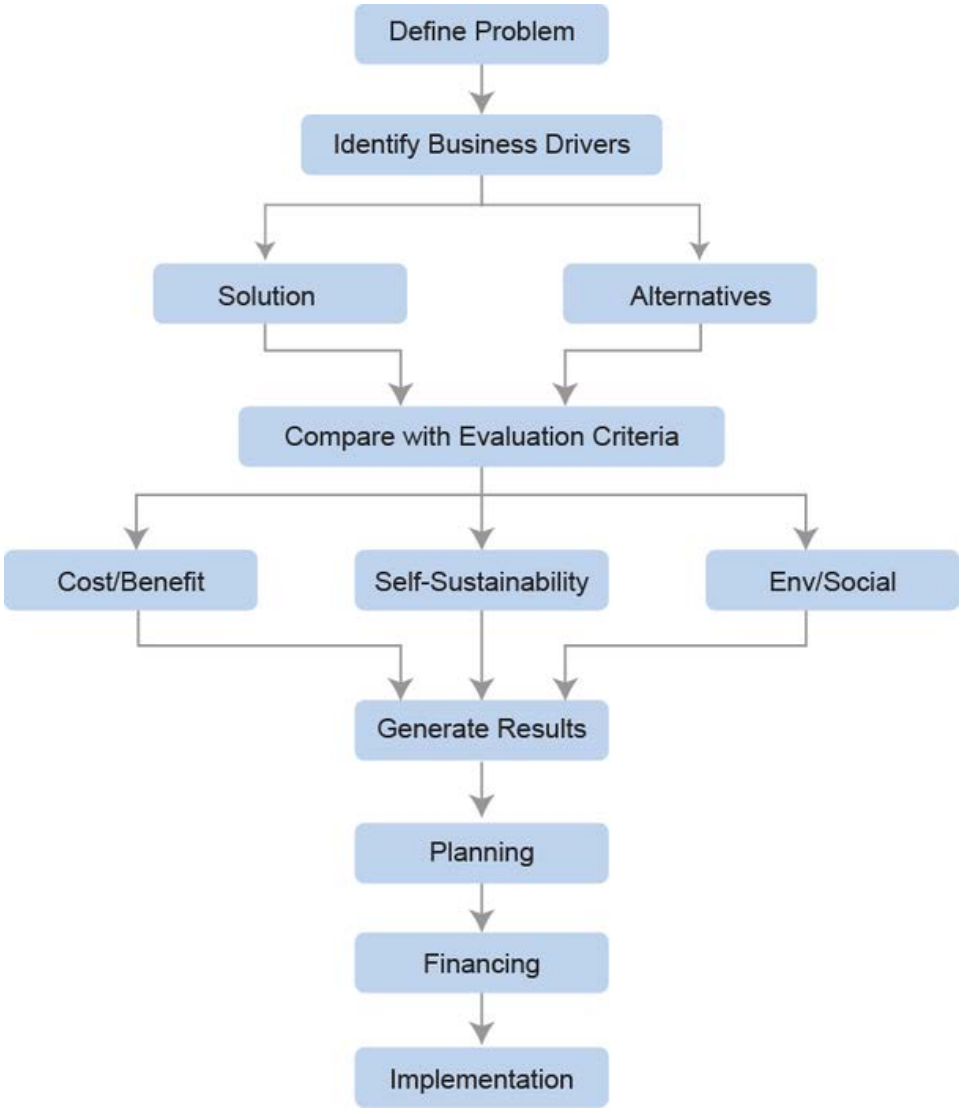

Figure 6-1. Business Case Decision Flow

6.1 Setting up the Business Case

The basis for any project starts with identifying a problem and solution, preparing the project vision, and outlining the business case process for evaluating the proposed solution and alternatives. In this model, we lay the foundation for pursuing an airport solar project. The text box below provides some fundamental resources that should be referred to.

6.1.1 Problem Identification

The business case starts with a problem and a proposed solution.

6.1.1.1 Problem Statement

The primary problem identified by the airport is volatile and escalating electricity prices. With energy representing between 10% and 15% of an airport's annual operating budget[32], gaining control over those costs is an important factor in effectively managing the airport's budget. Controlling costs has been increasingly important in the current era of dynamic and potentially volatile airline business, where airports need to diversify revenue sources, cut operating costs, and stabilize expenses to support an offer of competitive rates to airlines to attract their business. Furthermore, the airport was drawing on the electrical grid at peak periods when electricity is most expensive (summer afternoons).

In this case, the airport had performed a number of energy audits and subsequent conservation and improvement projects to reduce energy demand, primarily in the terminal. While these were successful in reducing energy demand, the forecast of increasing passenger activity, rising energy costs, and volatility of prices were concerns for future airport budgets. Increasing energy costs in the terminal translated to increasing airline costs, so airport management felt that the airlines would generally support measures that helped control those costs.

6.1.1.2 Proposed Solution

On-site generation could produce compounded cost savings by reducing electricity demand from the grid when the electricity prices are peaking. It could also benefit the airport by modernizing the airport's energy infrastructure for long-term operational efficiency and power reliability and increasing business resiliency.

The proposed solution is to develop an on-site solar PV energy facility to generate a meaningful portion of the airport's electricity demand during daylight hours when airport peak energy use and utility rates are high. Figure 6-2 shows how electricity will be produced on-airport and exported to the grid during overproduction, while electricity will be purchased from the grid when the sun is not shining. Solar provides for stable long-term electricity prices due to low operating costs and no need for fuel, the latter of which drives the unpredictability of future electricity prices. Alternatives to the proposed solution are other methods to generate electricity on-site and limit the airport to risks associated with the volatile price of electricity provided by the utility from the electrical grid. Specific siting and design elements are developed once the business case for the technology selection has been confirmed.

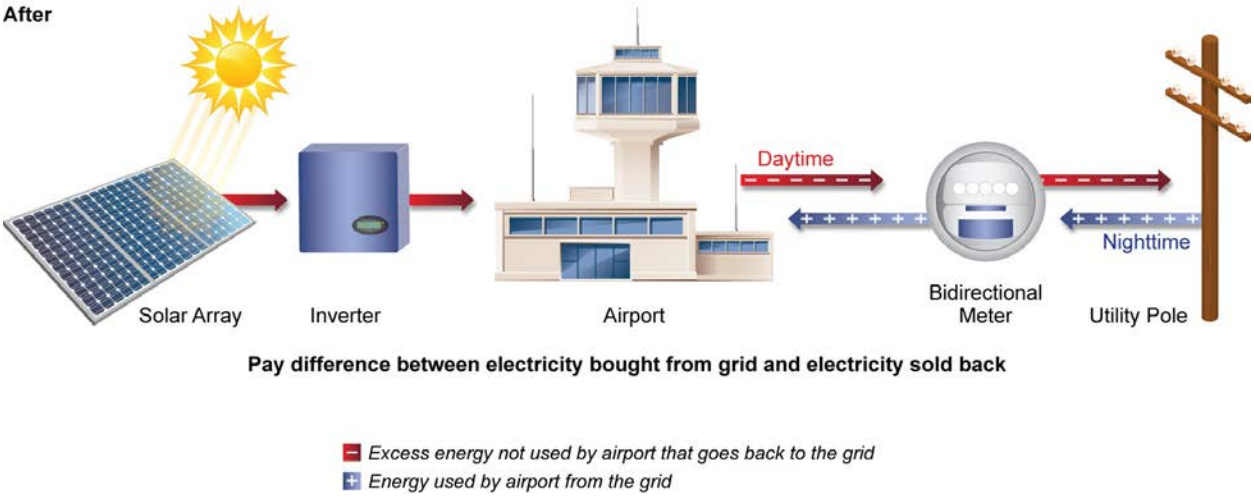

Figure 6-2. Preferred Solution to Generate Electricity On-Site from Solar

6.1.2 Project Vision

The project vision communicates the primary purpose of the project and its guiding principles.

6.1.2.1 Purpose

The purpose of this project is to develop a solar PV facility to generate a meaningful amount of electricity at a long-term stable price for airport use. The facility could be owned by the airport or developed by a private third party. Suitable sites may include airfield, roof top, or carports. An initial plan to develop the project concept including project ownership and a compatible site is assessed as part of the fatal flaw analysis. Fundamental design elements that affect the capabilities of the system, namely battery storage, are also considered in the fatal flaw screening.

TEXT BOX // Key References: in walking through the initial steps of setting up the business case, the airport should become familiar with a few fundamental references.

- The U.S. Energy Information Administration (EIA) generates independent statistics about energy prices and forecasts for the future.
- The Database of State Incentives for Renewable Energy (DSIRE) managed by the North Carolina State University is a central reference for up-to-date financial incentive programs for renewable energy and energy efficiency.
- The National Renewable Energy Laboratory provides basic information on how renewable energy technologies work as well as ownership and financing models.
- Airport Cooperative Research Program (ACRP) generates research publications that are specific to the interests of airports including Reports 108 and 144 on renewable energy.
- While not specific to the airport industry, a good example of a renewable energy business case is available from the National Association of College and University Business Officers. *The Business Case for Renewable Energy: A Guide for Colleges and Universities*.
- Your utility bill – where your meters are, cost of electricity, pricing structure for time and season.

6.1.2.2 Guiding Principles

The guiding principles for the project are as follows:

- The airport has experienced escalating and volatile electricity prices in recent years. Forecasts of energy prices from the U.S. EIA suggest that electricity prices will continue to increase. There is an added risk associated with increasing regulatory requirements on fossil-based fuel including new environmental protection technologies such as carbon sequestration.

- Renewable energy generates a steady and predictable electricity supply corresponding with peak usage times with production levels and electricity prices that are stable for 20 years or more.
- Renewable energy provides ancillary benefits including investment in airport infrastructure, emissions reductions, and community and industry leadership.

6.1.3 Business Case Process

The business case is a decision-making process for evaluating feasible approaches to a given problem and selecting the option that best suits the airport's circumstances and needs. This process is summarized here for the model business case of an airport solar PV project. Details of the model case are given in Sections 6.2 through 6.5.

6.1.3.1 Options

The proposed solution to the problem is to develop, own, and operate a solar PV electricity generating facility on airport property. There are several alternatives to the proposed solution that need to be evaluated as part of the business case process. They include:

- No-Build: no action is taken to address the identified problem. The current situation is unchanged and the effects of no action for the future must be evaluated.
- Conventional energy generation: this option proposes to generate electricity on-site using the most feasible conventional fuel-based technology.
- Renewable energy alternative: this option proposes to generate electricity on-site using the most feasible renewable energy alternative to solar PV.

6.1.3.2 Fatal Flaw Analysis

Each development alternative must be subject to a high level fatal flaw screening analysis to address fundamental issues with its feasibility prior to undergoing the more detailed review using project evaluation criteria. This analysis can be undertaken by the airport in conjunction with basic research about the proposed technology. By engaging environmental, planning, financial, operations and development staff in this initial analysis, a broad understanding of capabilities and options can be developed. The fatal flaw analysis may rule out an option as its label suggests. However, in most cases, the fatal flaw analysis identifies factors that may pose practical or financial challenges and associated risk. The relevant fatal flaw factors are:

- Airspace and airport operations compatibility: all projects and activities proposed on airport property must be compatible with an airport's primary mission in facilitating air travel.
- Passenger Demand Capacity: if Part 139 certificated, the airport must have existing and future passenger demand capacity projections to justify and fund the project.
- Energy resource availability: the energy generation technology, whether fossil or renewable fired, must have access to a reliable fuel supply to be viable.
- Infrastructure adequacy: energy generation technologies must be able to interconnect with the existing electrical infrastructure.
- Government incentive screening: the ownership structure of a renewable energy project is often dictated by the availability federal and state financial incentives for renewable energy.
- Energy storage: adding energy storage capabilities may advance the airport's objectives but also introduces potential costs and performance risks.

Details of the fatal flaw analysis applied to solar PV and alternatives in this model business case are given below in Section 6.3.

6.1.3.3 Evaluation and Ranking

An evaluation and ranking system has been developed as part of the Guidebook (discussed in Section 3) and is used in this model business case. The evaluation and ranking system creates a framework that must be fine-tuned to the airport's needs, objectives, and environs. The airport uses the evaluation and ranking tool provided with this Guidebook to facilitate its assessment of the proposed solution and the alternatives.

The default ranking weights are generic and should be reviewed and customized by the airport to ensure that they accurately reflect the individual airport and its goals. The value of the evaluation criteria in identifying the alternative that best meets the airport's objectives is also dependent on available information. The Guidebook includes some proxy answers that may be used in the evaluation process to reflect the airport's intent in lieu of accurate information specific to the project. In this way, the evaluation and ranking system is used early in project planning to identify information needed to make good decisions about the proposed solution and alternatives as well as for supporting the selection of a solution. That is, when the user first engages the ranking system, it may elicit more questions than answers. As the airport identifies the questions and compiles the answers during the development process, it can go back to the evaluation and ranking system and reassess the alternatives based on new information.

As such, the evaluation and ranking system must be regularly revisited throughout the project development process as part of the ongoing process of developing the business case. Details of the application of the evaluation and ranking applied to solar PV and alternatives in this model business case are given below in Section 6.4.

6.1.3.4 Development and Implementation

As stated above, the evaluation and ranking system sets the framework for project planning and decision-making which is then integrated into the development and implementation process. That process includes:

- Project evaluation through the Master Planning process
- Project review with airport stakeholders
- Focused, detailed studies
- Agency permitting and approval
- Financing
- Procurement
- Design and Construction
- Commissioning and operations

Throughout the development and implementation process, the airport is regularly identifying issues triggered by the evaluation and ranking criteria and collecting information to accurately assess the proposed project and alternatives against the criteria.

6.2 Defining Options

For this model business case, four options are evaluated and described below. In defining each option, some assumptions had to be made relative to facility ownership and fundamental design elements to evaluate the business case. The business case process could be used to assess alternative ownership and design elements if desired. Those presented below provide readers with credible examples.

6.2.1 Preferred

The preferred option is a solar PV electricity generating system on airport property and owned by the airport. The selection of an airport owned project vs. a third party owned facility was informed by an

initial assessment of the federal and state incentives for solar and a determination that state incentives are not lucrative enough at present to drive interest from the private sector. The system will generate electricity to be consumed directly on the airport and thereby reduce the corresponding quantity of electricity that would otherwise be purchased from the utility provider from the electrical grid. The cost savings through avoided electricity purchase is the financial metric for assessing the airport's return on investment or simple payback.

To meet the objective of generating a meaningful supply of electricity to positively impact the airport's long-term budget, the system is assumed to be sized to meet 25% of the airport's peak electricity demand during daylight hours. In targeting peak demand, the solar facility will maximize the quantity of electricity displaced, as well as potentially the most expensive electricity, thereby providing a faster payback. To meet 25% of the airport's peak demand for most small hubs and larger, the airport will require a minimum of ten acres of solar panels with a nameplate capacity of 2 MW. [Nameplate is the rated capacity of the system whereas actual electricity generation will vary based on climatic and seasonal conditions.]

Given the required size of the array, the project should be located on the ground as opposed to on building rooftops though a combination of ground and rooftop designs could be considered. The suitable location will be land that is outside of FAA-prescribed airfield and airspace safety zones, not required for aeronautical uses, and proximate to existing electrical infrastructure on the airport, preferably near the terminal. [A particular project site within an approved FAA safety zone may be viable in some cases, but the model business case looks to minimize risks, including those associated with aggressive siting.] While there are several land use types that may be options, the most common option would be carports covering surface parking that would provide the supplemental benefit of sheltered parking. Recent examples that best exemplify this preferred approach are the 1 MW solar facilities at San Jose International Airport (constructed on the roof of the adjacent parking garage) and Tucson International Airport (constructed over surface parking adjacent to the terminal). An initial budget figure for building these types of facilities would be $6m for a 2 MW solar facility, but would vary based on the size of the airport and the corresponding size of the proposed solar facility to be constructed to meet the airport's objectives. Costs are subject to change and the installed cost presented is an average generated by the National Renewable Energy Laboratories PV Watts Calculator.

A benefit to building the solar array over surface parking is the additional revenue derived from covered, as opposed to uncovered, parking. A survey of on- and off-airport surface parking at airports across the U.S. identified an average differential rate of $2.70 per day for covered parking. Tucson Airport charges $5.00 per day more for solar panel covered parking than uncovered parking. The airport would need to evaluate its current parking rates by location as well as off-airport parking rates, to set a reasonable differential parking rate. The additional revenue could help finance the debt associated with the canopy construction or pay for maintenance of the structure and parking area. Covered parking is generally perceived as a higher level of service to passengers.

The primary disadvantage of solar is as an intermittent electricity source that is not available at night. While battery storage can be added to the project design to expand its capabilities, for this business case battery storage was not included as it would increase the overall cost of the project and reduce its cost-effectiveness. [Another business case could include battery storage given a greater weight applied to benefits of power reliability, or increasing cost-effectiveness as markets develop.] The project's electricity production is also limited by variable performance in changing seasonal and weather conditions. The airport was able to utilize online planning resources from the National Renewable Energy Laboratory and ACRP Report 141 to understand the solar potential and variability.

The benefits of the project as proposed for cost savings from displaced electricity demand are not applicable to airports that are relatively small consumers of energy. The preferred project for general aviation and similarly sized small airports would be as host of a privately-owned and financed solar PV facility which would compensate the airport with an annual lease payment. The small airport solar PV

development scenario is not specified in this model business case but the same business case processes can be followed to evaluate it versus alternatives.

In this case, the airport investigated the current federal and state solar incentives and determined that a lack of state solar policies and associated private market suggests that the airport should pursue self-ownership funded by federal grants. There are several potential sites for the PV facility on airport property that are not expected to interfere with airspace or operations. The airport facilities staff is capable of maintaining a solar PV array with some training and technical guidance. The airport is located in a geographic area favorable for solar power and other PV projects have been developed by the local utility. An initial evaluation of the electrical infrastructure suggests that there are viable interconnection options. Based on this analysis, the airport staff identified an airport-owned solar PV project as the preferred alternative.

6.2.2 No-Build

The no-build scenario is a review of the existing conditions and the risks and benefits of not acting on the identified problem. The life of the preferred solution is conservatively 20 years and therefore the evaluation of the no-build and associated inaction would consider the risks and benefits over a similar timeframe though variations might consider delaying action for shorter periods of time such as 5 or 10 years.

Under the no-build, electricity is acquired from the utility provider as in the current condition. The airport is able to invest the money and staff resources otherwise required to construct the solar facility into alternative projects. In this case, the airport would be subject to the identified problem of escalating and volatile electricity prices and would not accrue other potential benefits associated with modernizing on-site electricity systems, mitigating emissions impacts, and showing community and industry leadership. While the electricity generation source mix varies in different regions of the country (e.g., the Midwest having a higher percentage of coal while the Northwest is dominated by hydropower), the no-build scenario assumes a national average generation mix which is served by coal and natural gas.

6.2.3 Conventional Alternative

The conventional alternative is defined as an electric generating system that is powered by conventional fuels such as diesel or natural gas to address the problem of escalating and volatile electricity prices. Like the preferred alternative, the conventional system would generate electricity to support on-site demand and therefore displace energy that is purchased from the utility service provider from the electrical grid with the financial benefit being the avoided cost of future purchases.

A conventional system would consist of a small-scale electricity generating station of comparable size to the preferred solution (e.g., 2 MW). Such a system would be relatively compact occupying an area of about 10 feet cubed and therefore could be located inside or outside a building. Like the preferred alternative, the system would need to be located in close proximity to existing electrical infrastructure with preference being relatively close to the Terminal building given the size of load. Given the relatively small size of the system, this is expected to be achievable. A picture of an on-site electricity generator fueled by diesel is provided in Figure 6-3.

Figure 6-3. Conventional On-Site Electricity Generator

A unique benefit of the conventional alternative is that the system could operate as a certain and controllable electricity source with availability determined on-demand, with sufficient fuel supply whereas the preferred alternative would generate electricity only during daylight hours with performance variable depending on season and weather conditions. Furthermore, the conventional alternative could also be equipped with co-generation components that capture and store waste heat from the electricity generation process and provide hot water for heating purposes.

The primary disadvantage of the conventional alternative is that the price of energy produced remains tied to the dynamic commodity prices of the fuel that fires the system which is inconsistent with the project's objective. Whereas the renewable systems have an initial capitalization cost and very low operating costs, conventional systems have both a capitalization cost and operating costs affected by continuous fuel purchases. This limits the extent of benefits associated with maintaining steady long-term electricity prices. The conventional project also produces air emissions which complicate environmental permitting, particularly in a non-attainment area, and eliminates the opportunity to exhibit sustainability leadership. This alternative also requires reliable delivery of fuel for continued operation. During a significant weather event or regional emergency, fuel delivery may be suspended for a time, leaving the system vulnerable to outages.

For the conventional alternative used in this business case, the researchers have proposed diesel primarily because the reference cost data includes it and diesel is most commonly used for fossil fuel on-site generation. Natural gas units for on-site generation have only recently come into favor due to decreasing cost of fuel supply and increasing regulation on diesel and petroleum-based fuels. However, diesel is a suitable proxy for considering natural gas and associated issues that would need to be addressed. Diesel must be delivered to the site by truck while natural gas is often available through an underground pipeline. Energy storage is not needed for a conventional fuel project and is not proposed.

6.2.4 Renewable Alternative

There are several viable renewable electricity alternatives including wind, biomass, and fuel cells, none of which is obviously superior, and all have been of limited use at airports to date. However, given its promise to provide broader infrastructure benefits at airports in the long-term and its market potential for

on-site generation, fuel cell is the selected renewable alternative applied to this business case model. The fuel cell generates electricity through chemical reactions illustrated in Figure 6-4.

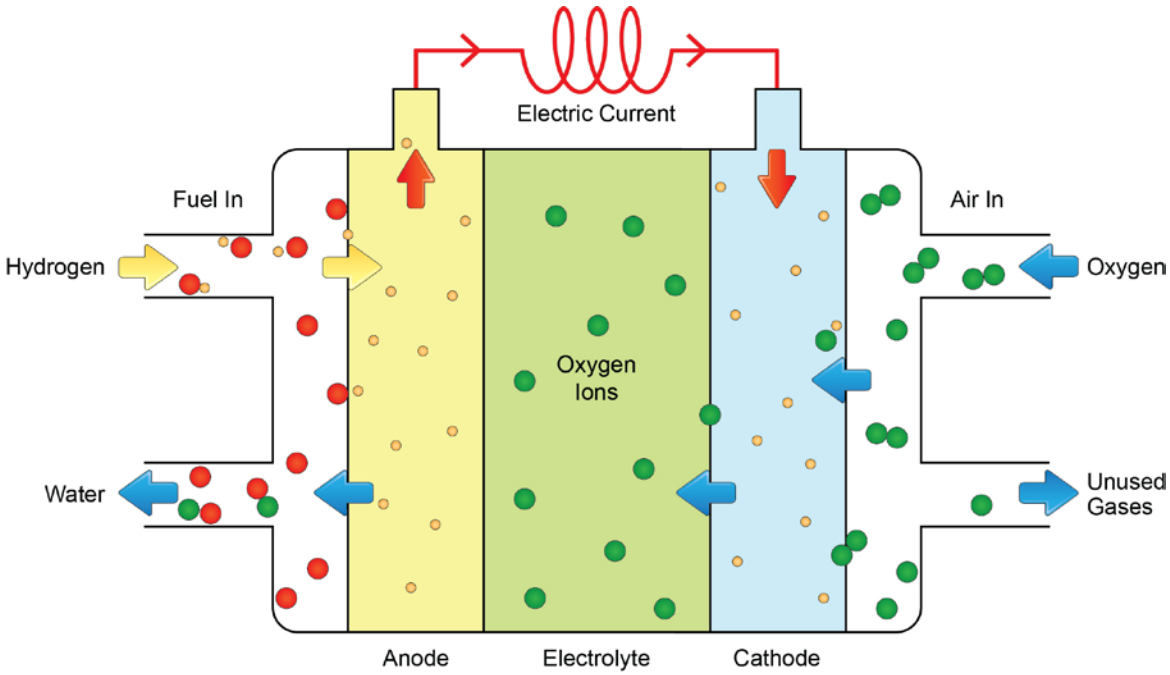

Figure 6-4. View of a Fuel Cell

The fuel cell that is currently commercially available and being deployed by business and government is a 200 kW unit that is about 30 feet long by 9 feet wide and 7 feet tall. Five to ten of these units would need to be installed to match the capacity requirements of the other alternatives making the space requirements less than for solar but more than a conventional fossil fuel fired generator. The fuel cell system would produce electricity on-site and displace electricity that is otherwise purchased from the grid.

The fuel cell provides base load power like the conventional generator and also requires an outside fuel source to catalyze and sustain the chemical reactions that generate electricity. Natural gas is typically used as a fuel due to its widespread availability, and biogas where carbon mitigation is a priority. Hydrogen fuel cells are a zero-emission technology; however they are not a cost-competitive option. Like the other technologies, it needs to be located proximate to existing electricity infrastructure to keep costs down and is best located near the terminal building, which is the airport's largest electricity consumption center.

Benefits of the fuel cell technology are in its reliability and power quality with high availability, assuming that fuel delivery providing the catalyst is not severed. While commercially available units supported by natural gas generate air emissions, those fueled by biogas are considered to be sustainable due to the use of a renewable fuel. No energy storage is needed as fuel cells serve as a consistent and reliable electricity source as long as the catalyst supply is available. The primary drawback for fuel cells is high initial capital cost. However access to the catalyst fuel source may also be a concern if uninterrupted service is required during a significant weather event. Additionally, finding a suitable location for an installation this size near the terminal building may be a challenge.

6.3 Fatal Flaw Analysis

Prior to the detailed analysis using the evaluation criteria, each of the alternatives must be screened through several fatal flaw metrics. The following sections describe the fatal flaw analysis for each alternative and identify any resulting considerations for the analysis and evaluation screening. Table 6-1 summarizes the results.

While future passenger capacity is listed in the fatal flaw analysis to recognize that airports with sufficient levels of business will be capable of capitalizing such projects, the sections below do not revisit this condition. Likewise, infrastructure adequacy is generally sufficient for airports given their land use intensity. The key for these projects is to site the facility near existing infrastructure to limit development costs which is generally more of a challenge for solar PV than the conventional or renewable alternatives but not an excluding factor.

The fatal flaw step should also review available financial incentive programs for renewable energy systems that may affect the most appropriate ownership structure to pursue. For this business case, we have assumed that the proposed solar project is located in a state and utility service territory with limited market-based financial incentives suggesting that an airport-owned facility would be the most cost-effective strategy. This business case process could be used to evaluate a third party owned facility where the airport purchases the facility's renewable electricity output and its varying financial structure.

Table 6-1. Overview of Fatal Flaw Analysis

Alternative	Airspace	Capacity	Fuel Availability	Infrastructure Adequacy	Conclusion
Solar PV	Design for glare	Airport specific	Sun available	Confirm during siting	Must design for glare
No Build	No issue	Airport specific	No issue	No issue	No issue
Diesel Generator	No issue	Airport specific	Conventional fuel expected to be available	Confirm during siting	Issues to consider in design
Fuel Cell	No issue	Airport specific	Catalyst fuel expected to be available	Confirm during siting	Issues to consider in design

6.3.1 Solar PV

6.3.1.1 Airspace

One of the reasons why solar PV has been widely implemented at airports is because it can be integrated into the airport environment in a compatible manner. This is primarily due to the modular nature of solar facilities allowing them to be located within existing development (e.g., on buildings, over parking areas, in airfield). Solar panels are also low in profile which keeps the structures from causing a physical penetration of airspace. This provides the opportunity to site facilities in areas where many other land uses are excluded due to height and occupancy by people. However, one impact area that has been identified in recent years is the potential to produce glare that can visually impact air traffic controllers and pilots. The FAA has developed a glare modeling tool that can readily be used during the conceptual design process to determine if a particular area and design could produce glare on the air traffic control tower (ATCT) or on pilots arriving for a landing. The FAA requires the use of a glare tool to evaluate any project proposed on airport and demonstrate compliance with an ocular hazard standard. Any project implementing solar must evaluate candidate sites for potential glare impacts and select an alternative design or site to avoid impact.

6.3.1.2 Fuel availability

Another reason for the broad success of solar PV projects at airports is that solar energy is available and generally economical everywhere in the continental U.S. For other renewable sources such as wind and hydro, proximity to an identified resource area is critical to being able to generate a sufficient amount of electricity. Solar, however, can be generated most anywhere although the capacity of a particular area compared with another can vary widely, shaping the cost-effectiveness of a project.

6.3.2 No Build

6.3.2.1 Airspace

Many airports have existing airspace obstructions that require mitigation. These vary from trees that penetrate airspace to obstructions on the ground that temporarily block controllers' view. The issues are typically identified in master planning and programmed for correction. In the no build condition, any existing obstructions will remain and any potential obstruction from an alternative will be avoided.

6.3.2.2 Fuel availability

In the no build condition, fuel availability for existing energy needs is not expected to be an issue. If it is, then it should be identified as a problem to be addressed.

6.3.3 Diesel Generator

6.3.3.1 Airspace

The diesel generator is likely to occupy space either inside of or next to existing buildings. Its size will be comparable to existing development and therefore airspace is not expected to be an issue.

6.3.3.2 Fuel availability

The on-site generator considered in this case is fueled by diesel, though gas and liquid biofuel are feasible options. The selection of the fuel will be affected by a number of factors including availability of the fuel source, and siting requirements associated with the various types of sources. Diesel must be delivered to the site by truck and therefore could be limited by a region-wide event. The broad prevalence of infrastructure to support supply of gas makes it a more reliable fuel source for many customers.

6.3.4 Fuel Cells

6.3.4.1 Airspace

As with the conventional generator alternative, airspace will not be an issue for fuel cells due to their relatively low profile and siting within existing buildings and other development.

6.3.4.2 Fuel availability

Fuel cells also require a tie to a continuous fuel source which typical means natural or bio gas. Due to the wide prevalence of natural gas infrastructure, availability of fuel is not expected to be an issue. If it is, then it will be identified early in the project and may be a factor toward excluding fuel cells for particular sites.

6.4 Evaluation Criteria Analysis

A set of evaluation criteria has been developed to incorporate sustainable objectives into the business case and provide decision-making value to environmental and social factors in the business case. As such, the evaluation criteria can be used to compare conventional and renewable energy projects using economic, self-sustainability, environmental/social and other factors.

The evaluation criteria were previously presented in Section 3. The evaluation and ranking tool is a baseline model that can be deployed by all airports assuming a generic airport condition. As one of the first steps in using the criteria, the user should review the weighting system and customize it as necessary to reflect the individual airport's characteristics and priorities. In this case, each set of criteria was weighted evenly at 25%. In addition, the criteria should be used not only to analyze alternatives and produce a result, but also to identify information necessary to accurately evaluate the alternatives and

build the business case for a project. Thus, the early stage use of the criteria may expose a lack of information to make an informed decision. The user can refer to the proxies and sources of information included in Section 3 to assist an initial evaluation.

The following analysis is provided as an example for using the evaluation criteria to assess a solar PV project, and the no-build, conventional and renewable alternatives. These four options have been individually assessed relative to the ranking criteria and scored on a high, medium and low scale. A high score strongly meets the criterion and receives 20 points; medium partially meets it and receives 10; and a low grade does not meet the criterion and receives a score of 0. The scores reflect a broad assessment across 21 different criteria. The final score is indicative of the degree to which the option meets the renewable energy business case. As explained in section 6.4.1, for this analysis, diesel generation is the specific example being used for conventional fuel. Table 6-2 provides a summary of the combined results.

Table 6-2. Evaluation of Proposed Project and Alternatives

Evaluation Factor	Solar PV	No-Build	Diesel	Fuel Cell
Economic (25% weighting)				
Capital Costs	10	20	20	0
Leveraging	20	0	20	20
O&M Costs	20	0	20	0
Life Cycle Costs	20	0	0	10
Revenue / Savings	20	0	0	10
Benefit/Cost	20	0	10	10
Energy Costs	20	0	0	10
Weighted total	**32.5**	**5**	**17.5**	**15**
Self-sustainability (25% weighting)				
Meet Energy Demand	15	0	15	15
Resiliency Benefits	10	0	10	10
Facilitate Future Expansion	10	0	0	10
Enhance Future Benefits	10	0	10	10
Weighted total	**11.25**	**0**	**6.25**	**11.25**
Environmental/Social (25% weighting)				
Meet Local Policy/Goals	20	0	0	10
Job Creation	10	0	10	10
Limit GHG Emissions	20	0	0	10
Improve Air Quality	20	0	0	10
Enhance Customer Experience	10	0	0	0
Consistent with Sustainability Plan	20	0	0	20
Weighted total	**25**	**0**	**2.5**	**15**
Other (25% weighting)				
Consistent with Master Plan	10	0	10	10
Ease of Implementation	10	10	10	10
Construction Impact Concern	10	10	10	10
Elevated Project Risk	10	0	10	10
Weighted total	**10**	**0**	**10**	**10**
TOTAL SCORE	**78.75**	**10**	**38.75**	**51.25**

6.4.1 Economic

The economic evaluation relies on industry-generated data on the cost of various technologies and the existing cost of energy. The financial information presented below comes from Lazard's Levelized Cost of Energy Analysis – Version 8.0, dated September 2014.[33] The key assumptions are included on pages 16-18 of the Lazard Analysis. These data are a guide for initial project evaluation. The airport will want to, if possible, generate site-specific information to help improve the accuracy of the evaluation for the local case. This could include replacing the existing energy cost information presented for metropolitan areas below with information from the airport's utility bills. The airport could also invite technology providers and industry experts to prepare cost information for the local airport case.

The Lazard data uses the following categories: solar PV utility-scale crystalline (10 MW); diesel generator (2 MW), fuel cell (2.4 MW). While the solar PV size category is larger than the 2 MW example, it can be simply scaled down to provide comparable numbers. For the conventional fuel option, diesel was selected as its size (2 MW) fits the proposed size for airport on-site generation whereas Lazard used gas generation units at utility scale grid load (100-250 MW) that are not representative of the model. Smaller on-site gas units are available, but the diesel information is reasonably representative of other on-site fossil fuel generation, with the variable being fuel cost.

The Lazard data is provided as a range reflecting various project locations, incentive availability, and fuel costs. In general, we used the median number for comparison. Rankings are listed in Table 6-2. Each entry in the evaluation criteria template includes an explanation of the criterion and examples of how the ranking could be applied. Application of the economic evaluation criteria for this case is presented in the following paragraphs. Because the no-build alternative provides limited benefit (likely through avoiding new short-term expenditures) or cost (resulting from negative consequences including increasing costs of operations and maintenance), it is not described in the analysis. A ranking value of 0 has been applied to all categories except for capital cost, which has the benefit of preserving capital investments for other projects.

Capital Cost: cost to construct project from conception through commissioning.

The capital cost data was taken from Lazard. The numbers presented below and used for this model is the average for the range presented. Diesel is the cheapest and achieves the highest score (20). Solar is the middle cost and the corresponding middle score (10). Fuel cell is the most expensive and receives the lowest score (0).

- Solar: $1,625 / MWh
- Diesel generator: $650 / MWh
- Fuel cell: $5,650 / MWh
- No-build: No cost

Capital Cost Leveraging: effectiveness of leveraging non-airport funds for the project.

Capital cost leveraging for an airport owned project assessed in this model is limited to government grants. While complete guidance has not been released by the FAA, it is anticipated that the Energy Efficiency Program established under Section 512 of the FAA Modernization and Reform Act of 2012 is one potential source. Other grants may be available at the local or regional level. Without specific local information, the capital cost leveraging for this example is anticipated to initially remain equal across the board. As a result, each was applied an average score of 10.

- Solar: Section 512 Program
- Diesel generator: Section 512 Program
- Fuel cell: Section 512 Program
- No-build: No leveraging

Operations and maintenance: measure of long-term O&M burden of the project.

The operations and maintenance data has been obtained from Lazard. We used the average of the range provided. O&M costs for solar and diesel are fixed while the fuel cell estimate is variable. After annualizing the fuel cell O&M, its costs are significantly higher than the others, which are reflected in the ranking scores: solar (20), diesel (20), and fuel cells (0).

- Solar: $16 / kw-year
- Diesel generator: $15 / kw-year
- Fuel cell: $40 / MWh
- No-build: Calculated based on cost accrued through inaction (e.g., changing price, increasing inefficiencies)

Life-cycle costs: measure of all costs throughout the 20 year life of the project.

The life-cycle costs are also measured by the levelized cost of energy. In the Lazard data, each of the three technologies is considered to have a project life of 20 years. The scores are applied relative to each other with solar having the lowest cost of energy (20), fuel cells being second (10), and the diesel generator (0) being most expensive.

- Solar: $61 / MWh
- Diesel generator: $315 / MWh
- Fuel cell: $129 / MWh
- No-build: Calculated based on cumulative cost accrued through inaction (e.g., changing price, increasing inefficiencies)

Cost savings or Revenue enhancement: financial value that could be generated by the project.

As an airport-capitalized and airport-owned project that will use energy on-site rather than sell to another customer, the financial benefit to the airport in this business case is in energy cost savings. The potential for energy cost savings will vary by project location and cannot be analyzed in the generic example. However, we have listed the average cost of electricity in the top ten metropolitan areas in the U.S. as reported in Lazard to show how each of the technologies would compare to potential cost savings in each market (see Table 6-3). Solar would provide cost savings for a number of the cities in the east garnering a score of 20. For cities with lower electricity costs, no-build would score best followed by solar. However if the problem identified is an aging electrical infrastructure and energy price volatility, then the no-build alternative does not align with the project objective. Potential for revenue generation would also be considered in scoring. Diesel is not close to providing cost savings resulting in a score of 0. Fuel cell also does not demonstrate current cost savings however it is much closer than diesel and expected to see additional decreases as the fuel cell market matures warranting a score of 10. It is important to note that additional savings may be accrued in areas where time of day pricing is in effect and peak prices can be avoided.

Table 6-3. Cost of electricity in top 10 U.S. metropolitan areas ($/MWh, 2013 data).

NYC	LA	CHI	DAL	HOU	PHL	WDC	MIA	ATL	BOS
$99	$86	$46	$36	$36	$90	$93	$48	$39	$93

- Solar: $61 / MWh
- Diesel generator: $315 / MWh
- Fuel cell: $129 / MWh
- No-build: Cost savings from deferred spending

Benefit-cost: assessment of economic benefit of the project versus cost to develop and operate.

This category of benefit-cost combines the scores of cost categories above (capital, operation and maintenance) and compares those to the benefit categories (life-cycle costs, cost savings). Solar scores highest (20) with relatively low capital and O&M costs and potential for cost savings and low life-cycle

costs. Diesel generator score on the mid-range with a low capital cost but a high life-cycle cost. Fuel cell scores lowest at 0 with high capital and O&M costs, and limited cost savings potential.

- Solar: capital (10), O&M (20), life-cycle (20), cost savings (20)
- Diesel generator: capital (20), O&M (20), life-cycle (0), cost savings (10)
- Fuel cell: capital (0), O&M (0), life-cycle (10), cost savings (10)
- No-build: dependent upon existing conditions

Energy cost: effect on the long-term cost on the airport's energy

Long-term energy cost is an important driver for the proposed project and therefore the ability to provide both long-term low and stable costs is valued in this category. Solar scores highest (20) with no fuel costs and low O&M resulting in a stable long-term energy price. Diesel generator scores lowest (0) with its dependency on unpredictable fuel commodity price. Fuel cell garners a mid-level score (10) given its limited requirement for fuel which promotes a relatively stable long-term cost.

- Solar: $61 / MWh, plus no fuel and low O&M resulting in a stable price
- Diesel generator: $315 / MWh, with low O&M and volatile price influenced by cost of fuel
- Fuel cell: $129 / MWh, with high O&M but relatively stable electricity cost
- No-build: generally low costs increasing over time due to increased inefficiencies

6.4.2 Self-Sustainability

The self-sustainability category is a measure of factors that support the long-term self-sustainability of the airport business. These factors generally have a logical economic connection to the airport business; however, it is often difficult to quantify their economic benefit. The direct benefit of each factor is in limiting risk to the organization. Like an insurance policy, the airport proceeds with some investment to minimize a potential long-term risk to the organization.

Because these factors are less quantitative and more dependent on the airport's sustainability objectives, the following analysis is more qualitative than for the economics category above. In some instances, like the first one, the criteria are more of a guidepost to help design a project that meets the airport's objectives.

Meeting energy demand: extent to which the project has a meaningful contribution to meeting the airport's energy demand.

Each technology can be sized to generate an amount of on-site electricity that is sufficient to meet the airport's objectives. For all three technologies, they can generally be sized in a modular fashion to meet the design objectives. The ranking value should be applied once the project is designed and it is confirmed that the project meets the standard of providing a meaningful amount of energy to provide the associated project benefits.

- Solar: 1 MW = 5 acres, size potentially limited by available land area
- Diesel generator: modular units that can be located within developed spaces
- Fuel cell: similar to diesel, though requiring somewhat more space
- No-build: airport is tied to the grid which meets demand

Business resiliency: benefit of the project to the airport's resiliency in the face of unexpected disaster.

Each technology has its advantages and drawbacks as a component in an airport's energy resiliency plan. Solar has value as a generating technology that requires no outside fuel, a key factor should regional networks shut down. Its downside is that it is only available during daylight hours and its capacity is affected by seasonal and daily weather conditions. Diesel generators are customarily used for backup power, which demonstrates their utility. However, the diesel must be delivered requiring the surface transportation network to be functional during the disaster. Gas is a somewhat more reliable fuel option, since underground pipelines are protected from storms though still susceptible to disruption in seismically

active areas. Fuel cells have the advantage that they run reliably for long periods, though they require a stable connection to a gas network.

- Solar: it can provide daytime power; requires battery backup to expand temporal resiliency
- Diesel generator: Diesel dependent on truck delivery. Gas dependent on protection of pipelines.
- Fuel cell: Dependent upon protection of pipelines.
- No-build: Risk that grid will shut down and airport will be vulnerable

Mitigate obstacles to future development: create credits to facilitate future airport expansion.

The ability to mitigate for impacts as a credit for future expansion is predicated on providing an environmentally protective alternative. The example of this was the requirement that the San Diego County Regional Airport Authority (SDCRAA) design and construct a green terminal to minimize potential impacts of expansion. Solar and fuel cells score for meeting this objective. Diesel does not.

- Solar: yes
- Diesel generator: no
- Fuel cell: partial
- No-build: does not address the issue as source is often fossil fuel power

Facilitate compounded opportunities: project represents an initial phase with greater benefits in future.

The value as part of this category is to expand the proposed project into broader benefits in the future. An evaluation of this criterion depends on the design of the final project. It is conceivable that there could be broader benefits associated with any of the technologies but that should be evaluated and scored after the project is designed.

- Solar: yes as part of a larger energy plan
- Diesel generator: yes if combined with co-generation to also generate heat
- Fuel cell: yes as part of a larger energy plan
- No-build: no compounded benefit

6.4.3 Environmental / Social

Environmental and social benefits accurately provide enhanced weight for renewable energy projects. This is reflected in the following criteria and the associated scores.

Consistent with environmental and sustainability goals: project will contribute to meeting local/regional policy and goals.

The airport should review its environmental and sustainability goals relative to the project. In general, solar and fuel cells would score high in the potential to advance environmental and sustainability goals. Switching from oil or diesel to gas could provide some improvement.

- Solar: meets renewable and clean air objectives and goals
- Diesel generator: gas replacing oil or diesel could provide an improvement over existing conditions
- Fuel cell: contributes to lower emissions
- No-build: does not contribute to sustainability goals

Job creation: project will create construction period and permanent jobs.

Each technology could provide some benefit to job creation. The extent of this benefit would need to be calculated and scored based on final design.

- Solar: yes, particularly where green jobs is a focus
- Diesel generator: yes, as much as any other construction project can
- Fuel cell: yes, particularly where green jobs is a focus

- No-build: does not create jobs

Greenhouse gas emissions: project will limit greenhouse gas emissions.

As a carbon free generating source, solar will score highest for this category. It is followed by fuel cells, which require a limited amount of fuel to catalyze and maintain the chemical reaction. Diesel or any other fossil fuel fired alternative produces greenhouse gas emissions and therefore cannot obtain credit in this category. Under the no-build alternative, electricity is provided from a mix of generation sources which will vary in greenhouse gas emissions by region but is generally dominated by fossil fuel based generation with the exception of the Pacific Northwest (hydro) and pockets near nuclear plants.

- Solar: yes
- Diesel generator: no
- Fuel cell: partial
- No-build: typically existing sources are contrary to this goal

Air quality benefit: project will provide broader air quality benefits.

The air quality category recognizes the challenges faced in many urban areas of the country that have elevated levels of air pollutants beyond greenhouse gas pollutants including particulates. As highlighted in the previous category, solar produces no emissions and therefore is a valuable electricity generator in air quality impaired areas. Fuel cells also limit emissions significantly while diesel and other fossil fuel generators augment the pollution.

- Solar: yes
- Diesel generator: gas replacing oil or diesel could provide an improvement over existing conditions
- Fuel cell: partial
- No-build: typically existing sources are contrary to this goal

Enhances customer experience: potential for the project to have a positive impact on the customer.

The potential for an energy project to enhance a customer's experience is a difficult benefit to assess. However, we know that renewable energy has broad appeal and can be found in popular advertisements from car companies and consumer products. Solar also has the potential to provide quantifiable benefits such as in the case of shaded parking. Fuel cells are not as visible as solar and wind in this regard and are unlikely to provide similar positive appeal. A conventional diesel or gas generator project is not expected to influence the customer's experience in any way.

- Solar: yes, if visible as renewable energy is broadly supported by the public, or in the case of the shaded parking design
- Diesel generator: not expected
- Fuel cell: not expected as the fuel cell technology lacks visibility and is not widely understood
- No-build: no existing visible benefit

Consistent with airport's sustainability plan: extent to which the project matches existing strategic sustainability plan.

The sustainability plan may or may not include a renewable energy component though any such plan could. Therefore, the airport should review its individual plan or goals to determine if the renewable energy project is consistent and affords benefits. A diesel or gas generation project will not be consistent with a sustainability plan.

- Solar: yes
- Diesel generator: no
- Fuel cell: yes
- No-build: not consistent

6.4.4 Other

The *Other* category addresses logistical issues associated with energy generation projects. As with some of the less quantifiable criteria identified above, many of the following cannot be fully incorporated into a generic business case and require local analysis. However, these should also be reviewed and considered as part of the project formulation to ensure that the final design measures positively with each category.

Consistency with the Master Plan and/or Sustainability Master Plan: extent to which the project is consistent with the Airport Master Plan.

The airport will be incorporating their business case with the typical airport planning process. Moving the preferred project and alternatives through the master planning will formalize the project validation.

- Solar: expected that project can be located and built in a manner that complements the Master Plan
- Diesel generator: expected that project can be located and built in a manner that complements the Master Plan
- Fuel cell: expected that project can be located and built in a manner that complements the Master Plan
- No-build: expected to consistent with Master Plan

Ease of implementation: measure of how difficult it may be to implement the project.

Another practical consideration that could also translate into the relative cost of development is the relative ease of project implementation. For example, projects that are politically risky or engender local opposition may create new obstacles during the development process and lead to additional costs to resolve. These issues should be considered early and potential risks evaluated as the project proceeds from concept into planning.

- Solar: expected that project can be implemented easily; modify if local circumstances suggest otherwise
- Diesel generator: expected that project can be implemented easily; modify if local circumstances suggest otherwise
- Fuel cell: expected that project can be implemented easily; modify if local circumstances suggest otherwise
- No-build: expected to be easily implemented as long as there is no system failure

Potential impacts from construction: potential for project to have negative consequences on normal airport operations during construction.

The potential for disruption during construction is a second look at project compatibility with a focus on the construction period. Some consideration of construction impacts may be made during the fatal flaw analysis. However, as construction logistics are further evaluated, impacts need to be avoided to minimize safety issues and potential costs. Consideration may be given to displacement of revenue-producing functions during construction. For example, public parking would need to be temporarily vacated during construction of solar panel supports within the parking area.

- Solar: expected that project can be constructed without impact; modify if local circumstances suggest otherwise
- Diesel generator: expected that project can be constructed without impact; modify if local circumstances suggest otherwise
- Fuel cell: expected that project can be constructed without impact; modify if local circumstances suggest otherwise
- No-build: expected have no impact unless there is a system failure

Project risk: potential for project to run into unforeseen development or operational problems.

This is a difficult issue to identify in advance as the very nature is that the occurrence is "unforeseen." If the project is the first of its kind in the region or the technology is new, risks of unknowns would be higher than if many similar projects had been previously undertaken and experience developed. However, airport staff should revisit the evaluation criteria regularly during project development as part of the continuous process of building the business case and they must be mindful of potential project risks that were not previously predicted. Updating a risk analysis for the project will help ensure that planning and design recognize and mitigate risks to the extent possible.

- Solar: expected that project will avoid unforeseen risks; modify if local circumstances suggest otherwise
- Diesel generator: expected that project will avoid unforeseen risks; modify if local circumstances suggest otherwise
- Fuel cell: expected that project will avoid unforeseen risks; modify if local circumstances suggest otherwise
- No-build: expected have no impact unless there is a system failure

6.5 Summary Conclusion and Next Steps

The initial review of the preferred alternative – an on-site solar PV electricity generating facility that is financed, owned and operated by the airport – scores favorably against the other alternatives in meeting the airport's objective of stabilizing long-term electricity rates. In fact, the solar PV project scored as the best alternative in each of the three categories of the evaluation criteria: economic, self-sustainability, and environmental/social.

The Lazard data, particularly that which is related to the levelized cost of energy over the 20 year life of the project, provide important evidence to show that solar PV can be cost-effective when looking at the cost of electricity over the project term. These data use assumptions for future cost of fossil fuel that come from credible sources (e.g., the U.S. EIA) but are by no means certain. However, it supports the premise that solar PV with its low operational and maintenance costs and no need for fuel helps to spread the investment cost over time and contribute to stabilized annual electricity rates.

Given the project purpose of stabilizing electricity prices and the dependence of fossil fuel generation sources on a fuel commodity whose price is not stable or predictable, the project purpose sets a standard for project characteristics served by renewable energy. Users of the ranking criteria can readily reference these benefits and use them when describing how the project meets the airport's business case. Many of these benefits, included in the self-sustainability section, support the long-term viability of the airport organization and not a specifically "green" agenda. However, for constituents expecting to see the airport's sustainability leadership, the green business case points are included in the environmental/social section and their value included in the decision-making process.

Any business case must consider the no-build scenario. It can end up being the preferred solution if, through the fatal flaw analysis, the airport determines that the capacity levels that fund the airport business do not support an investment of $10m. Otherwise, the no build case is a means of establishing a baseline for reviewing each of the alternatives. No-build alone cannot address a problem that is part of the existing condition and requires action to solve.

With the initial analysis identifying the project and its goals, comparing it and several potential alternatives to a fatal flaw screening, and evaluating a set of criteria that incorporates the economic, self-sustainability, and environmental/social weights, the preferred project can proceed through the planning and development process. With each step, new information will be identified and factored into the evaluation criteria. In this way, the criteria are regularly used to identify information needs and evaluate project design, and further bolster the business case for airport renewable energy.

7 Learning from Business Case Examples

Previous sections of this report provide detailed information on the steps necessary for airports to develop a business case for renewable energy. Business case examples provide enhanced context for illustrating the decision-making steps for renewable energy.

Renewable energy provides unique benefits to organizations that use it. However, different types of organizations have different missions and different stakeholders and therefore have varying priorities including those related to using renewable energy. To highlight the diverse views of and approaches to renewable energy by different organizations and to provide tangible examples of how organizations have used renewable energy and developed their business case, the Project Team contacted organizations identified to be leaders in renewable energy. Their experiences are described below.

The researchers identified organizations with a high penetration in renewable energy use primarily through the US EPA's list of top renewable energy users posted on its Green Power Partnership website.[34] We also contacted Ceres, a non-profit organization that advocates for corporate sustainability, and used information available in its Power Forward report. [35]

The researchers prepared an initial list of ten organizations as potential examples including airports, an airline, a health care company, a higher education institution, and a corporate technology company among others. Each organization was contacted and asked to participate in the report by providing some straightforward information about their renewable energy programs and the decision-making that led to their development. While the initial list of 10 organizations changed based on ability to respond, we were successful in documenting information from a wide variety of organizations involved in renewable energy and describing how they developed the business case for their programs. The following organizations agreed to participate:

Table 7-1. Business Case Examples

Name	Location	Type
Facebook	California	Corporate
Great Falls Hospital	New York	Health Care
Luther College	Iowa	Academic
Outagamie Airport	Wisconsin	Airport
San Diego Airport	California	Airport
Southwest Airlines	Texas	Airline

Each participant completed a general questionnaire and followed up with phone conversations to supply additional detail. While the examples may not be relevant to all readers, they demonstrate real world examples of why organizations pursue renewable energy and how that is accomplished.

7.1 Facebook

Facebook (NASDAQ: FB) is an online social networking service headquartered in Menlo Park, California. With over one billion people around the world using Facebook, its greatest opportunity to effect environmental change is through the power and reach of the Facebook platform. Facebook is working to develop programs and initiatives that can enable and empower people on Facebook to get engaged in environmental issues and solutions. By enabling millions of people from diverse backgrounds to easily connect and share, Facebook can play a unique role in promoting efforts to achieve a sustainable future.

Since its founding, Facebook has been committed to operating in a way that minimizes environmental impact while ensuring its long-term sustainability. Facebook recognized that its operations demand a significant amount of energy and it has a responsibility to consume that energy in a sustainable way. Facebook's data centers are its biggest energy consumers, and in 2011 it commenced operation of a new

data center based on an innovative set of designs that increased energy efficiency by 38%. Facebook's vision for minimizing its carbon footprint is described at Facebook.com/green under the "carbon footprint" tab. Facebook is proud of its environmental record and it continues looking for ways to further embed sustainability into everyday business.

Mission: Facebook's mission is to give people the power to share and make the world more open and connected.

Figure 7-1. Hybrid Solar Installation at Facebook's Menlo Park Campus

Renewable energy action: Facebook made a public commitment in 2012 to strive toward 100% renewable energy. It has established interim goals, including 25% renewable energy by 2015 which is has met. It develops annual renewable energy plans and budgets that are implemented toward meeting those interim goals. To utilize renewable energy, Facebook is siting its facilities in places where the grid is powered by clean energy, and signing contracts with utilities and other energy providers to directly source clean energy. In an effort to increase the efficiency and long-term commitment of renewable energy purchasing by large corporations, Facebook was one of 12 signatories to the Corporate Renewable Energy Buyers' Principles in July 2014, which was launched by the World Wildlife Fund and World Resources Institute. Facebook anticipates that participation in the Buyers' Principles Project will enable it to meet its renewable energy commitments more cost-effectively. In addition, Facebook has installed 1.2 MW of on-site solar at its Menlo Park campus and is augmenting those facilities to provide approximately one-third of its headquarters' on-site electricity needs.

Primary Driver: Sustainability and reducing carbon footprint.

Supplemental Drivers: Business and financial advantages associated with long-term price stability and hedge; affecting change by greening the grid; and taking a leadership position as a company committed to sustainability.

Planning and Decision-making: The program was led by the Director of Sustainability working with the Director of Data Center Energy. Initiatives were then brought to Vice Presidents of Data Centers and Engineering.

Financing Renewable Energy: Facebook includes renewable energy purchases in its annual budget. The amount is set based on progress towards interim renewable energy goals.

Lessons Learned: The main lesson from Facebook's experience is that while it wished to develop renewable energy on-site, it could not do so in the scale necessary to satisfy the large needs of data centers. Therefore, it determined that purchasing renewable energy from off-site locations was the best way to achieve its objectives.

7.2 Glen Falls Hospital

Glens Falls Hospital (GFH) is the largest hospital between Albany, NY, and Montreal, Canada, and the comprehensive health care system for New York's Warren, Washington, northern Saratoga, Essex, Hamilton and northern Rensselaer counties (see Figure 7-2). In addition to its main acute care hospital campus, it operates 29 regional health care facilities, including health centers in the New York communities of Cambridge, Corinth, Granville, Greenwich, Hoosick Falls, Salem, Whitehall, and Wilton. As a not-for-profit hospital, GFH provides a health care safety net for individuals and families from the immediate Glens Falls area to smaller, geographically remote communities tucked away in the heart of the six-million-acre Adirondack Park.

Figure 7-2. Glen Falls Hospital Purchases Renewable Energy Certificates to meet its Energy Goals

Mission: Glen Falls Hospital seeks to improve the health of people in its region by providing access to exceptional, affordable, and patient-centered care every day and in every setting. Its fundamental values are: **C**ollaboration, **A**ccountability, **R**espect, **E**xcellence, and **S**afety: CARES.

Renewable energy action: Glen Falls Hospital purchases renewable energy from off-site sources through a power broker.

Primary Driver: Glen Falls Hospital seeks to provide a sustainable building environment where its patients are able to heal in a more holistic setting.

Supplemental Drivers: Glen Falls Hospital was incentivized to buy renewable energy by applying for (and receiving) rebates with National Grid and the New York State Energy Research and Development Authority (NYSERDA).

Planning and Decision-making: The opportunity to purchase renewable energy was first raised by their electricity provider. The Vice President for Facilities and Real Estate took the lead on the initiative and coordinated with Directors for Supply Chain and Finance. Once a price was determined and it was equal to or less than what the hospital was paying for traditional power, it was an easy "sell" internally.

Financing Renewable Energy: The renewable energy purchase was self-financed as a replacement for the traditional electricity sources.

Lessons Learned: The decision that Glens Falls Hospital considered was closely aligned with the annual budget cycle. Their recommendation in such instances where an organization is looking to purchase green power is to begin the financial investigations well in advance of the organization's budget process.

7.3 Luther College

Luther College is an undergraduate liberal arts college affiliated with the Evangelical Lutheran Church in America (ELCA) located in the town of Decorah in northeastern Iowa.

Mission: "Luther is committed to a way of learning that moves us beyond immediate interests and present knowledge into a larger world - an education that disciplines minds and develops whole persons equipped to understand and confront a changing society. Luther is a place of intersection. Founded where river, woodland, and prairie meet, we practice joyful stewardship of the resources that surround us, and we strive to be a community where students, faculty, and staff are enlivened and transformed by encounters with one another, by the exchange of ideas, and by the life of faith and learning."

Renewable energy action: As a leader in college campus environmentalism, Luther has made some serious commitments to renewable energy. When constructed in 2012, Luther's solar PV array was the largest in Iowa. The 280 kW facility is installed on the north edge of campus and powers Baker Village -- an energy-efficient, all-electric student housing complex that uses geothermal energy for heating and cooling. This brings Luther's total solar array count to three, and it now uses solar energy to completely power two facilities that house more than 120 undergraduates. Its wind turbine, erected in 2011 and shown in Figure 7-3, harnesses a second renewable energy source and supplies over a fourth of Luther's power, dramatically reducing its greenhouse gas emissions and enabling Luther to shrink its carbon footprint while it works toward its goal of carbon neutrality and other sustainability commitments.

Figure 7-3. Luther College's Wind Turbine Near the Center of Campus

Primary Driver: The primary driver was Luther's Climate Action Plan, which is consistent with Luther College's mission statement, which states, in part, that Luther "practices joyful stewardship of the resources around us." That said, long-term cost savings regarding energy expenditures have also been an important factor. Prior to 2008, energy costs were one of the most rapidly increasing costs in the college

budget. Luther is expecting costs to rise again as its electric utility builds a new gas-fired power plant and passes the capital and fuel costs on to their customers.

Supplemental Drivers: The educational value of Luther's renewable energy systems certainly was an important consideration. Luther wants to be a model and not a mirror. As an institution of higher education, it feels called upon to demonstrate the feasibility of renewable energy technology and to demonstrate to its students that it can be good fiscal and environmental stewards of their tuition dollars at the same time.

Planning and Decision-making: The project was led by a faculty member at Luther who is also the chair of the Energy and Water Task Group of the Campus Sustainability Council, which was the primary driver behind the development of these renewable energy projects. None of the projects would have been moved along, however, without consistent and firm support of the President of the College. Outreach with stakeholders was important for obtaining local approvals and gaining input from the community. Luther held voluntary public meetings for the wind turbine project. The school also provided information about all of the projects and required public meetings. The wind turbine project required a special use permit from the Winneshiek County Planning and Zoning Commission and the Board of Supervisors. Luther also worked closely with homeowners near the turbine to provide key information, answer questions, and to secure support. The solar PV projects have required a variance from the City of Decorah Planning and Zoning Commission and the Decorah City Council.

Financing Renewable Energy: Luther set aside $1.1 million in budget savings over four years to make an equity investment in the $3.2 million wind turbine project. Luther formed Luther College Wind Energy Project, LLC and a C-corporation, Luther College Ventures, to tap various state and federal incentives including a USDA Rural Energy for America Program (REAP) grant and the cash grant option available for a limited period under the American Recovery and Reinvestment Act. The balance was financed via a 33/67 percent mix of a zero interest loan from the Iowa Energy Center's Alternative Energy Revolving Loan Program and conventional financing from a local bank. The project is also eligible for Iowa's 476C wind energy production tax credit.

As noted above, Luther is leasing the 280 kW PV array and is paying the lease payments with offset electricity purchase funds as well as with donations to the college to support renewable energy. The production from a new 820 kW array will be purchased based on a fixed price ten year contract with the third party owner and operator of the facility. Neither solar PV option required any upfront cash investment by the college.

Lessons Learned: Luther College provided the following recommendations to organizations seeking to develop renewable energy projects on-site:

- Connect the motivation for investments in renewable energy with the college's strategic plan;
- Full transparency with the public and the Board of Regents;
- Pay for high-quality professional studies;
- Dogged determinism;
- Focus on the worst-case scenario for renewable energy resource assessment;
- Expect utilities to move slowly in approving interconnection agreements, and in raising other obstacles, because such projects eat into their sales; and
- Develop in-house expertise to conduct studies and economic modeling.

7.4 Outagamie Airport

Outagamie County Regional Airport (ATW) is owned and operated by Outagamie County and serves Appleton and the Fox Cities communities. Based on 2014 flight operations, it was the fourth busiest airport in Wisconsin. The airport meets the air transportation needs of the community with four major airlines providing service to six major hubs – Chicago, Atlanta, Minneapolis, Detroit, Milwaukee, and

Cincinnati. Several major corporations are also located at the airport, including Air Wisconsin, Gulfstream, Federal Express and Airborne.

Mission: "The Outagamie County Regional Airport (ATW) is operated as a self-funded enterprise. Fueled by a people-powered approach, ATW offers custom-tailored aviation solutions and service excellence from the ground up. ATW is a valuable asset to our community that continuously promotes aviation and fosters economic development by operating the most effective and efficient airport in Northeast Wisconsin."

Renewable energy action: ATW established a strategic goal to achieve a carbon net zero goal by 2030. It has since pursued a planning and implementation program to reduce energy use and install on-site carbon free energy generation consistent with its long-term carbon neutral objective.

After completing a facilities assessment to direct its energy reduction measures in 2008, ATW used funding from the U.S. DOE under the American Recovery and Reinvestment Act to construct a 50 kW solar photovoltaic system and a solar thermal hot water unit on the roof of its terminal building. In 2011, ATW was awarded a grant from the FAA to develop a sustainability master plan to help it further plan for a variety of sustainability measures including implementation of energy projects toward its net zero strategic goal. In August 2013, it completed construction of a general aviation terminal, shown in Figure 7-4, designed in accordance with LEED Platinum standards. The facility is equipped to achieve a net zero energy standard with electricity generated from a 26kW photovoltaic system and a ground source geothermal system provided 100% of heating and cooling needs.

Figure 7-4. Outagamie's LEED Platinum General Aviation Terminal

Primary Driver: Aggressive county sustainability program which resulted in the creation of the strategic goal for the airport to achieve carbon neutral status by 2030.

Supplemental Drivers: As the policy was implemented initially through a facilities study and retro-commissioning program, ATW began to demonstrate the cost savings associated with energy improvements. As the airport developed its initial renewable energy projects supported by federal grants, the benefits of long-term stable and predictable energy costs began to be realized which built support for future investments taking initial form in the LEED Platinum General Aviation Terminal.

Planning and Decision-making: The former Airport Director had a strong interest in energy reduction and related cost savings. As data was collected to demonstrate the financial benefits of energy investments, this was fed back into a program of supporting new opportunities including the construction of solar PV and thermal on the terminal roof. At this point, the airport was gaining a reputation as a leader in sustainability and energy conservation, which helped it obtain the sustainability master plan grant from the FAA in 2011. This process helped to institutionalize sustainability throughout the organization and when the LEED General Aviation Terminal Project was conceived, the airport staff knew what questions to ask and experts to work with to design a building that achieved aggressive sustainability goals in a short-term cost-effective manner which would result in long-term cost savings.

Financing Renewable Energy: The airport has seeded initial projects through distinct sustainability and energy federal grant opportunities. It is now implementing improvements as part of its normal financing program which includes FAA AIP grants, rates and fees, concessions, and county debt measures where applicable.

Lessons Learned: The primary lesson from the Outagamie experience is that much can be accomplished when various government entities work together to achieve mutual goals.

7.5 San Diego Airport

San Diego International Airport (SAN), owned and operated by the San Diego County Regional Airport Authority (SDCRAA) since 2003, was the 30th busiest airport in the U.S. in 2014 in terms of flight operations. It served just under 18.8 million passengers in 2014, the largest number in its history. It is the largest single-runway airport in the country.

Mission: SDCRAA plans for and provides air transportation services to the region with safe, effective facilities that exceed customer expectations. SDCRAA is committed to operating San Diego's air transportation gateways in a manner that promotes the region's prosperity and protects its quality of life.

Renewable energy action: The SDCRAA executed a lease and power purchase agreement (PPA) with Borrego Solar to install 3.3 MW of solar at SAN. Under the agreement, Borrego will construct and operate the facility and the SDCRAA will buy all of the electricity output, estimated to be 5.3 million kilowatt hours (kWh), for a 20 year period. Depending on future electricity prices, the SDCRAA expects to save $3-8 million by locking in stable electricity prices from the solar project. The solar facility will interconnect to Terminal 2 with solar modules located on roof of the Terminal Building, as shown in Figure 7-5, and on carport structures over the short-term parking area providing a supplemental benefit of shaded parking. An additional MW-size project will also be developed by Borrego over surface parking on the north side of the airport.

The SDCRAA has also recently completed a 12 kV microgrid on the campus to feed the terminals and reduce energy bills. With the grid in place, most projects, including solar, can feed back into the airport's system to support the entire campus rather than just the facility with which the renewable energy system is associated. The goals are to "island the airport" (i.e. operate independent of the grid) for a portion of the year and to stabilize energy use by 2035 when the airport is projected to maximize its capacity. The microgrid will be able to support a variety of power distribution and generation projects around the airport.

Primary Driver: Initially renewable energy was driven by the financial and facilities maintenance division, who were working to control energy costs, and provide continuation of operations in the case of outages like one experienced in September 2011.

Supplemental Drivers: Sustainability, financial sustainability, and resiliency are the three core values of the SDCRAA's sustainability program – to maximize the airport's ability to stay in place as long as possible. As presented to the Board in a December 2014 meeting, the five overarching objectives of the solar project are: 1) energy efficiency and conservation; 2) energy independence; 3) carbon neutrality; 4) cost containment; and 5) energy leadership.

The airlines serving SAN were supportive of the renewable energy projects for same two primary reasons: energy cost avoidance and the opportunity to maintain operational continuity during power outages. The September 2011 outage, which affected the San Diego region, was severely disruptive to airline and airport operations.

Figure 7-5. Solar PV on the Roof of Terminal 2 at San Diego Airport

Planning and Decision-making: A project champion came from the Financial Planning and Budget department driven by recognition that power costs were out of control. Initially a lot of duplicative work was done in departmental silos. As decision-making evolved, the process began coming together when departments began collaborating. As options were investigated, the Facilities Management, Facilities Development, Airport Design and Construction and Environmental departments were also engaged. The SDCRAA Board ultimately was briefed on the program by senior management and voted to approve it.

Staff members now believe that the Facilities Management group may not be the appropriate owner of the solar power system due to the focus on technology, data analysis, and active management for the solar system, which is not in alignment with Facilities Management's typical role. As a result, they hired a Resource Manager to work within the nexus of energy, finance, environmental, and development where staff sees the renewable energy system residing.

SAN has decided that the best approach for their needs is to build generating capacity that meets forecast requirements of year 5 of the 20-year project. Financial underwriters are very cautious about this approach because of the overbuilding/overproduction in the early years and the potential that the forecast growth will not occur. SAN is considering storage options to make the early period more financially beneficial (by capturing all power generated). Staff expressed hope that the addition of storage batteries to the system would precipitate approval.

Financing Renewable Energy: SAN had limited bonding capacity beyond the Greenbuild Program, so staff determined how to implement the renewable energy program outside of the SDCRAA's capital. One benefit of entering into a lease and PPA is that the airport does not need to capitalize the project, but rather can wrap the cost into its annual budget commitments. Financial analyses were prepared for three cases: an airport constructed and operated system, an airport constructed and third party operated system and a third party constructed and operated system with a PPA. Because the SDCRAA needed the RECs

from the project, their ownership needed to be a perquisite of any arrangement. The decision was made to pursue the PPA option to minimize current capital expense and staff increases; to stay within the airport's core business; and in recognition that SDCRAA could not take advantage of the tax credits available to the private developer. The PPA also gave the airport ownership of RECs and any other environmental attributes.

The Board expressed concern about the length of the agreement (20 years) which tied SAN to not only the power rate, but the requirement to preserve the facility location for that period. Since space is quite constrained at the airport, this was more critical than it might be at other airports. The Staff was able to offset this through buyback clauses in the PPA. Buyback clauses serve two purposes: to enable reclamation of the site for other development, if needed, prior to the 20-year term of the PPA and to upgrade the technology, should significantly better technology be available. SAN's first negotiation for buyback resulted in some fairly high buyback figures. However staff was more educated on the second round, realizing that after that initial seven year period, when the developer has realized the majority of profit, the buyback cost would be more reasonable.

Subsequent and Ongoing Activities:

Based on an overall analysis of the renewable energy objectives, the SDCRAA will include other technologies to balance out the airport's power production. Of the 30 MW goal for renewable energy, a total of 8 MW of PV is about all the solar that they anticipate the system should have. An Energy Master Plan is underway to assess other potential technologies; identify strategies to integrate energy use and generation; discuss financial implications of decisions in this dynamic market; and to provide guidance on implementing projects to meet the generation goals. This plan will help inform and go hand-in-hand with airport development planning. Planners need guidance on timing of the various renewable energy elements and their relationship to land use and infrastructure development.

SDCRAA has received inquiries from universities regarding use of the airport's renewable energy infrastructure as a research tool for predictive analytics. SDCRAA is discussing the idea of an energy steering group with external stakeholders that could provide guidance to the Authority.

Lessons Learned: SDCRAA Staff were interested in sharing their lessons learned so that others could approach the process more efficiently. Among the points made were the following:

- Airports should understand as much as they can about the utility's business and business structure for PPAs. Be aware that there are tariffs and standby charges on top of the power charge. Working with utilities can be challenging. It is beneficial to talk with other entities that have developed similar projects.
- It is critical to project how much power the airport will need, and with an implementation plan be able to bring system elements online to efficiently meet needs. Airports should be able to show their baseline demand vs. projected demand as their development plans are implemented to identify when, where, and how much energy generation should be deployed.
- Consider power storage options so that all power generated can be utilized. It is highly beneficial to shave the peak power generation into storage.
- The solar industry, and the renewable energy industry in general, is changing quickly. Acquisitions and mergers can eliminate companies and require modifications in contract documents to recognize the new entities. Likewise, the technology may change, but an airport has to balance that with the long-term investment in a renewable energy system.
- Airports need to reach out to other entities – universities and businesses – that have more developed renewable energy systems to understand pros and cons, opportunities and constraints, and to learn from others.
- A PPA means loss of control for the airport. Changes in corporate structure of the developer will require changes in the agreement with the airport. Changes in technology can mean changes in price for the airport making it difficult to determine when to execute. Siting the project and

committing to that site for a long term agreement may preclude other development unless the system is bought out early. However, a PPA will result in predictability of pricing for the airport.

- Energy never gets cheaper. The utility has the power to play with pricing of the commodity. Utilities also have long-term capital commitments for infrastructure that are repaid through rates.
- Keep everyone around the table. Plans must be integrated between airport departments. A holistic approach is necessary to understand the power demand, timing, and financial consequences.
- The Authority structure helped keep the focus on the airport's goals and objectives only rather than approaching the renewable energy program through the lens of a city department. The authority structure also helped foster collaboration.
- A business analysis is needed on each alternative with the most current and accurate information available. This can be an iterative process that is updated as more information is developed. At a minimum, the airport should assess return on investment, debt service impact, cash impact and payback.
- Airports need expert advice on technology and implementation.
- Plans need to be updated regularly and sometimes frequently as conditions change.

7.6 Southwest Airlines

Southwest Airlines (NYSE: LUV) is a Dallas based airline that prides itself on its customer service (Figure 7-6). The company employs approximately 47,000 people and serves more than 100 million customers annually. Southwest is the nation's largest carrier in terms of originating passengers boarded and operates the largest fleet of Boeing aircraft in the world to serve 94 destinations across the United States and six near-international countries. Southwest is committed to its triple bottom line of Performance, People and Planet. To Southwest Airlines, it's about more than just doing the right thing. Southwest believes environmentally responsible decisions also make good business sense and continuously seeks new and better ways to further reduce impacts on the environment and to use resources responsibly. Southwest believes that purchasing green power provides a cost-effective opportunity to emphasize the company's commitment to being a good citizen of the Planet. Southwest is built on efficiency. It's the foundation of its environmental commitment and key to its success and the sustainability of Southwest Airlines.

Figure 7-6. Southwest Airlines Purchases Renewable Energy Certificates to Meet its Energy Goals

Mission: The mission of Southwest Airlines is dedication to the highest quality of customer service delivered with a sense of warmth, friendliness, individual pride, and company spirit.

Renewable energy action: Southwest purchases renewable energy in the form of renewable energy certificates (RECs). In 2015, Southwest executed a two year commitment to purchase RECs to 50 million kWh of electricity to fulfill an estimated total use equivalent to 50% of the electricity needs of its headquarters, 70% of the electricity for the Training and Operational Support (TOPS) building, and 30% of its Dallas and Houston facilities.

Primary Driver: To offset its traditional energy usage and support the company's environmental and climate change commitments.

Supplemental Drivers: To demonstrate the company's commitment to efficient use of resources to customers and stakeholders.

Planning and Decision-making: The program was led by Supply Chain Management who coordinated with the Facilities and Environmental Departments, and the company's Green Team. Company leadership ultimately approved the program.

Financing Renewable Energy: Southwest executed two-year contracts to buy RECs which is a line-item cost in its budget in addition to its cost of electricity. It solicits bids from energy providers every other year to obtain the best market price for renewable energy at that time.

Lessons Learned: For entities that seek to purchase renewable energy from off-site sources, a reverse auction is a good process for obtaining competitive prices.

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8 Funding a Renewable Energy Project

The financing options available to sponsors of airport renewable energy projects include those that are traditionally available to airports as well as those that are available to government entities. Based on analysis of the potential funding sources for renewable energy projects, the options discussed below were found to have the greatest potential for use by airports. These options should be investigated by the airport during the planning stages of the project to determine what combination of sources best suits the project's needs and fits within the airport's financial structure.

8.1 Airport Funding Options

There are a number of opportunities for capital funding for renewable energy projects available to airports, from federal government incentives to local and state incentives. Currently, most federal incentives for renewable energy projects are part of the Federal Income Tax Code, so public entities such as an airport that have no tax liability are not eligible recipients. These tax incentives (thirty percent investment tax credit and accelerated depreciation) can reduce installed project costs by well over forty percent for a private owner. The ability of private owners to access tax incentives is one reason for the frequency of private ownership of renewable energy projects on public lands and buildings.

In addition to federal incentives, there may also be state and local incentives available to airports. Some states have developed databases of incentive programs for renewable energy. Incentive programs change frequently, so airports should regularly examine the programs in their areas.

Airports can also employ funding mechanisms typically used for capital improvements on an airport: FAA AIP funding (primarily discretionary funds), PFCs and revenue bonds. Each of these programs has specific requirements and processes.

8.1.1 Airport Improvement Program

The AIP provides grants to eligible projects at airports in the National Plan of Integrated Airport Systems (NPIAS) for the purpose of planning and improving public-use airports. Funds from these grants are divided into two separate categories, Entitlement Grant Funds and Discretionary Grant Funds. Projects eligible to receive funding under AIP generally include those that enhance airport safety, capacity, security and environmental concerns. Each type requires the airport to contribute local funds to match a portion of the federal contribution. The current version of FAA Order 5100.38, the Airport Improvement Program Handbook, provides guidance on all aspects of AIP.

8.1.1.1 Entitlement Funds

AIP Entitlement Funds are grant funds awarded by the FAA and apportioned based on enplanements and PFC authorizations. These are generally required to be used on projects with the highest priorities to support airport operations, safety and security. It is unlikely that an airport would use entitlements to fund a renewable energy project. Rather, entitlements would be applied to higher priority projects such as runway or taxiway construction.

8.1.1.2 Discretionary Funds

AIP Discretionary Funds are grants awarded by the FAA based on a ranking of eligible projects, prioritizing those that best carry out the purpose of the AIP. Highest priority is given to safety, security, reconstruction, capacity and standards. Airport projects compete for funds against other projects in the same FAA region. Under current FAA priorities, it is unlikely that a renewable energy project would be rated high enough to receive AIP Discretionary funding. A search of FAA Grant Awards showed that no solar projects were funded in 2013 or 2014, two were funded in 2012, and three were funded in 2011.

8.1.2 Passenger Facility Charges

PFCs are funds collected by airlines on passenger tickets as part of the use of the airport. Funds are committed to projects that have been approved by the FAA after consultation with the airlines and public comment. Typically, PFCs are used to pay debt service and financing costs associated with bond issues. PFCs can be combined with federal grant funds to meet the non-federal share of AIP-funded projects. Projects funded with PFCs must preserve or enhance safety, security or capacity of the national air transportation system; reduce noise or mitigate noise impacts resulting from an airport; or present opportunities to enhance competition between or among carriers. Medium and large hub airports that impose PFCs face a reduction in their AIP apportionment funds.

As an example of PFC funds use for renewable energy, airports that integrate solar projects with terminal or infrastructure development may be eligible to fund the solar elements with PFCs. The use of PFCs to fund stand-alone solar projects is less certain, but may be clarified with the anticipated FAA guidance on Section 512 projects or new FAA reauthorization legislation.

8.1.3 Section 512

Section 512 of the FAA Modernization and Reform Act of 2012 added a program that encouraged public-use airport sponsors to assess the airport's energy requirements so that the airport can increase the energy efficiency of airport power sources. The legislation made these specific types of projects eligible for AIP, but not for any special set-aside funding, particularly the noise and environmental set-aside, which had been used to fund a renewable energy projects under VALE. Energy efficiency projects include those relating to heating and cooling, base load, back-up power and power for on-road airport vehicles and ground support equipment as well as solar PV projects. Under Section 512, the Secretary of Transportation may award grants to perform Energy Assessments. Such Energy Assessments must be completed before the FAA issues a grant to fund other, specific projects that the legislation made AIP eligible. The FAA has prepared Draft Interim Guidance on Energy Efficiency dated August 7, 2012; however the FAA is in the process of preparing updated guidance for this program. Until the new guidance is published, FAA Office of Airports must be contacted for guidance on applicability and the funding process. The airport's regular federal share applies to these grants.

8.1.4 VALE

The VALE Program is designed to reduce all sources of airport ground emissions, and is one of the noise and environmental set-asides in AIP. Through VALE, airport sponsors can use AIP funds and PFCs to finance low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements. VALE funds were available to airport solar projects until recently; however the FAA has determined that use of VALE for solar is no longer within the intent of the program but could be funded under Section 5.12. VALE funding had been used for other renewable energy technologies such as geothermal at Portland, Maine; Duluth, Minnesota; and most recently at South Bend Regional Airport in Indiana.

8.1.5 Bonds and Loans

CREB (Clean Renewable Energy Bond) – Qualified tax credit bonds authorized by the Energy Tax Incentive Act of 2005, and allocated under Section 54c of the Internal Revenue Code which allows projects to be financed and the federal government pays the interest after project completion. Bonds are subsidized by the U.S Treasury which provides a credit of 70 percent of the full allowable interest rate. The amount of funding available through CREBs changes annually, based on congressional allocation. These funds require the approved project sponsor to issue bonds for the project.

QECB (Qualified Energy Conservation Bond) – Qualified tax credit bonds that enable state or local governments to borrow money at attractive rates to fund energy conservation projects. Bonds are

subsidized by the U.S Treasury which provides a credit of 70 percent of the full allowable interest rate. Funding through QECBs is dependent on congressional allocation, and can change annually. For example, Congress allocated $3.2 billion for 2015.

Based on the guidance provided by the U.S. DOE[1] both bond programs have the same term limits, bond rates and assurances. These are as follows:

- Coupon Rates are negotiated with the buyer like any other bond program.
- The bond term limits are set by the U.S. Treasury Department on a monthly basis. Also the Treasury Department has a maximum coupon rate that is eligible for Tax Credit. This is called the Tax Credit Rate and is also set on a monthly basis. (To see the current prevailing rates go to *https://www.treasurydirect.gov/GA-SL/SLGS/selectQTCDate.htm*)
- Issuer sells taxable bonds and pays a taxable coupon semi-annually to the investor.
- All bond proceeds generally must be spent within 3 years or used to redeem bonds at the end of that 3 year period. Issuers must have a binding commitment with a third party to spend at least 10% of the bond proceeds within 6 months of the issuance date.
- Only 2% of the bond proceeds can be used towards cost of issuance. If issuance costs are higher, the balance of these costs must be funded from other sources.
- Davis Bacon prevailing wage laws do not apply to issuer employees but do apply to contracted labor.

8.1.6 Utility Rebates and Incentives

The U. S. DOE offers rebates and incentives for renewable and efficient energy development to businesses and individuals. State and local governments may also offer utility related rebates and incentives. Sponsors can find details on the specific rebates and incentives that are available in their area by visiting the DOE's Database of State Incentives for Renewable and Efficiency (DSIRE). The rebates and incentives change frequently, so airports should investigate opportunities early in the planning stages and verify that these options are still available as project planning proceeds.

8.1.7 Renewable Energy Certificates

RECs are tradeable commodities that indicate that a renewable energy generator has produced electricity. The REC is a way for regulatory entities to track buying and selling of renewable energy and credit the consumer of the green power. RECs are most often sold on a per megawatt-hour (MWh) basis typically through a multi-year contract. The REC purchase is a paper transaction meaning that the buyer and seller of the RECs have no physical connection (e.g. a Tech company in California can buy RECs from a wind farm in the Midwest). Airports that capitalize, construct, own and operate renewable energy facilities create RECs as the electricity is generated. The airport can hold and retire the REC and credibly claim that it uses green energy to power the airport. Or it can sell the REC to obtain additional revenue to help pay off its initial project investment with the buyer of the REC claiming the renewable energy purchase. The value of the REC will vary based on the REC market.

8.2 Private Partner Funding Options

Third party owned projects are particularly attractive in states where there is a strong solar power market and private entities are actively looking for development sites and green power purchasers. In these situations, development companies profit from renewable energy developments primarily due to the

[1] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Qualified Energy Conservation Bonds ("QECBs") & New Clean Renewable Energy Bonds ("New CREBs"),

ability to monetize the federal ITC, which is currently equal to 30% of the project installation cost, and state incentives for renewable energy which direct utilities to purchase green power at a premium price.

8.2.1 Tax Credits

Tax credits have been a fundamental public policy tool to incentivize many types of private sector activities that governments have sought to encourage. Congress approves tax credits for specific business sectors as part of budget authorizations and the IRS administers the programs and provides policy guidance on the implementation of programs. The ITC applies a tax credit as a percentage of the investment value or cost to construct a solar power facility.

Authorization of tax credits by Congress has been unpredictable. It has allowed tax credit programs to expire and then be renewed for short-periods of time. This uncertainty has made it difficult for private investors to rely on the availability of the tax credits on a project-by-project basis, which has caused inefficiencies. However, Congress extended the ITC for 8 years in 2008, providing a relatively stable funding platform for investors to work from. Unfortunately, the stable period will soon change when, after December 31, 2016, the tax credit will be reduced from 30% to 10%. Therefore, private developers are accelerating efforts to develop and put into service new renewable energy facilities before the value of the tax credit is decreased.

Broad-scale tax credits applicable for airport renewable energy projects from state and local entities are rare, though the interpretation of some tax laws like real estate taxes will likely have some impact on the financial costs of developing renewable energy. As an example, solar projects constructed on-site are exempt by Wisconsin state law from property tax.

8.2.2 Accelerated Depreciation

Accelerated depreciation is one of several methods used by companies to defer corporate income taxes by reducing taxable income by depreciating a fixed asset. It allows the owner of a renewable energy project, providing it is not a public entity, to take deductions in the early years of the life of the project. A straight-line depreciation method allows for the deductions spread evenly over the life of a project. The advantage of the accelerated depreciation allows for the owner to deduct far more in the first years after commencement of the project, thereby reducing taxable income which could allow the owner to purchase more assets.

8.2.3 Debt and Equity

Debt is the amount of money borrowed from one party by another usually to allow the borrower the ability to purchase a commodity. Many companies or individuals use debt to purchase products or services such as renewable energy. Typically the lender has an arrangement with the borrower that it has to be paid back at a later date, typically with interest.

Equity is the ownership of an asset after all the debts of that asset are paid off. An example would be house with no outstanding debt would be considered equity. Partial equity would be the value of the asset minus the debt or amount owed.

8.2.4 Power Purchase Agreements

A PPA is a contract between a buyer and seller of energy that obligates the party to deliver and pay for energy for a pre-determined price and term. The PPA is a critical aspect of project financing because it guarantees a long-term revenue stream during facility operation which assures that investors will receive a return on their investment based on the established PPA price of electricity.

8.3 Business Structure

Renewable energy projects have different business structures depending on ownership. There are three primary ownership scenarios for airport renewable energy projects. They are airport owned, third party owned with airport as host, and third party owned with airport as power purchaser. Other lesser arrangements are airport owned with an equipment lease, utility owned with airport as host, and tenant owned.

Each type of ownership has different cost metrics that affect the business structure of the project, in this case a renewable energy project. There are a number of variables that must be considered when evaluating financing alternatives for a renewable energy project and determining if a project at an airport is financially feasible. For example, unlike airports, which are public entities, private development companies profit from renewable energy developments primarily due to the ability to monetize 1) the federal ITC, which is currently equal to 30% of the project installation cost, and 2) state incentives for renewable energy, which direct utilities to purchase green power at a premium price. However, airports have access to grants, AIP funds, PFCs and other grant/loan programs that may not be available to a private developer, which may subsidize a large portion of the renewable energy project cost and can make airport owned projects financially attractive.

Government legislation has developed public policy programs to incentivize solar and other renewable energy technologies due to their broad long-term technological, environmental and social benefits. Successful financing options are closely aligned with maximizing public policy incentives to reduce the cost and increase the value of renewable electricity. Such programs are structured differently to benefit government and private owners.

8.3.1 Airport Owned

In the airport owned scenario, the airport funds, constructs, owns and operates the renewable energy power facility. The facility generates electricity on-site, behind-the-meter and directly feeds electricity consumption at the airport. At times when the system generates more electricity than the building can consume, the excess electricity is sold back to the utility. At times when the building consumes more electricity than the system can produce, the airport purchases the additional required electricity from the utility. The meter records the amount of electricity drawn from the grid and credits back excess electricity sold to the utility. The amount of electricity that can be sold and the value of that electricity (e.g., wholesale or retail rate) vary among states. However, the difference between what is bought and sold is the airport's electricity bill (which could be a liability or an asset).

The airport invests in the facility and recoups its investment through savings in energy bills due to the value of the renewable electricity. Benefits are accrued over time through the value of avoided cost that would otherwise be paid through purchasing electricity from the utility. The savings can be added over time to determine the time required to pay back the investment in the system. As owner of the renewable facility, the airport would also create RECs, which are a tradable commodity and may provide the airport additional revenue to improve system payback.

8.3.2 Third Party Owned

In a third party owned project, the airport leases out property (land or building) to a private developer who will construct, own and operate the facility under a long-term lease agreement. These arrangements are economical to all parties because the third party as a private, tax paying entity can monetize the tax incentives, whereas a government owner can't, reduce the project cost and pass the savings on to all participants.

The third party requires a site and a power purchaser. The airport may act as the host only and receive an annual lease payment. To keep project costs down, the third party will look for inexpensive land with low lease rates, and thus where the airport does act only as host, the lease payment will be for land that has

little market value and no other uses. Alternatively, the airport can also act as the power customer by executing a PPA to purchase the electricity at a mutually agreed upon price. The PPA is a critical aspect of project financing because it guarantees a long-term revenue stream during facility operation which assures that investors will receive a return on their investment based on the established PPA price of electricity. In the scenario where the airport buys the power, it executes a land lease for a nominal cost and earns a financial benefit through an electricity price agreed to in the PPA that serves its long-term business interests. Third parties may have an interest in developing renewable energy projects at airports because airports are a credit worthy, long-term purchaser of energy.

Appendix A Airport Survey of Renewable Energy Decision-Making

Constant Contact Survey Results

Survey Name: Airport Renewable Energy Research

Response Status: Partial & Completed

Filter: None

7/24/2015 2:04 PM EDT

*Please identify the renewable energy technologies used at your airport:

Answer	0% 100%	Number of Response(s)	Response Ratio
Solar PV		16	72.7 %
Solar Thermal		2	9.0 %
Geothermal		5	22.7 %
Wind		1	4.5 %
Other		1	4.5 %
	Totals	**22**	**100%**

*Which response best describes your renewable energy project's ownership arrangement:

Answer	0% 100%	Number of Response(s)	Response Ratio
Airport-owned facility, airport uses the energy on-site		17	77.2 %
Privately-owned facility, airport buys the energy generated		3	13.6 %
Privately-owned facility, airport does not buy the energy, but instead receives a lease payment		2	9.0 %
Utility-owned facility, airport uses the energy on-site		0	0.0 %
	Totals	**22**	**100%**

Please indicate the origin of the renewable energy initiative:

Answer	0% 100%	Number of Response(s)	Response Ratio
Introduced by outside private party		4	18.1 %
Initiated independently by internal staff member(s)		11	50.0 %
Emerged from organizational strategic planning		6	27.2 %
Directed by government hierarchy		2	9.0 %
Other		2	9.0 %
	Totals	**22**	**100%**

Please identify the airport staff position that managed the project development:

Answer	0% 100%	Number of Response(s)	Response Ratio
Director		7	31.8 %
Environmental		2	9.0 %
Facilities		5	22.7 %
Finance		0	0.0 %
Other		10	45.4 %
	Totals	**22**	**100%**

Which factor was the primary driver for the renewable energy project:

Answer	0% 100%	Number of Response(s)	Response Ratio
Economic		9	42.8 %
Political		2	9.5 %
Environmental		9	42.8 %
Social		0	0.0 %
None		1	4.7 %
Other		1	4.7 %
	Totals	**21**	**100%**

Which factor was the secondary driver for the renewable energy project:

Answer	0% 100%	Number of Response(s)	Response Ratio
Economic		7	33.3 %
Political		1	4.7 %
Environmental		9	42.8 %
Social		3	14.2 %
None		0	0.0 %
Other		1	4.7 %
	Totals	21	100%

Please rank the importance of each factor considered in decision-making (0= least important; 5 = most important):

1 = 0, 2 = 1, 3 = 2, 4 = 3, 5 = 4, 6 = 5

Answer	1 2 3 4 5 6	Number of Response(s)	Rating Score*
Reducing costs or generating revenue		21	4.9
Locking in long-term energy price stability		21	4.0
Diversifying energy supply		21	3.4
Mitigating permitting obstacle(s) to future airport expansion		21	1.5
Meeting state / local renewable energy or sustainability policies		21	3.1
Achieving GHG emission reduction targets		21	2.6
Meeting demand from investors and customers		21	2.1
Demonstrating industry leadership		21	4.6

*The Rating Score is the weighted average calculated by dividing the sum of all weighted ratings by the number of total responses.

Degree to which project has had a broad positive effect on airport's financial bottom line:

Answer	0% 100%	Number of Response(s)	Response Ratio
High		4	19.0 %
Medium		3	14.2 %
Low		10	47.6 %
Undetermined		4	19.0 %
	Totals	21	100%

Degree to which the project has had a broad positive effect on the airport and its business:

Answer	0% 100%	Number of Response(s)	Response Ratio
High		5	23.8 %
Medium		9	42.8 %
Low		4	19.0 %
Undetermined		3	14.2 %
	Totals	**21**	**100%**

Please provide any additional comments that may be useful in characterizing your decision-making process for your renewable energy project:

11 Response(s)

Appendix B Sample RFP

I. INTRODUCTION

A. BACKGROUND AND SCOPE OF WORK

The goal of the Project is to develop an on-site solar photovoltaic generating facility that will supply up to 80% of the current annual electrical energy needs of the new Santa Barbara Airline Terminal at a rate that is competitive with rates offered by Southern California Edison (SCE).

B. CITY CONTACT

The City has designated Greg Corral, as its Contact for this RFP. Contact information is listed below:

Purchasing Supervisor
Telephone: (XXX) XXX-XXXX
Fax Number: (XXX) XXX-XXXX
E-mail: XXXXXX@SantaBarbaraCA.gov

Sealed proposals for RFP No. XXXX shall be received for the **Santa Barbara Airline Terminal Solar Photovoltaic Project** per the attached terms, conditions and specifications. Proposals will be received in the City of Santa Barbara Purchasing Office, located at 310 E. Ortega Street, Santa Barbara, California, until **3:00 P.M.,** March 20, 20XX:

MAILED RFP's should be addressed as follows:

RFP No. XXXX
City of Santa Barbara
Purchasing Office
PO Box 1990
Santa Barbara, CA 93102-1990

Or delivery by hand or courier or next day delivery to:

RFP No. XXXX
City of Santa Barbara
Purchasing Office 310
K Ortega Street Santa
Barbara, CA 93101

Any inquiries or request regarding this procurement should be submitted to the City's Contact in writing. Offerors may contact ONLY the City's Contact regarding this solicitation. Other City employees do not have the authority to respond on behalf of the City and contact with unauthorized City personnel may result in disqualification.

II. CONDITIONS GOVERNING THE PROCUREMENT

GENERAL REQUIREMENTS

This procurement will be conducted in accordance with the City of Santa Barbara procurement codes and procedures.

1. Receiving Time/Late Proposals

It is the responsibility of offeror to see that their proposal is submitted with sufficient time to be received by the Purchasing Office prior to the proposal closing time. The receiving time in the Purchasing Office will be the governing time for acceptability of proposals. Telegraphic, telephonic and facsimile proposals will not be accepted.

Late proposals are not accepted regardless of postmark and will be returned unopened to the sender.

2. Acceptance of Conditions Governing the Procurement

Offerors must indicate their acceptance of the Conditions Governing the procurement in the letter of transmittal. Submission of a proposal constitutes acceptance of the Evaluation Factors contained in Section V of this RFP.

3. Mandatory Meeting

A **MANDATORY** meeting will be held on February 26, 20XX at 9:00 a.m., at the Airport Maintenance Conference Room, located at 1699 Firestone Road, Santa Barbara, CA, to discuss the specifications and field conditions. RFP Documents are available at the Purchasing Office and at the meeting.

4. Incurring Cost

Any cost incurred by the offeror in preparation, transmittal, presentation of any proposal or material submitted in response to this RFP shall be borne solely by the offeror.

Any cost incurred by the offeror for set up and demonstration or for interviews shall be borne solely by the offeror.

5. Prime Contractor Responsibility

Any contract that may result from the RFP shall specify that the prime contractor is solely responsible for fulfillment of the contract with the City. The City will make contract payments only to the prime contractor.

6. Subcontractors

Use of subcontractors must be clearly explained in the proposal, and major subcontractors must be identified by name. The prime contractor shall be wholly responsible for the entire performance whether or not subcontractors are used.

7. Amended Proposals

An offeror may submit an amended proposal before the deadline for receipt of proposals. Such amended proposals must be complete replacements for a previously submitted proposal and must be clearly identified as such in the transmittal letter. The City personnel will not merge, collate, or assemble proposal materials.

8. Offeror's Rights To Withdraw Proposal

Offerors will be allowed to withdraw their proposals at any time prior to the deadline for receipt of proposals. The offeror must submit a written withdrawal request signed by the offeror's duly authorized representative addressed to the City's Contact.

The approval or denial of withdrawal requests received after the deadline for receipt of the proposals is governed by the applicable procurement regulations.

9. Proposal Offer Firm

Responses to this RFP, including proposal prices, will be considered firm for ninety (90) days after the due date for receipt of proposals or sixty (60) days after receipt of a best and final offer if one is requested by the City.

10. Best and Final Offer

The City reserves the right to request Best and Final Offers from any or all proposers. This will be the only opportunity to amend or modify proposals based on feedback from the City. Information from competing proposals will not be disclosed.

11. Disclosure of Proposal Contents

All proposals will be treated as confidential documents until the selection process has been completed. Once the selection has been made, all proposals will become a public record. Under the California Public Records Act, any information submitted with a response is a public record subject to disclosure unless a specific exemption applies.

In the event that a proposer desires to keep portions of its proposal confidential, the confidential information so claimed must be identified in writing at the time the proposal is submitted. The proposer must clearly identify those portions with the word "Confidential" printed on the top right hand corner of the page. In addition, vendors must provide a written explanation for the basis of the claim, including the reasons why the information is confidential and a certification that the information has not been released to the public and is not publicly available elsewhere. Statements identifying the entire document as confidential or which do not specifically identify which information is claimed as confidential and provide an explanation for the claim are not acceptable for this purpose.

If a proposer submits information clearly marked proprietary or confidential, the City will consider a proposer's request for exemptions from disclosure. However, the City will make a decision regarding disclosure based upon applicable laws, including the California Public Records Act. It is the proposer's obligation to defend any legal challenges seeking to obtain said information as its sole expense and proposer agrees indemnify and hold harmless the City, its agents and employees, from any judgment or damages awarded against the City in favor of the party requesting the materials. The City shall incur no liability due to release of information from a proposer labeled "proprietary" or "confidential."

12. No Obligation

The procurement in no manner obligates the CITY to the eventual rental, lease, purchase, etc., of any equipment, software, or services offered until a valid written contract is awarded and approved by appropriate authorities.

13. Termination
This RFP may be canceled at any time and any and all proposals may be rejected in whole or in part when the City determines such action to be in the best interest of the City of Santa Barbara.

14. Sufficient Appropriation
Any contract awarded, for multiple years, as a result of the RFP process may be terminated if sufficient appropriations or authorizations do not exist. Such termination will be effected by sending written notice to the contractor. The City's decision as to whether sufficient appropriations and authorizations are available will be accepted by the contractor as final.

15. Errors and Restrictive Specifications
If an offeror discovers any ambiguity, conflict, discrepancy, omission, or other error in the RFP, the offeror should immediately notify the City's Contact at XXX-XXX-XXXX designated in Section 1, paragraph B. Without disclosing the source of the request, the City may issue a written addendum to clarify the ambiguity, or to correct the problem, omission, or other error.

If prior to the submission date, a Proposer knows of or should have known of an error in the RFP but fails to notify the City's Contact of the error, the Proposer shall submit their bid at their own risk and if awarded a contract, shall not be entitled to additional compensation or time by reason of error or its later correction.

A Proposer who believes that one or more of the RFP's requirements is onerous or unfair, or unnecessarily precludes less costly or alternative solutions, may submit a written request that the RFP be changed. The request must include recommended language and the reason for proposing the change. **The City's Contact must receive any requests in writing no later than 5 working days before the submission deadline.**

16. Legal Review
The City requires that all proposers agree to be bound by the General Requirements contained in this RFP. Any proposer concerns must be promptly brought to the attention of the Buyer.

17. Governing Law
This procurement and any Contract with proposer that may result shall be governed by the laws of the State of California.

18. Oral Changes and Basis for Proposal
Do not rely upon oral explanations. Changes and addenda will be issued in writing. Only information supplied by the City in writing through the Purchasing Department, the City's Contact, or in this RFP should be used as the basis for the preparation of proposals.

19. Contract Terms and Conditions
The contract between the City and a contractor will follow the format specified by the City and contain the terms and conditions set forth in Appendix A, "Contract Terms and Conditions." However, **the City reserves the right to negotiate with a successful proposer the final provisions or provisions in addition to those contained in this RFP.** The contents of this RFP, as revised and/or supplemented, and the successful proposal will be incorporated into and become part of the contract.

Should a proposer object to any of the City's terms and conditions, as contained in this Section or in Appendix A, that proposer must propose specific alternative language. The City may or may not accept the alternative language. General references to the proposer's terms and conditions or attempts at complete substitutions are not acceptable to the City and may result in disqualification of the proposer.

Proposer must provide a brief discussion of the purpose and impact, if any, of each proposed changed followed by the specific proposed alternate wording.

20. Proposer's Terms and Conditions

Proposers must submit with the proposal a complete set of any additional terms and conditions that they expect to have included in a contract negotiated with the City.

21. Contract Deviations

Any additional terms and conditions that may be the subject of negotiation will be discussed only between the City and the selected proposer and shall not be deemed an opportunity to amend their proposal.

22. Proposer Qualifications

The City may make such investigations as necessary to determine the ability of the proposer to adhere to the requirements specified within this RFP. The City will reject the proposal of any proposer who is not a responsible proposer or fails to submit a responsive offer.

23. Right To Waive Minor Irregularities

The City reserves the right to waive minor irregularities and the right to waive mandatory requirements provided that all of the otherwise responsive proposals fail to meet the same mandatory requirements and/or doing so does not otherwise materially affect the procurement. This right is at the sole discretion of the City.

24. Right To Publish

Throughout the duration of this procurement process and contract term, potential proposers and contractors must secure from the City written approval prior to the release of any information that pertains to the potential work or activities covered by this procurement or the subsequent contract. Failure to adhere to this requirement may result in disqualification of the proposer or termination of the contract.

25. Ownership of Proposals

All documents submitted in response to the RFP shall be become the property of the City of Santa Barbara and are subject to public records request.

26. Contract Award

Proposal will be evaluated by Committee comprised of City staff and may include outside consultants. The Evaluation Committee will make an award recommendation to City Council. City Council may approval the agreement and/or direct staff to negotiate the final terms and execute the contract.

This contract shall be awarded to the proposer or proposers whose proposal is most advantageous, taking into consideration the evaluation factors set forth in the RFP. The most advantageous proposal may or may not have received the most points or be the lowest cost proposal. Proposers will be notified when the award is being made or an award recommendation goes to Council for approval.

27. Protest Deadline

All parties wishing to file a protest shall comply with the procedures set forth below.

A protest relative to a particular RFP must be submitted in writing and addressed to the General Services Manager, City of Santa Barbara, 310 E. Ortega St., Santa Barbara, CA 93101 and be received by the City by 3 P.M. of the 5th business day following notification to the bidder of a recommendation to award the purchase order/agreement to another firm. The protest shall

contain a full and complete statement specifying in detail the grounds of the protest and the facts in support thereof. The protest shall be hand delivered or sent via certified mail.

a) The protest document must contain a complete statement of the factual and legal basis of the protest.
b) The protest document must refer to the specific portion of the RFP document that forms the basis of the protest.
c) The protest must include the name, address, and telephone number of the person representing the protesting party.
d) The General Services Manager will issue a written decision on the protest within TEN working days of receipt of the written, protest.
e) If the protest is rejected, the party filing the protest shall have SEVEN calendar days to file an appeal to the City's Finance Director. He or she will issue a ruling within 15 working days. If he or she determines the protest is frivolous, the party originating the protest may be determined to be irresponsible and may be ineligible for future Purchase Orders/contracts.

Protests received after the deadline will not be accepted.

28. Records and Audits

The CONTRACTOR shall maintain such detailed records as may be necessary to demonstrate its performance of the duties required by this Contract, including the date, time and nature of services rendered. These records shall be maintained for a period of three years from the date of the final payment under this Contract and shall be subject to inspection by CITY. The CITY shall have the right to audit any billings or examine any records maintained pursuant to this Contract both before and after payment. Payment under this Contract shall not foreclose the right of CITY to recover excessive and/or illegal payments.

29. Enforcement of Contract/Waiver

A party's failure to require strict performance of any provision of this Contract shall not waive or diminish that party's right thereafter to demand strict compliance with that or any other provision. No waiver by a party of any of its rights under this Contract shall be effective unless expressed in writing and signed by the party alleged to have granted the waiver. A waiver by a party of any of its rights shall not be effective to waive any other rights.

III. RESPONSE FORMAT AND ORGANIZATION

A. NUMBER OF RESPONSES

Proposers may submit multiple proposals, if desired. The City is not recommending or suggesting that proposers submit multiple proposals. The City is merely stating an available option. If a proposer chooses to submit multiple proposals, each must be entirely separate from the others. The Evaluation Committee will not collate, merge, or otherwise manipulate the proposer's proposals.

B. NUMBER OF COPIES

Proposers shall provide five (5) identical copies of their proposal to the location specified in Section I, Paragraph D on or before the closing date and time for receipt of proposals.

C. PROPOSAL FORMAT

All proposals must be typewritten on standard 8 $^{1}/_{2}$ x 11 paper (larger paper is permissible for charts, spreadsheets, etc.), include a letter of transmittal, and placed within a binder with tabs delineating each section. The submittal (excluding the Letter of Transmittal and appendices) should be no longer than 20 double sided pages and must contain the following items:

1. Letter of Transmittal

a. Identify the submitting organization and all independent entities participating together;
b. Identify the name, title, telephone and fax numbers, and e-mail address of the person authorized by the organization to contractually obligate the organization;
c. Identify the name, title, telephone and fax numbers, and e-mail address of the person designated as point of contact for the organization;
d. Identify the names, titles, telephone and fax numbers, and e-mail addresses of persons to be contacted for clarification;
e. Accepts conditions governing procurement;
f. Be signed by the person authorized to contractually obligate the organization;
g. Acknowledge receipt of any and all amendments to this RFP.

2. Qualifications

Demonstrate team experience and expertise. Specifically demonstrate recent (last five years) team experience with each element presented below on projects of similar size and scope, which employ an approach similar to this Project. Place emphasis on projects where the proposed team has worked together in the past.

- Successfully negotiating and executing PPA agreements,
- Financing proposed projects,
- Permitting project development, especially experience with permitting projects located in California's Coastal Zone, or in other complex situations or settings.
- Construction of similar systems that were completed on-schedule and functioned as designed.
- Demonstrate successful long term operation of PV systems, including history of meeting output goals and a commitment to maintenance through documentation of past project performance and reliability.

3. Key Personnel

Describe the Project team composition and include resumes of key personnel. The City must be promptly notified of any changes in personnel prior to award. Identify any Offerors or team members involved in litigation related to design, installation or maintenance of a solar PV collection system, or related to a power purchase agreement.

4. References

List a minimum of three (3) references for whom comparable services were provided to in the last five (5) years. Include the name of the firm, name of the contact, telephone number of the contact, email address of contact (if available), brief description of the services provided and your firm's role, and the start and completion date.

5. Preliminary Design Concept

Present a basic preliminary plan of the proposed solar electric system design, which shall include:

- Site plan showing location and arrangement of proposed solar modules, support structures and inverters;
- Support structure design concept and type of collection system (fixed, single axis, dual axis) proposed;
- • Schematic electrical diagram showing points of connection to the City's distribution system or grid, inverter locations, meters and other main components;
- Equipment table listing manufacturer, model number, warranties and quantities for solar modules, inverters and meters;
- Technical system data, including:
- Power capacity (DC kW), measured at the inverter(s) input
- Power capacity (AC kW), measured at the site distribution system interconnection points
- Estimated capacity factor (%), annual output (kWh), and annual output degradation rate, including the methodology used to develop the estimates
- Highlight benefits specific to the proposed system and how the proposal showcases solar PV for the public;
- Demonstrate system output by providing a summary printout of a model run using the PVWATTS v.2 computer program developed by the National Renewable Energy Laboratory using appropriate system parameters for the proposed solar energy collection system.

Schedule

Present a proposed development schedule showing major milestones. Identify any anticipated impacts on Airport operations.

Proposal Worksheets

Attach completed *Proposal Worksheets* (Appendix 5) in the form provided herein including:

- Proposed rate sheet for annual kWh pricing
- Anticipated annual production in kWh
- Agree in principle to the Draft Power Purchase Agreement

6. Project Work Plan

Describe your understanding of the project and approach. Include deliverables, milestones, assumptions, and identify potential risks that could delay the project. List any resources you expect the City to provide.

The City may require oral presentations.

IV. PROJECT DESCRIPTION/SPECIFICATIONS

TENTATIVE SCHEDULE

Evaluation, Interview and Selection Completed	May 20XX
Contract Negotiation Complete	September 20XX
City Council Approval	October 20XX
Design and Permitting Complete	November 20XX
Construction Complete	May 20XX
Project Completion	June 20XX

The City shall have the right to modify or cancel the Pre-submittal Meeting and Site Visit date, Deadline for Submitting RFP Questions and RFP Proposal Submittal Due Date prior to the opening of the submitted proposals by duly noticed addendum. All other tentative schedule timeframes are approximate and provided for informational purposes only.

BACKGROUND

The City wishes to identify a qualified Offeror with demonstrated experience in:

- Installation, maintenance and operation of grid connected solar photovoltaic systems in excess of 300 kW;
- Securing financing for development of large solar photovoltaic (PV) collection systems;
- Sale of solar electric power to government agencies by means of a power purchase agreement structured to utilize tax and incentive benefits to minimize the cost of purchased power.

The goal of the Project is to develop an on-site solar photovoltaic generating facility that will supply up to 80% of the current annual electrical energy needs of the new Santa Barbara Airline Terminal at a rate that is competitive with rates offered by SCE. Airport anticipates that such a system will:

- Improve sustainability of new Airline Terminal by reducing carbon emissions and overall environmental impact of the facility through use of solar power.
  Provide energy to the Airport over the term of the agreement at a price less than or equal to power provided by SCE.
- Eliminate uncertainty of future electricity rates and reduce dependence on foreign energy sources.
- Create a decentralized, local power source for the new Airline Terminal.
- Showcase solar PV technology for the community and Airport users.

The new Airline Terminal building, which is located at 500 James Fowler Road, was opened in late 2011. The historic terminal and short-term parking lot portions of the project were opened in August 2012. Over 700,000 airline passengers use the Terminal annually to travel, non-stop, to and from five cities in the western United States aboard 32 flights daily. The facility is open to the public approximately 20 hours each day.

The new Airline Terminal was designed to be energy efficient and has attained a Leadership in Energy and Environmental Design (LEED) gold rating. A 13 kW solar PV collection system was installed and is operated by the Airport on the roof of the new Terminal building. This system is integrated into the Airline Terminal's electrical system and has been enrolled in the California Solar Initiative.

Southern California Edison (SCE) is the electric utility serving the facility. Invoices from SCE for energy used at the Terminal over the past year are attached as Appendix 1.

To provide access for the Offeror's potential connection to the Airline Terminal electric service yard, the Airport installed four 3" conduits running from the Airline Terminal electrical service yard (southwest corner of the new Terminal building), terminating 5' north of the existing SCE Surface Operable Enclosure (SOE) located off the intersection of James Fowler Road and William Moffett Place (see attached PV Conduit Exhibit — Appendix 2 Photovoltaic Conduit Routing Exhibit). These conduits run into the electrical service yard to the proposed location of a future disconnect switch (disconnect to be provided by Offeror) and into the switchgear. The switchgear has a 1,200 amp circuit dedicated for the future photovoltaic installation (Appendix 3). The Offeror will be responsible for any and all additional costs associated with supplying power from the proposed site to the Airline Terminal.

PROJECT DESCRIPTION

The proposed solar collection facility will be constructed on canopies in the Airport's Long Term Parking Lot 1. The lot covers approximately 6 acres and is located directly east of the north end of the Airline Terminal. The long axis of the lot is oriented in an east-west direction. The northern edge of the lot borders the airfield. The proposed solar PV collection system should employ the most appropriate technology and design for the selected site to minimize the cost per kWh for the Airport.

The City expects to enter into a Power Purchase Agreement (PPA) with the Project Developer for a term of twenty (20) years. The Project Developer will have contractual responsibility for accomplishing and paying all costs for design, permitting, installation, operation, maintenance, investor arrangements, and financing of the solar PV collection system and all appurtenant equipment.

The system proposed by the Offeror must be designed and sized to deliver energy to the Airport at a price competitive with current SCE rates. Airport will only consider proposals where the present value of energy purchased from the PPA provider is below, or equal to, the present value of the same energy purchased from SCE over the term of the agreement. Offeror must consider past billing data, including time-of-use and seasonal rates, to determine the feasibility of the proposed system. Airport will model each proposal to determine if the offeror's price for energy produced by the system is competitive with SCE rates over the term of the anticipated agreement. When doing the analysis, Airport will assume a 3% annual rate increase for SCE energy and will use a discount rate of 5% for the present value calculation. Generally, larger capacity systems will be favored over smaller capacity systems, and physically smaller systems will be favored over physically larger systems where the proposed systems demonstrate comparable economics.

To reduce costs to both parties, Airport anticipates that the Draft Power Purchase Agreement, presented as Appendix 4, will form the basis of the agreement between the Airport and the Project Developer. The Santa Barbara City Attorney will negotiate minor changes to the draft agreement on the Airport's behalf, but will not re-negotiate a new agreement. Proposers must agree in concept to the draft agreement and identify any specific terms where additional negotiation would be required.

The Project will be carried out by the Project Developer in conformance with all applicable laws and codes, and SCE interconnection requirements for net-metered installations. The City will assign any incentive payments, Renewable Energy Credits, and all other environmental attributes associated with the project to the Project Developer (or system owner) and will purchase all electrical energy produced by the system pursuant to the PPA. The Project Developer is responsible for seeking incentive payments, and will be expected to take advantage of tax incentives, including tax credits and accelerated depreciation, to minimize the cost of power delivered to the City. The successful proposer will be required to comply with the applicable laws governing wage rates that are in effect at the time of construction.

Some of the unique challenges associated with the Airport that will impact site layout, schedule, technology employed and performance of the system, include:

- Proximity to aircraft and Airport operations,
- FAA requirements and approvals necessary to construct. FAA provides guidance for constructing solar PV at airports, see http://www.faa.gov/airnorts/environmental/policy guidance/media/airport solar guide_print.pdf
- Located in the California Coastal Zone and subject to requirements of the Local Coastal Plan,
- Subject to City of Santa Barbara requirements, review and permitting process, and
- Proximity to, or presence in, a floodway or floodplain.

The Project Developer will provide real-time web-based monitoring of energy consumption at the Airline Terminal and power generated by the proposed system accessible at no charge to the Airport.

The system proposed herein should be operational by October

2015. DESIGN PARAMETERS

1. The system developed by the Project Developer will be fully integrated into the Airline Terminal power supply system and the electrical grid, with the delivery and metering point in the Airline Terminal electrical service yard. The Project Developer shall supply and install all equipment necessary to interconnect the PV system with the Airline Terminal electrical system. All costs associated with utility interconnection shall be borne by the Project Developer. All transmission lines constructed by the Project Developer will be underground.
2. The PV collection system may not interfere with the safe operation of the Airport, including FAA equipment, aircraft operations, Airport operations and parking lots. If the completed system interferes in any way with safe operation of the Airport, the Project Developer will immediately and entirely eliminate the source of any interference at their sole cost. The Project Developer will phase construction of the Project to minimize disruption to Airport parking activities, if necessary.
3. Capacity of the parking lot should be maintained.

   The PV collection system and support structure must be aesthetically pleasing and of a style and design acceptable to the Airport Department, Architectural Board of Review, Planning Commission, building department, and other review and approval bodies, while minimizing environmental impacts. Santa Barbara Solar Design Guidelines are available for general guidance. See http://www.santabarbaraca.goviservices/planning/design/features/solar.asp
4. Project Developer shall install PV modules with a minimum manufacturer's warranty of 25 years and inverters with a minimum manufacturer's warranty of 10 years. All Project equipment and appurtenances will be installed in conformance with manufacturer's recommendations and applicable codes. All solar electric generating equipment, inverters and meters used on the Project must:

   a. All photovoltaic (PV) modules shall be tested and listed by UL and shall meet the requirements specified in UL 1703 to ensure compliance with applicable safety standards, including but not limited to safe operation and disconnection from the electrical distribution system in the event of internal equipment failure, or separation from the distribution system.

b. PV Modules shall:
   1) Be CA Energy Commission Certified and shall meet all the requirements for being eligible for CSI Incentives.

   2) Be on the CA Energy Commission list of approved products see: www.gosolarcalifornia.ca.gov/equipment/index.html.

   3) Have a minimum CA Energy Commission PTC rating of 88% of the nameplate.

   4) Have a minimum rating of 12.0 watts per square foot DC. PV modules shall have a positive electrical tolerance.

c. The manufacturer of the PV modules must have had at least 5 (five) years of successful operating experience in producing PV modules with an aggregate successful operating capacity of at least 5 MW per year. Manufacturer of the module shall be able to provide evidence of this qualification.

d. PV Module shall have a warranty that includes the following elements:

   1) All PV modules shall have a warranty period that begins at the date of start-up:

   2) PV Module(s) produce a power output of ninety percent (90%) or greater at the end of 10 years.

   3) PV Module(s) produce a power output of eighty percent (80%) or greater at the end of 25 years.

   4) State if the warranty is based on PVUSA Test Conditions or Standard Test Conditions.

   5) PV Module(s) must possess at ten-year workmanship warranty.

5. If the proposed solar facility impacts existing lighting for public or operational areas, Project Developer will provide adequate high-efficiency replacement lighting, consistent with FAA and city requirements, as part of development of the Project. Lighting conditions will meet lighting standards appropriate for the area. All parking lot lighting should continue to be grid tied.

6. Support structure design must minimize perching and nest building opportunities for birds.

7. All materials used to construct the Project shall be suitable for marine environment applications, including but not limited to, the following:

   a. Above-ground conduit and conduit fittings shall be rigid, liquid tight flexible metallic conduit, or equivalent, as approved by City
   b. Fasteners and hardware shall be galvanized steel, stainless steel, or corrosion and sunlight resistant material, as approved by City
   c. In addition to meeting the local electrical code requirements, all conductors shall be copper and carry at least a damp location rating or better if required by code.
   d. Structural materials shall be suitable for use under the prevailing environmental conditions for which they are intended. This includes, but is not limited to, a marine environment. Material exposed to the marine environment shall be galvanized steel, stainless steel, anodized aluminum, or corrosion and sunlight resistant material, as approved by City.

e. PVC electrical raceways, enclosures, and/or fittings shall not be approved where exposed to sunlight.

8. Maintenance of the proposed system will be the responsibility of the Project Developer. Non-storm water discharges associated with maintenance of the system are prohibited.

9. While the system should showcase solar PV technology for the public, the Airport will not be responsible for theft, damage or vandalism.

SERVICES PROVIDED BY THE CITY OF SANTA BARBARA

1. Provide a City Project Manager as a point of contact for all dealings with the Project Developer.

2. Provide any available information about the site facilities.

3. Provide assistance with the City's discretionary review and permitting process.

4. Maintain on-site vegetation during the term of the agreement so as to provide access to sunlight substantially equal to the currently existing conditions.

Appendix List

1. Past SCE bills
2. Photovoltaic conduit routing exhibit
3. Electrical single line diagram
4. Proposed Power Purchase Agreement
5. Required proposal worksheets
6. Nondiscriminatory Employment Certificate
7. Non-Collusion Declaration

V. EVALUATION

A. EVALUATION POINT SUMMARY

The following is a summary of Section IV specifications identifying points assigned to each item. These weighed factors will be used in the evaluation of the proposals. Only finalist proposers will receive points for an oral presentation and demonstration.

Specifications:	Maximum Points:
Economic Value	45
System	30
Experience	15
Schedule	10
TOTAL	**100**

B. EVALUATION FACTORS

1. Economic Value - Proposed price per AC kWh delivered to Airport over term. (45 points)

2. System - Generating capacity, size, configuration and type of equipment. (specifying module type, inverters, preliminary mounting type/design, monitoring equipment, output, how Project is showcased to public) (30 points)

3. Experience - Demonstration of successful experience in the timely finance, planning, development and operation of solar PV systems of comparable size and/or type under a PPA (or similar) approach. (15 points)

4. Schedule - Detailed schedule including agreement development, construction and operation timeline, with anticipated impacts to Airport operations (10 points).

C. EVALUATION PROCESS:

1. All proposals will be reviewed for compliance with the mandatory requirements as stated within the RFP. Proposals deemed non-responsive will be eliminated from further consideration.

2. The City may contact the proposer for clarification of their response as specified in Section II, Paragraph B, Subparagraph 6.

3. The City may use other sources of information to perform the evaluation as specified in Section II, Paragraph 22.

4. Responsive proposals will be evaluated on the factors in Section V that have been assigned a point value. The responsible proposers with the highest scores may be selected as finalist based upon their initial proposals or the City may proceed with the proposer receiving the best score. Finalist who are asked or who choose to submit revised proposals for the purpose of obtaining best and final offers will have their points recalculated accordingly. Points awarded from oral presentations and product demonstrations will be added to the previously assigned points to attain final scores. The responsible proposer whose proposals is most advantageous to the City, taking into consideration the evaluation factors in Section V, will be recommended for contract award to the City Council as specified in Section II, Paragraph B, Subparagraph 11. Please note, however,

that a serious deficiency in the response to any one factor may be grounds for rejection regardless of overall score.

SELECTION AND NEGOTIATION PROCESS

The City will conduct the following steps in making the selection and negotiating an agreement:

- All proposals will be reviewed for completeness, clarity and conformance with Project criteria and submittal requirements. The top proposals will be identified based on the above selection criteria, clarification of any key issues, as necessary, and reference checks.
- Project Developers that have submitted the best proposals will be invited for an interview with the City selection committee. Project Developer must be represented by Key Personnel identified in the submittal during any interview.
- Based on the proposal submittals and interview results, the City will enter into negotiations with the Project Developer(s) whose proposal(s) best serve the City's interests with the goal of finalizing the power purchase agreement and any other needed agreements. Negotiations may include a request by the City for a best and final offer from any or all of the Project Developers.

POWER PURCHASE AGREEMENT

This Power Purchase Agreement is entered into as of _____ , 20__ by and between _____ ("Provider") and the City of Santa Barbara, a municipal corporation ("Host").

WHEREAS, Provider desires to develop, design, construct, own and operate a solar powered electric generating facility at Host's property located at _____ Santa Barbara, California, and sell the electric energy produced by the facility to Host.

WHEREAS, Host desires to make a portion of its property available to Provider for the construction, operation and maintenance of the facility and to purchase the electric energy produced by the facility.

NOW, THEREFORE, in consideration of the promises, the covenants set forth herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows.

1. DEFINITIONS. The following terms, when used herein, shall have the meanings set forth beside them below.

"Access Rights" means the rights provided in this Agreement for Provider and its designees, including Installer, to enter upon and cross the Site to install, operate, repair, remove, and maintain the Facility, and to interconnect the Facility with the Local Electric Utility and to provide water, electric and other services to the Facility.

"Agreement" means this Power Purchase Agreement, including all exhibits attached hereto, as the same may be amended from time to time in accordance with the provisions hereof.

"Applicable Law" means any constitutional provision, law, statute, rule, regulation, ordinance, treaty, order, decree, judgment, decision, certificate, holding, injunction, registration, license, franchise, permit, authorization, or guideline issued by a Governmental Authority that is applicable to a Party to this Agreement or the transaction described herein. Applicable Law also includes an approval, consent or requirement of any governmental authority having jurisdiction over such Party or its property, enforceable at law or in equity.

"Change in Law" means that after the date of this Agreement, an Applicable Law is amended, modified, nullified, suspended, repealed, found unconstitutional or unlawful. Change in Law does not include changes in federal or state income tax laws. Change in Law does include changes in the interpretation of an Applicable Law.

"Commercial Operation Date" means the date, which shall be specified by Provider to Host pursuant to Section 4(g), when the Facility is physically complete and has successfully completed all performance tests and satisfies the interconnection requirements of the Local Electric Utility.

"Confidential Information" has the meaning provided in Section 15(b).

"Construction Guaranty" means a performance bond or escrow agreement in favor of the Host and in accordance with Host's requirements in the amount of _____ dollars, or such other construction guaranty deemed by Host to be sufficient to secure the construction of the Facility in substantial conformance with the Proposal.

"CSI" means the California Solar Initiative.

"Dispute" has the meaning provided in Section 24(a).

"Electric Service Provider" means any person, including the Local Electric Utility, authorized by the State of California to provide electric energy and related services to retail users of electricity in the area in which the Site is located.

"Environmental Attributes" means Renewable Energy Certificates, carbon trading credits, emissions reductions credits, emissions allowances, green tags, Green-e certifications, or other entitlements, certificates, products, or valuations attributed to the Facility and its displacement of conventional energy generation.

"Facility" means an integrated system for the generation of solar energy consisting of the photovoltaic panels and associated equipment to be installed on the Premises in accordance with this Agreement.

"Facility Lessor" means, if applicable, any Person to whom Provider transfers the ownership interest in the Facility, subject to a leaseback from such Person.

"Fair Market Value" means the price that would be paid in an arm's length, free market transaction, for cash, between an informed, willing seller and an informed willing buyer (who is neither a lessee in possession nor a used equipment or scrap dealer), neither of whom is under compulsion to complete the transaction, taking into account, among other things, the age and performance of the Facility and advances in solar technology, provided that installed equipment shall be valued on an installed basis and costs of removal from a current location shall not be a deduction from the valuation.

"Force Majeure Event" has the meaning provided in Section 20(a).

"Governmental Authority" means any international, national, federal, provincial, state, municipal, county, regional or local government, administrative, judicial or

regulatory entity operating under any Applicable Laws and includes any department, commission, bureau, board, administrative agency or regulatory body of any government.

"Host" means the City of Santa Barbara, and its successors.

"Initial Period" has the meaning provided in Section 2.

"Installer" means the person designated by Provider to install the Facility on the Premises. Installer shall be _____ or such other qualified and licensed contractor as may be approved by Host.

"Land Registry" means the office where real estate records for the Site are customarily filed.

"Lender" means persons providing construction or permanent financing to Provider in connection with installation of the Facility and shall include investors in sale-leaseback transactions.

"Local Electric Utility" means the local electric distribution owner and operator which under the laws of the State of California is responsible for providing electric distribution and interconnection services to Host at the Site.

"Operations Period" has the meaning provided in Section 2.

"Party" means either Host or Provider, as the context shall indicate, and "Parties" means both Host and Provider.

"Person" means any individual, partnership, corporation, limited liability company, business trust, joint stock company, trust, unincorporated association, joint venture, firm, or other entity, or a Governmental Authority.

"Point of Delivery" has the meaning set forth in Section 6(a).

"Premises" means the portion of the Site described on Exhibit D.

"Provider" means _____ , and its successors.

"Renewable Energy Certificate" or "REC" means a certificate, credit, allowance, green tag, or other transferable indicia, howsoever entitled, created by an applicable program or certification authority indicating generation of a particular quantity of energy, or product associated with the generation of a specified quantity of energy from a renewable energy source by a renewable energy facility.

"Site" means the real property described on Exhibit C attached hereto, which property includes the Premises.

"Term" shall have the meaning provided in Section 2 hereof.

2. TERM.

(a) This Agreement shall consist of an Initial Period, and, unless the Host has exercised its right under Section 4(b) hereof to terminate the Agreement or the Provider has exercised its right under Section 4(c) hereof to terminate the Agreement prior to the end of the Initial Period, an Operations Period. As used herein, "Term" shall mean all of the Initial Period and the Operations Period.

(b) The Initial Period will begin on the later of the date set forth above or such time when thirty (30) days have elapsed from Host's _____ adoption of an ordinance approving this Agreement and during such thirty (30) day period there has been no filing of a referendum on such ordinance approval. The Initial Period will terminate on the earlier of (i) the Commercial Operations Date or (ii) the date this Agreement is terminated pursuant to the provisions of Section 4(b) or Section 4(c).

(c) If applicable, the Operations Period will commence on the Commercial Operations Date and, subject to the provisions of this Agreement, shall terminate at 11:59 p.m. on the last day of the month in which the twentieth (20^{th}) anniversary of the Commercial Operation Date occurs.

(d) Twenty-four months prior to the end of the Operations Period, the Parties will meet to discuss the extension of this Agreement on terms and conditions reflecting the then current market for solar generated electricity and with such other amendments and additional terms and conditions as the Parties may agree. Neither Party shall be obligated to agree to an extension of this Agreement.

3. ACCESS TO PREMISES, OWNERSHIP OF FACILITY

(a) Host hereby grants Provider and its designees access to the Premises, for the Term, for the purposes of designing, installing, operating, and maintaining the Facility, and any other purpose set forth in this Agreement, and otherwise in accordance with the provisions of this Agreement. Access shall be subject to and consistent with Airport Security Plan requirements as they exist from time to time.

(b) Provider shall be the legal and beneficial owner of the Facility at all times. The Facility is personal property and shall not attach to or be deemed a part of, or fixture to, the Site. The Facility shall at all times retain the legal status of personal property as defined under Article 9 of the Uniform Commercial Code. Host covenants that it will use reasonable commercial efforts to place all persons having an interest in or lien upon the real property comprising the Premises on notice of the ownership of the Facility and the legal status or classification of the Facility as personal property. If there is any mortgage or fixture filing against the Premises which could reasonably be construed as prospectively attaching to the Facility as a fixture of the Premises, Host shall provide a

disclaimer or release from such lienholder. If Host is the fee owner of the Premises, Host consents to the filing of a disclaimer of the Facility as a fixture of the Premises in the office where real estate records are customarily filed in the jurisdiction of the Premises. If Host is not the fee owner, Host will obtain such consent from such owner of the Premises. Provider may mortgage, pledge, grant security interests, or otherwise encumber, or enter into a sale and lease of the Facility in connection with any construction or permanent financing obtained by Provider in connection with the installation of the Facility, and any refinancing thereof.

(c) Host grants Provider and its representatives the following Access Rights with respect to the Site, including without limitation:

(i) reasonable vehicular and pedestrian access across the Site to the Premises as designated on Exhibit C for purposes of designing, installing, operating, maintaining, repairing and removing the Facility. In exercising such access Provider shall reasonably attempt to minimize any disruption to activities occurring on the Site. Access will be subject to and consistent with the Airport Security Plan;

(ii) the right to locate transmission lines and communications cables across the Site as designated on Exhibit C. The location of any such transmission lines and communications cables outside the areas designated on Exhibit C shall be subject to Host's prior written approval and shall be at a location that minimizes any disruption to Host's activities occurring on the Site, including Host's aviation uses, and minimizes aesthetic impacts, subject to the description of the Facility in Exhibit E.

(iii)adequate storage space on the Site convenient to the Premises for materials and tools used during construction, installation of the Facility. Host shall maintain overall security of the Site consistent with current practices, including lockable gates at all entrances. Provider shall provide and maintain such fencing or other enclosures as necessary to secure the specific storage area made available to Provider by Host.

(iv)water, drainage, and electrical connections on the Premises for use by Provider in installing, operating and maintaining the Facility, provided that Provider shall pay the cost of utilities and comply with stormwater discharge limitations applicable to the City.

(d) Provider will be responsible for connecting monitoring equipment for the Facility to external networks so that it is possible for Provider to remotely monitor the Facility. Provider shall not interconnect with Host's systems.

(e) Unless otherwise mandated by the federal government, Host, or any lessee, grantee or licensee of Host, will maintain its buildings and plantings on the Site and its adjacent properties to maintain the solar access of the Facility in substantially the

same condition as of the date of this Agreement and in a manner that shall not interfere with the construction, operation or maintenance of the Facility.

4. PLANNING AND INSTALLATION OF FACILITY.

(a) During the first thirty (30) days of the Initial Period, Provider shall, at its own expense, diligently assess the suitability of the Premises for the Facility. The assessment shall include inspection of the Premises on which the Facility will be located; application for any building permits or other governmental authorizations necessary for the construction of the Facility; making arrangements for interconnection with the Local Electric Utility; making any applications to the California Public Utilities Commission or other agencies for receipt of payments for the Facility under the CSI or other applicable programs; applying to any other governmental agencies or other persons for grants or other determinations necessary for the construction of or receipt of revenues from the Facility; and any other investigation or determination necessary for the construction, operation or maintenance of the Facility.

(b) Based on the assessment conducted pursuant to Section 4(a), during the first three hundred sixty five (365) days of the Initial Period, Provider shall have the right to cease development of the Facility on the Premises, if any of the following conditions have occurred:

(i) Provider, after consultation with Host, demonstrates with reasonable certainty that Provider will not be able, despite reasonable diligence, to obtain building permits, architectural approval, and all other permits or other approvals necessary to construct the Facility;

(ii) Information about the Site provided to Provider by Host is found to be inaccurate and such inaccuracy results in a material and substantial change in the cost or feasibility of constructing the Facility;

(iii) Circumstances beyond Provider's reasonable control prevent interconnection with the Local Electric Utility; or

(iv) The Local Electric Utility notifies Host or Provider that the Facility is ineligible to qualify for payments under CSI.

If Provider determines that any of such conditions have occurred, Provider shall furnish evidence, of such to Host. Provider will consider any information given by Host to Provider within seven (7) days of receipt of such evidence, after which Provider may terminate this Agreement without any further liability of the Parties to each other, by delivering to Host notice of such termination, provided that (i) Provider shall remove any equipment or materials which Provider has placed on the Site; (ii) Provider shall restore any portions of the Site disturbed by Provider to its pre-existing condition; (iii) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the delivery of the notice; and (iv) the confidentiality provisions of Section 16,

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the indemnity obligations under Section 17 hereof, and the dispute resolution provisions of Section 26 hereof shall continue to apply notwithstanding the termination of this Agreement.

(c) If neither party has terminated the Agreement by the end of the time period set forth in Section 4(b), or upon an earlier date as may be mutually agreed by the Parties, Host shall issue to Provider a Notice to Proceed and Provider shall proceed to construct the Facility as described in Exhibit E at Provider's sole expense, except to the extent Exhibit E expressly identifies a cost as Host's responsibility. Provider shall, within ten (10) days of such Notice to Proceed provide the Construction Guaranty to Host. Provider shall give as much notice of intent to commence installation of the Facility on the Premises as reasonably possible, but in no case less than fifteen (15) days, during which time Host and Provider will schedule a pre-construction meeting to discuss arrangements for the period of construction. Provider shall commence construction of the Facility not later than sixty (60) days following issuance of the Notice to Proceed. As of the date hereof; Provider anticipates that the Facility shall consist of the components and shall have the design set forth in Exhibit E attached hereto. Provider, however, has the right, subject to Host's reasonable approval, to modify the design of the Facility, including the selection of the components in the Facility, provided, however, that such changes shall not result in the Facility exceeding the nameplate capacity, building footprint, location and height set forth in Exhibits D and E, except as Host, in its sole discretion, may approve.

(d) If within 365 days (not including any days in which a Force Majeure condition existed) following the date of the Notice to Proceed , the Commercial Operations Date has not occurred, Host may terminate this Agreement by delivering notice to Provider of its intention to terminate this Agreement, and the Agreement shall terminate thirty (30) days after Provider's receipt of such notice unless the Commercial Operation Date occurs within such thirty (30) day period, provided, however, that if Provider is unable to achieve the Commercial Operation within such period due to difficulties in receiving timely supply of equipment to be incorporated in the Facility or the presence of hazardous materials on the Site, Host's right to terminate under this Section 4(d) shall be extended for such period as may be reasonably necessary to accommodate the supply of such equipment or the remediation of such hazardous materials. Upon such termination, neither Party shall have any further liability to the other, provided that (i) Provider shall remove any equipment or materials which Provider has placed on the Site; (ii) Provider shall restore any portions of the Site disturbed by Provider to their pre-existing condition; (iii) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the delivery of the notice; and (iv) the confidentiality provisions of Section 16, the indemnity obligations under Section 17 hereof, and the dispute resolution provisions of Section 25 hereof shall continue to apply notwithstanding the termination of this Agreement.

(e) Provider shall install one or more meter(s), the quantity and specifications of which are consistent with the specifications set forth in Exhibit E, to measure the

output of the Facility at the Point of Delivery. Provider shall install an Interval Data Recorder (IDR) with industry standard telemetry.

(f) Provider shall give Host regular updates, on a schedule reasonably requested by Host, on the progress of installation of the Facility and shall notify Host of when Provider will commence testing of the Facility. Host shall be entitled to have its representatives present during the testing process, but subject to written rules and procedures as may be established by Provider and Installer. After Provider has determined, in its reasonable judgment, and has provided Host with appropriate documentation that the Facility meets the requirements of the Local Electric Utility, has been installed in accordance with all Applicable Laws, and is capable of producing electricity on a continuous basis, Provider shall notify Host that installation of the Facility is complete and shall specify the Commercial Operations Date for the Facility, which may be immediately upon delivery of such notice to Host, provided however that Provider shall have notified Host of Provider's intent to specify the Commercial Operations Date at least ten (10) days prior to such date. All electricity produced by the Facility prior to the Commercial Operations Date shall be delivered to Host and Host shall pay for such electricity at a rate equal to 75% of the rate applicable to the first year of the Operations Period, provided that Host has inspected the Facility to confirm that all necessary equipment, including metering, is in place and functioning properly.

(g) Host shall release its interest in the Construction Guaranty within thirty (30) days from Provider's achieving the Commercial Operation Date as evidenced by satisfactory documentation from the Local Electric Utility.

(h) Provider and Installer are not responsible for any hazardous materials encountered at the Site. Upon encountering any hazardous materials, Provider and Installer will stop work immediately in the affected area and duly notify Host and, if required by Applicable Law, or any Governmental Authority with jurisdiction over Site. Upon receiving notice of the presence of suspected hazardous materials, Host shall take all measures required by Applicable Law to remediate the site, provided however if such remediation cost will exceed one hundred thousand dollars, Host may terminate this Agreement without any further liability of the Parties to each other, by delivering to Provider notice of such termination, provided that (i) Provider shall remove any equipment or materials which Provider has placed on the Site; (ii) Provider shall restore any portions of the Site disturbed by Provider to its pre-existing condition; (iii) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the delivery of the notice; and (iv) the confidentiality provisions of Section 16, the indemnity obligations under Section 17 hereof, and the dispute resolution provisions of Section 25 hereof shall continue to apply notwithstanding the termination of this Agreement. Provider and Installer shall be obligated to resume work at the affected area of the Site only after a qualified independent expert provides written certification that (i) remediation has been accomplished as required by Applicable Law and (ii) all necessary approvals have been obtained from Governmental Authority having jurisdiction over the Project or Site. Notwithstanding the preceding provisions, Host is not responsible for any hazardous materials introduced to the Site by Provider or Installer.

5. OPERATION OF THE FACILITY

(a) Provider shall use licensed and bonded contractors to perform the work of installing, operating, and maintaining the Facility. All labor to install, operate, and maintain the Facility shall be paid not less than the minimum rates established by the State of California's Director of the Department of Industrial Relations (State Wage Rates). Provider intends to use Installer to perform such work, but may use other contractors, for all or a portion of such work, subject to the reasonable approval of Host. Provider shall advise Host of the contractors being used by Provider. Provider shall, to the extent consistent with applicable law and local practice, have contractors execute lien waivers to prevent the imposition of any mechanics, labor or materialman's liens against Host's interest in the Site. Provider shall be responsible for the conduct of its contractors, and Host shall have no contractual relationship with the contractors in connection with the work on the Facility. Provider shall ensure that Installer maintains insurance applicable to the Installer's activities which satisfy the requirements in Exhibit F.

(b) Provider shall design, obtain permits, install, operate, and maintain the Facility so as to keep it in good condition and repair, in compliance with all Applicable Laws and in accordance with the generally accepted practices of the electric industry, in general, and the solar generation industry, in particular. Such work shall be at Provider's sole expense, except to the extent Exhibit E expressly identifies a cost as Host's responsibility. Provider shall, and shall cause its contractors to, keep the Site reasonably clear of debris, waste material and rubbish, and to comply with reasonable safety procedures established by Host for conduct of business on the Site.

(c) Host will provide security for the Facility to the extent of its normal security procedures for the Site.

(d) Provider may shut down the Facility at any time in order to perform required emergency repairs to the Facility. At other times, Provider shall give Host notice of the shutdown as may be reasonable in the circumstances. Provider shall not have any obligation to reimburse Host for costs of purchasing electricity which would have been produced by the Facility but for such shutdown. Provider shall not schedule shutdowns during peak periods of electric generation and periods when peak energy and demand prices are charged by the Electric Service Provider, except as may be required in accordance with prudent electric industry practices in the event of equipment malfunction.

6. SALE OF ELECTRIC ENERGY

(a) Throughout the Operations Period, subject to the terms and conditions of this Agreement, Provider shall sell to Host and Host shall buy from Provider all electric energy produced by the Facility, whether or not Host is able to use all such electric energy (Host shall be free to sell energy which is excess to its requirements to the Local Electric Utility or receive any applicable net metering credit from the Local Electric

Utility as contemplated by the provisions of Section 9(b)). The Point of Delivery of the electric energy shall be as indicated on the one-line diagram included in Exhibit E. Title to and risk of loss with respect to the energy shall transfer from Provider to Host at the Point of Delivery.

(b) The electric energy from the Facility shall be delivered from Provider to Host at the specifications set forth in Exhibit E and otherwise in compliance with all requirements of the Local Electric Utility.

(c) Provider does not warrant or guarantee the amount of electric energy to be produced by the Facility for any hourly, daily, monthly, annual or other period. Provider is not a utility or an electric service provider, and does not assume any obligations of a utility or electric service provider, including any obligation to provide service or be subject to rate review by governmental authorities.

(d) The output of the Facility will be measured by the meter installed in accordance with Section 4(e). Provider shall conduct tests of the meters at such times as it deems appropriate in accordance with industry standards, but not less than once in any two year period. Host shall pay for any independent testing of the meter(s) in excess of such minimum testing schedule that Host deems necessary, except if, after such testing, the meter is shown to be in error by more than 2%, in which case Provider shall pay for the cost of such test and billing adjustments shall be made retroactively to the date which is half-way in between the Host testing and the last testing date of the meter by Provider, but in no event longer than 180 days.

7. PAYMENT AND BILLING

(a) Host shall pay Provider for electricity produced by the Facility at the rates set forth in Exhibit A hereto. The rate shall become effective on the Commercial Operations Date at the "Year 1" rate shown in Exhibit A and shall adjust annually thereafter in accordance with Exhibit A on each anniversary of such date. The energy purchase rates contained in Exhibit A reflect Provider's responsibility to pay for all costs for the design, permitting, construction, maintenance, operation, administration, and removal of the Facility pursuant to this Power Purchase Agreement. , . Host shall have no responsibility for any portion of any such costs, except to pay for electricity produced as provided in this Power Purchase Agreement.

(b) Host shall pay for the electricity produced by the Facility quarterly in arrears. Promptly after the end of each calendar quarter, Provider shall provide Host with an invoice setting forth the quantity of electricity produced by the Facility in such quarter, the applicable rates for such and the total amount due, which shall be the product of the quantity and the applicable rates.

(c) Invoices shall be in writing and shall be either (i) delivered by hand; (ii) mailed by first-class, registered or certified mail, return receipt requested, postage prepaid; (iii) delivered by a recognized overnight or personal delivery service; (iv)

transmitted by facsimile (such transmission to be effective on the day of receipt if received prior to 5:00 pm local time on a business day or in any other case as of the next business day following the day of transmittal); or (v) transmitted by email if receipt of such transmission by email is specifically acknowledged by the recipient (automatic responses not being sufficient for acknowledgement), addressed as follows:

Santa Barbara Municipal Airport
601 Norman Firestone Road
Santa Barbara, CA 93117
Facsimile: (XXX) XXX-XXXX

(d) Host shall pay each invoice within twenty (20) days of receipt of the invoice. Provided the Host has the ability to make payment by electronic funds transfer , payment shall be made by electronic funds transfer to an account designated by Provider in the invoice or in a written notice delivered to Host; otherwise payment shall be made by check or other means agreed by the Parties. Any amounts not paid when due, including any amounts properly disputed and later determined to be owing, shall accrue interest on the unpaid amount at the rate of 1% per month, compounded monthly.

(e) If Host objects to all or a portion of an invoice, Host shall, on or before the date payment of the invoice is due, (i) pay the undisputed portion of the invoice, and (ii) provide an itemized statement of its objections setting forth in reasonable detail the basis for its objections. If Host does not object prior to the date payment of any invoice is due, Host shall be obligated to pay the full amount of such invoices but Host may subsequently object to such invoice and, if such objection proves to be correct, receive a refund of the disputed amount plus interest on the disputed amount at the rate of 1% per month, compounded monthly; provided, however, that Host may not object to any invoice more than twelve (12) months after the date on which such invoice is rendered. The right to dispute or object to an invoice, shall, subject to the time limitation provided in this Section 7(e), survive the expiration or termination of this Agreement.

8. GUARANTEE OF MINIMUM ANNUAL OUTPUT

Provider has estimated that the system will deliver the Expected Annual Output as indicated in Exhibit A of this agreement. Provider guarantees a Minimum Annual Output from the system of 90% of the Expected Annual Output from the system over the course of an operational year commencing with the commercial operation date. If Provider fails to meet the Minimum Annual Output requirement on an operational year basis, for reasons other than shutdown required by the Host, as described in Section 11, Provider will pay the Host, or the Host may, at its option, offset against future payments due Provider, an amount equal to the Host's lost savings.
The formula for calculating lost savings:

Lost Savings (Minimum Annual Output — Actual Annual Output Delivered) X
(Annual Average Tariff Price in $/kWh — Annual Contract Price for PV Electricity Produced)

If Provider fails to pay the Host the amount due for any annual shortfall of the guaranteed Minimum Annual Output within 60 days after notice to make such payment, Host shall have the express right to withhold payment, up to the shortfall amount due, from any payment otherwise payable to the Provider for electricity.

9. SUPPLEMENTAL POWER, NET METERING AND RECS

(a) Throughout the Term, Host shall be responsible. for obtaining all of its requirements for electric energy in excess of the amounts produced by the Facility and pay for such service pursuant to contracts with or applicable tariffs of the Local Electric Utility or other Electric Service Provider. Provider shall have no obligation to obtain or pay for such supplemental or back-up electricity.

(b) At any time that electric production from the Facility is greater than Host's requirements at such time, Host shall nevertheless pay Provider for all of the electricity produced by the Facility, except as provided in Section 14(e) of this Agreement, at the rates and in the manner provided in this Agreement. At Host's option, power in excess of Host's requirements may be delivered to the Local Electric Utility through the Point of Delivery and Host shall receive any payments from the Local Electric Utility, whether directly for the electricity or through receipt of credits or payments that may be available from the Local Electric Utility under net metering or similar programs. If Applicable Law or the practice of the Local Electric Utility restricts the ability of the Host to sell electricity produced by the Facility to the Local Electric Utility, then the Parties shall agree on alternate arrangements to enable them, insofar as possible, to receive payments from the Local Electric Utility, provided that the economic benefits to Provider remain as provided in this Section 9(b).

Except as provided in Section 9(b), Provider shall receive all payments available under the CSI and any other federal, state or local programs applicable to renewable energy sources and Host shall assist Provider in preparing all applications and other documents necessary for Provider to receive such payments, including designating Provider as the customer for purposes of the CSI or assigning payments from the CSI to Provider. If Host receives any payments under the CSI or other programs in respect of the Facility, except as provided in Section 9(b), it shall promptly pay them over to Provider. Host's obligation to make any payments to Provider under this paragraph (c) is limited to any payments actually received by Host.

(d) Host shall be the owner of any Renewable Energy Certificates and Environmental Attributes which may arise as a result of the operation of the Facility and shall be entitled to transfer such Renewable Energy Certificates and Environmental Attributes to any person. Provider shall assist Host in preparing all documents necessary for Host to receive such Renewable Energy Certificates and Environmental Attributes, and if Provider is deemed to be the owner of any such Renewable Energy Certificates and Environmental Attributes, Provider shall assign the same (or the proceeds thereof) to Host. If Provider receives any payments in respect of such certificates or attributes, it shall promptly pay them over to Host.

(e) Provider shall be entitled to receive any payments for electric capacity or ancillary services which may become available as a result of the construction or operation of the Facility. Host shall assist Provider in preparing all documents necessary for Provider to receive such payments, and if Host is deemed to be the owner or provider of such capacity or services, Host shall assign the same to Provider. If Host receives any payments in respect of capacity or such services it shall promptly pay them over to Provider.

(f) Except as contemplated by the provisions of Section 9(b), the electricity purchased by Host from Provider under this Agreement shall not be resold, assigned or otherwise transferred to any other person, and Host shall not take any action which would cause Host or Provider to become a utility or public service company.

(g) Neither Party shall assert that Provider is an electric utility or public service corporation or similar entity which has a duty to provide service, is subject to rate regulation or is otherwise subject to regulation by any governmental authority as a result of Provider's obligations or performance under this Agreement.

10. PURCHASE OPTIONS.

(a) Commencing on the seventh anniversary of the Commercial Operation Date, and on each subsequent anniversary of the Commercial Operation Date, the Host may, at Host's election, approach Provider to discuss the possible purchase of the Facility by Host from Provider. Host acknowledges that Provider shall have no obligation to sell the Facility, and Provider acknowledges that by initiating discussions Host shall not have made any commitments with respect to the purchase of the Facility.

(b) Host shall have the right, but not the obligation, to purchase the Facility from Provider at the expiration of the Operations Period at the then Fair Market Value of the Facility. No earlier than twelve months prior to the expiration of such Operations Period and no later than nine (9) months prior to the expiration o f the Operations Period, Host shall notify Provider of its intent to exercise the option. Within ninety-one (91) days of its receipt of such notice, Provider shall give Host its appraisal of the Fair Market Value of the Facility at the end of the Term, which appraisal shall be based on Provider's knowledge of solar industry facilities. Host may, but is not obligated to, accept such appraisal. If Host does not accept such appraisal within ten (10) days of receiving the appraisal from Provider, the Parties shall meet to discuss the appraisal. If they are unable to reach agreement within twenty (20) days of the Host's receipt of the appraisal from Provider, then the Parties shall mutually select a nationally recognized independent appraiser with experience and expertise in the solar photovoltaic industry. Such appraiser shall act reasonably and in good faith to determine Fair Market Value and shall set forth such determination in a written opinion delivered to the Parties, provided however Host is under no obligation to purchase.

(c) Upon Host's notice that it elects to exercise the option set forth in either Section 10(a) or 10(b) above, Provider shall prepare and deliver, or cause to be delivered, to Host a set of records on the operation and maintenance history of the Facility and a set of as-built drawings of the entire Facility. Upon payment of the option price, Provider shall deliver, or cause to be delivered, to Host a bill of sale conveying the Facility to Host. Such bill of sale shall not contain any warranties other than a warranty against any defects in title arising through Provider. Provider shall use all reasonable efforts to transfer any remaining manufacturer's warranties on the Facility, or portions thereof, to Host.

(d) In connection with, and prior to the effective date of, Hosts' purchase of the Facility, Host and Provider may discuss entering into an operation and maintenance agreement under which Provider shall perform all or a portion of the operation and maintenance requirements of the Facility following Host's purchase of the Facility. However, neither party shall be under an obligation to enter into such an agreement.

(e) If Host does not exercise the option to purchase the Facility and the Parties do not agree to any subsequent agreement with respect to the Facility by the end of the Operations Period, then Provider, at its expense, shall promptly decommission and remove the Facility within three (3) months of the expiration of the Operations Period. Host grants Provider and its representatives reasonable vehicular and pedestrian access across the Site to the Premises for purposes of decommissioning the Facility. In exercising such access and performing the decommissioning, Provider shall reasonably attempt to minimize any disruption to activities occurring on the Site. Host will provide adequate storage space on the Site convenient to the Premises for materials and tools used during decommissioning, which space Provider shall secure with fencing or other equipment as Provider deems necessary. During decommissioning, Provider will comply with all Applicable Law.

(f) Host's option to purchase the Facility under Section 10(b) shall not survive the termination of this Agreement.

11. SHUTDOWNS, SALE OF SITE, CLOSURE OF PREMISES

(a) Host from time to time may request Provider to temporarily stop operation of the Facility, such request to be reasonably related to Host's activities in operating the Airport, including compliance with FAA mandates, or maintaining and improving the Site. During any such shutdown period (but not including periods of Force Majeure), Host will pay Provider an amount equal to the sum of (i) payments that Host would have made to Provider hereunder for electric energy that would have been produced during the period of the shutdown; and (ii) revenues that Provider would have received under the CSI and any other assistance program with respect to electric energy that would have been produced during the period of the shutdown. Determination of the amount of energy that would have been produced during the period of the shutdown shall be based, during the first year of the Operations Period, on the estimated levels of production and, after the first year of the Operations Period, based. on actual operation of the Facility in

the same period in the previous calendar year, unless Provider and Host mutually agree in writing to an alternative methodology.

(b) If Host sells the Site and the improvements thereon Host may, in lieu of Host's continuing performance under this Agreement with respect to the Facility at the Site, cause a subsequent owner of the Site, who shall demonstrate to Provider's lenders that it possesses investment grade credit, to assume this Agreement with respect to such Site. Host shall give Provider at least 180 days notice of a pending sale.

(c) In the event the Premises are closed as a result of an event not related to Force Majeure, Host shall nevertheless continue to pay Provider for all electricity produced by the Facility and delivered to the Point of Delivery.

(d) Notwithstanding anything to the contrary in this Section 11, if there is a temporary shutdown or stop in operation of the Facility, not the result of a Force Majeure event, caused by or related to any action or inaction of Provider such that Facility is no longer able to produce electricity or transfer electricity to the Premises or to the Local Electric Utility and as a result, the Facility is not operating and producing electric energy for a continuous period of ninety (90) days, then either Party shall have the right to terminate this Agreement upon thirty (30) days notice to the other Party. Upon such termination, Provider shall be required within three (3) months of such termination to decommission and remove the Facility from the Site in accordance with the provisions of Section 10(e) hereto. In the event of such a termination of this Agreement with respect to the Facility, the Parties shall not be released from any payment or other obligation arising under this Agreement prior to the shutdown of the Facility, and the indemnity, confidentiality, and dispute resolution provisions shall survive the termination of this Agreement.

12. PERMITS AND OTHER APPROVALS

(a) Provider shall be responsible for paying all costs for and arranging the interconnection of the Facility with the Local Electric Utility and shall obtain any consents or approvals from the Local Electric Utility which are necessary for the construction, commissioning, or operation of the Facility.

(b) Provider shall pay for and obtain all approvals from governmental entities necessary for the construction and operation of the Facility, including land use permits, building permits, and demolition and waste disposal permits.

(c) Host shall pay for and obtain all consents required for it to enter into and perform its obligations under this Agreement from its lenders, tenants, and any other persons with interests in the Site. These consents shall include estoppel certificates which recognize the rights of Provider, and its assignees and successors, under this Agreement.

13. TAXES

(a) Provider shall be responsible for any and all income taxes associated with payments from Host to Provider for electric energy from the Facility. Provider, as owner of the Facility, shall be entitled to all deductions, credits and other tax benefits under federal and state income tax laws with respect to the Facility, including depreciation allowances, investment and production tax credits.

(b) Host shall be responsible for all taxes, fees, and charges, including sales, use and gross receipts taxes, imposed or authorized by any Governmental Authority on the sale of electric energy by Provider to Host. Host shall timely report, make filings for, and pay any and all such taxes assessed directly against it and shall reimburse Provider for any and all such taxes assessed against and paid by Provider.

(c) Host shall be responsible for all ad valorem personal property or real property taxes levied against the Site, improvements thereto and personal property located thereon, except that Provider shall be responsible for ad valorem personal property or real property taxes levied against the Facility. Provider acknowledges and agrees that this Agreement may create a possessory interest subject to property taxation. Provider agrees to pay and discharge any possessory interest taxes associated with the Facility, hereinafter levied or assessed or imposed upon or against the Facility, or against any of Provider's personal property now or hereafter located at the Site, or which may be levied, charged, assessed or imposed upon any taxable possessory interest or right of Provider acquired pursuant to this Agreement. If Host is assessed any taxes related to the existence of the Facility on the Premises, Host shall immediately notify Provider. Host and Provider shall cooperate in contesting such assessment; provided, however, that Host shall pay such taxes to avoid any penalties or interest on such Taxes, subject to reimbursement by Provider. If after resolution of the matter, such tax is imposed upon Host related to the improvement of real property by the existence of the Facility on the Site, Provider shall reimburse Host for such tax.

(d) Each Party has the right to contest taxes in accordance with Applicable Law and the terms of encumbrances against the Site. Each Party shall use all reasonable efforts to cooperate with the other in any such contests of tax assessments or payments. In no event shall either Party postpone during the pendency of an appeal of a tax assessment the payment of taxes otherwise due except to the extent such postponement in payment has been bonded or otherwise secured in accordance with Applicable Law.

(e) In the event either Party fails to pay any taxes that may become a lien upon the other Party's property, such Party may pay such amounts and in such event shall be entitled to recover such paid amount from the other Party, together with interest thereon at the rate of one percent (1%) per month, compounded monthly

Any reimbursement of taxes owing pursuant to this Section 13 shall be paid within twenty (20) days of receiving an invoice therefor from the Party who paid the taxes.

14. INSURANCE

(a) Provider shall maintain the insurance coverage set forth in Exhibit F in full force and effect throughout the Term.

(b) Provider will also meet any additional insurance requirements as may be specified in the CSI program contract and/or utility interconnection agreement.

(c) Provider shall furnish current certificates indicating that the insurance required under this Section 14 is being maintained. The insurance policy provided hereunder shall contain a provision whereby the insurer agrees to give the Host thirty (30) days written notice before the insurance is cancelled or materially altered.

(d) Provider's insurance policy shall be written on an occurrence basis and shall include the Host as an additional insured as its interest may appear. A cross liability clause shall be made part of the policy. Provider's insurer shall waive all rights of subrogation against the Host.

(e) All insurance maintained hereunder shall be maintained with companies rated no less than **B+** XII as to Policy Holder's Rating in the current edition of Best's Insurance Guide (or with an association of companies each of the members of which are so rated).

15. COOPERATION.

(a) The Parties acknowledge that the performance of each Party's obligations under this Agreement will frequently require the assistance and cooperation of the other Party. Each Party therefore agrees, that in addition to those provisions in this Agreement specifically providing for assistance from one Party to the other, that it will at all times during the Term cooperate with the other Party and provide all reasonable assistance to the other Party to help the other Party perform its obligations hereunder.

(b) Host acknowledges that Provider will obtain construction and/or permanent financing from third party sources in connection with the installation of the Facility, and may from time to time refinance such financing. Such financing shall recognize Host's right under this agreement and shall not encumber Host's right and interests in the Site and Premises. Host agrees to execute all consents to assignment and provide such opinions of counsel as may be reasonably requested by Provider and Lender in connection with such financing.

(c) Unless otherwise mandated by the federal government, Host will maintain its buildings and plantings on the Site and its adjacent properties to maintain the solar access of the Facility in substantially the same condition as on the date of this Agreement.

(d) The Parties acknowledge that the installation of the Facility is part of a process of managing and reducing the cost of Host's electric requirements. Host agrees

to discuss with Provider other concepts, systems and approaches which Provider may propose from time to time to assist Host in the managing and reducing the cost of Host's electric requirements.

(e) If during the term of this Agreement Provider determines that it can significantly increase the capacity or availability of the Facility beyond the capabilities of the Facility as initially installed under Section 4 hereof whether through availability of improved technology or otherwise, Host and Provider shall first discuss such opportunities and may agree to amend this Agreement accordingly on such terns as they may agree to.

16. PRESS RELEASES

(a) The Parties acknowledge that they each desire to publicize information about this Agreement and the Facility. The Parties therefore agree that they may each make press releases about entering into this Agreement, the size and location of the Facility, and the identity of the other Party. To the extent allowed by law, the terms of this Agreement and information about the Facility, other than that described above, constitutes Confidential Information, as defined below.

(b) For purposes of this agreement, Confidential Information means information of a confidential or proprietary nature that is specifically marked as confidential. Such information shall include, but not be limited to any documentation, records, listing, notes, data, computer disks, files or records, memoranda, designs, financial models, accounts, reference materials, trade-secrets, prices, strategic partners, marketing plans, strategic or other plans, financial analyses, customer names or lists, project opportunities and the like, provided however that Confidential Information does not include information which (i) was in the possession of the receiving party before receipt from the disclosing party; (ii) is or becomes publicly available other than as a result of unauthorized disclosure by the receiving party; (iii) is received by the receiving party from a third party not known by the receiving party with the exercise of reasonable diligence to be under an obligation of confidentiality respecting the information; or (iv) is independently developed by the receiving party without reference to information provided by the disclosing party.

17. INDEMNIFICATION

As part of the consideration for this Agreement, Provider shall provide the following:

a. Provider shall, to the extent permitted by law, investigate, defend, indemnify, and hold harmless the Host, its officers, employees, and agents from and against any and all loss, damage, liability, claims, demands, detriments, costs, charges, and expense (including reasonable attorney fees), and causes of action of whatsoever character (hereinafter collectively referred to as "claims") which the Host may incur, sustain or be subjected to on account of loss or damage to property or loss of use thereof, or for bodily injury to or death of any persons (including but not limited to property, employees, subcontractors, agents and invitees of each party hereto) arising out of or in any way

connected with the work to be performed under this Agreement, except to the extent a claim arises from a professional error or omission.

b. With respect to those claims arising from a professional error or omission, the following indemnification shall be applicable: Provider shall investigate, defend, indemnify and hold harmless the Host, its officers, agents, and employees from and against any and all loss, damage, liability, claims, demands, detriments, costs, charges, and expenses (including reasonable attorney's fees) and causes of action of whatsoever character which Host may incur, sustain or be subjected to on account of loss or damage to property or loss of use thereof; or for bodily injury to or death of any persons (including but not limited to property, employees, subcontractors, agents and invitees of each party hereto) arising out of or due to the professionally negligent acts, errors or omissions of Provider.

18. SECURITY FOR OBLIGATIONS

(a) Host and/or Provider shall make any necessary filings to disclaim the Facility as a fixture of the Premises and the Site in the Land Registry to place all interested parties on notice of the ownership of the Facility by Provider.

(b) Upon request by Provider, the Parties shall execute and record with the Land Registry easements and other instruments documenting the Access Rights granted by Host to Provider in this Agreement, and which shall be in form and substance reasonably acceptable to both Parties. The cost of recording shall be borne by the Provider.

(c) With respect to consents that Host obtains under Section 12(c) hereof from holders of mortgages, liens or other encumbrances against the Site such consents shall include recognition of, and agreement not to disturb, the rights of Provider hereunder. Such consents, or acceptable notices thereof; shall be recorded, at Host's expense, in the Land Registry. Host may in the future mortgage, pledge, grant security interests in all or a portion of the Site and the improvements thereon, provided the mortgagee or other grantee of the encumbrance acknowledges this Agreement, the Facility, the Access Rights granted hereunder, and the priority of Provider's rights in the Facility and the Access Rights.

(d) Each Party shall not directly or indirectly cause, create, incur, assume or suffer to exist any mortgage, pledge, lien, (including mechanics', labor or materialman's lien), charge, security interest, encumbrance or claim of any nature, including claims by governmental authorities for taxes (collectively referred to as "Liens" and each, individually, a "Lien") on or with respect to the interests of the other in the Site, the Premises, and the Facility, and in the Access Rights granted hereunder. Each Party shall promptly notify the other of the imposition of a Lien on the property interests of the other Party, and shall promptly discharge such lien, provided however, that a Party may seek to contest the amount of validity of any Lien affecting the property of the other Party, provided it timely complies with all procedures for contesting such Lien, posts any bond or other security necessary under such procedures, and if such procedures do not require

the posting of security, the Party establishes for the benefit of the other Party a deposit, letter of credit or other security acceptable to the other Party to indemnify the other Party against any Loss (as defined in Section 17(a)) which could reasonably be expected to arise if such Lien is not removed or discharged.

19. REPRESENTATIONS AND WARRANTIES.

(a) Each Party hereby represents and warrants to the other, as of date hereof, that:

(i) Organization. It is duly organized, validly existing and in good standing under the laws of its state of formation and the State of California, and has the power and authority to enter into this Agreement and to perform its obligations hereunder.

(ii) No Conflict. The execution and delivery of this Agreement and the performance of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under (i) its organizational documents; (ii) any agreement or other obligation by which it is bound; (iii) any law or regulation.

(iii) Enforceability. (i) All actions required to be taken by or on the part of such Party necessary to make this Agreement effective have been duly and validly taken; (ii) this Agreement has been duly and validly authorized, executed and delivered on behalf of such Party; and (iii) this Agreement constitutes a legal, valid and binding obligation of such Party, enforceable in accordance with its terms, subject to laws of bankruptcy, insolvency, reorganization, moratorium or other similar laws, provided however that with respect to Host, such representations are subject to the adoption of an ordinance approving this Agreement and no challenge or filing of a referendum on such ordinance approval being made within a thirty (30) day period after such adoption.

(iv) No Litigation. There are no court orders, actions, suits or proceedings at law or in equity by or before any governmental authority, arbitral tribunal or other body or threatened against or affecting it or brought or asserted by it in any court or before any arbitrator of any kind or before or by any governmental authority which could reasonably be expected to have a material adverse effect on it or its ability to perform its obligations under this Agreement, or the validity or enforceability of this Agreement.

(b) In addition to the representations and warranties in Section 19(a), Host hereby represents and warrants to Provider, as of date hereof, that:

(i) Electric Usage. Host has given Provider complete and correct records of its electric usage at the Site.

(ii) Condition of Premises. Host has given Provider, to the extent of

its knowledge, complete and correct records of the physical condition of the Premises. Provider acknowledges that it has had an opportunity to review the condition of the Site and Premises prior to entering into this Agreement.

20. FORCE MAJEURE

(a) "Force Majeure Event" means any act or event that prevents the affected Party from performing it obligations in accordance with this Agreement, if such act or event is beyond the reasonable control, and not the result of the fault or negligence, of the affected Party and such Party had been unable to overcome such act or event with the exercise of due diligence (including the expenditure of reasonable sums). Subject to the foregoing, Force Majeure Event may include the following acts or events: (i) natural phenomena, such as storms, hurricanes, floods, lightning and earthquakes; (ii) explosions or fires arising from lightning or other causes unrelated to the acts or omissions of the Party seeking to be excused from performance; (iii) acts of war or public disorders, civil disturbances, riots, insurrection, sabotage, epidemic, terrorist acts, or rebellion; (iv) strikes or labor disputes; and (v) action by a governmental authority, including a moratorium on any activities related to this Agreement. Force Majeure Events shall not include equipment failures or acts or omissions of agents, suppliers or subcontractors, except to the extent such acts or omissions arise from a Force Majeure Event. Changes in prices for electricity shall not constitute Force Majeure Events.

(b) Except as provided in Section 20(c) or otherwise specifically provided in this Agreement, neither Party shall be considered in breach of this Agreement or liable for any delay or failure to comply with this Agreement, if and to the extent that such delay or failure is attributable to the occurrence of a Force Majeure Event; provided that the Party claiming relief as a result of the Force Majeure Event shall promptly (i) notify the other Party in writing of the existence and details of the Force Majeure Event; (ii) exercise all reasonable efforts to minimize delay caused by such Force Majeure Event; (iii) notify the other Party in writing of the cessation of such Force Majeure Event; and (iv) resume performance of its obligations hereunder as soon as practicable thereafter.

(c) Obligations to make payments for services already provided shall not be excused by a Force Majeure Event.

(d) In the event of a casualty event which destroys all or a substantial portion of the Premises, Host shall elect, within sixty (60) days of such event, whether it will restore the Premises, which restoration will be at the sole expense of Host. If Host does not elect to restore the Premises, then Provider shall not restore the Facility and this Agreement will terminate. If Host does elect to restore the Premises, Host shall provide notice of such election to Provider and Provider shall then elect, within sixty (60) days of receipt of such notice, whether or not to restore the Facility, subject to the Parties agreeing on a schedule for the restoration of the Premises and an equitable extension to the Term of this Agreement. If the Parties are not able to so agree or if Provider does not elect to restore the Facility, it shall promptly remove any portions of the Facility

remaining on the Premises and this Agreement will terminate. If Provider does elect to restore the Facility it shall do so at its sole expense. Termination provisions pursuant to this paragraph 19(d) shall be: (i) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the casualty event; and (ii) the confidentiality provisions of Section 16, the indemnity obligations under Section 17 hereof, and the dispute resolution provisions of Section 25 hereof shall continue to apply notwithstanding the termination of this Agreement.

(e) Notwithstanding anything to the contrary in Sections 20 (a) — (c), if nonperformance on account of a Force Majeure event continues beyond a continuous period of ninety (90) days, then either Party shall have the right to terminate this Agreement upon thirty (30) days notice to the other (it being agreed that in case of a casualty event which destroys all or a substantial portion of the Premises, the provisions of Section 20(d) shall apply). Upon a termination in accordance with this Section 20(e), Provider shall be required to decommission and remove the Facility from the Site in accordance with the provisions of Section 10(e). In the event of such a termination of this Agreement with respect to the Facility, the Parties shall not be released from any payment or other obligation arising under this Agreement which accrued prior to the shutdown of the Facility or the Premises, and the indemnity, confidentiality and dispute resolution provisions of this Agreement shall survive the termination of this Agreement.

21. CHANGE OF LAW

In the event there is any Change in Law that is applicable to the operation of the Facility, the sale of electric energy produced by the Facility, or any other obligation of the Provider or Host hereunder, there shall be no adjustment to the rates for electric energy from the Facility set forth in this Agreement, notwithstanding that compliance with the Change in Law results in an increase in Provider's costs to operate and/or maintain the Facility or increases the cost to Host of using electricity produced by the Facility.

22. PROVIDER DEFAULT AND HOST REMEDIES

(a) Events of Default by Provider. Provider shall be in default of this Agreement if any of the following ("Provider Events of Default") shall occur:

(i) Any representation or warranty by Provider under Section 19 hereof; is incorrect or incomplete in any material way, or omits to include any information necessary to make such representation or warranty not materially misleading, and such defect is not cured within fifteen (15) days after receipt of notice from Host identifying the defect.

(ii) Provider, fails to commence installation of the Facility as provided in Section 4(d), abandons construction of the Facility and fails to resume construction within thirty (30) days after receipt of notice from Host stating that, in Host's determination, Provider has abandoned construction of the Facility;

(iii) After the Commercial Operation Date, Provider fails to operate the Facility for a period of ninety (90) days which failure is not due to damage to the Facility not caused by Providers operation or in operation, act of governmental authority, or exercise of Provider's rights under this Agreement, or otherwise excused by the provisions of Section 20 (b) (relating to Force Majeure Events); and Provider fails to resume operation within thirty (30) days after receipt of notice from Host stating that, in Host's determination, Provider has ceased operation of the Facility.

(iv) Provider fails to perform any obligation hereunder, such failure is material, such failure is not excused by the provisions of Section 20(b) (relating to Force Majeure Events), and such failure is not cured within: (x) ten (10) days if the failure involves a failure to make payment when due or maintain required insurance; or (y) thirty (30) days if the failure involves an obligation other than the payment or the maintenance of insurance, after receipt of notice from Host identifying the failure.

(v) Provider (A) applies for or consents to the appointment, or the taking of possession by, a receiver, custodian, trustee or liquidator of itself or a substantial portion of its property; (B) admits in writing its inability, or is generally unable, to pay its debts as such debts become due; (C) makes a general assignment for the benefit of its creditors; (D) commences a voluntary case under any bankruptcy law; (E) files a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding up, or composition or readjustment of debts; (F) acquiesces in, or fails to contest in a timely manner, any petition filed against Provider in an involuntary case under bankruptcy law or seeking to dissolve Provider under other Applicable Law; or (G) takes any action authorizing its dissolution.

(b) Upon an Event of Default by Provider, Host shall provide Lender with a reasonable opportunity to cure such Event of Default pursuant to Section 27(e)(iv), and if Lender does not cure such Default, Host may terminate this Agreement, seek to recover damages for costs of replacement electricity and pursue other remedies available at law or equity, in such case, Provider shall within three (3) months of written request of Host remove the Facility from the Premises and restore the Premises as described in Section 10(e).

23. HOST DEFAULT AND PROVIDER REMEDIES.

(a) Events of Default by Host. Host shall be in default of this Agreement if any of the following ("Host Events of Default") shall occur:

(i) Any representation or warranty by Host under Section 19 hereof, is incorrect or incomplete in any material way, or omits to include any information necessary to make such representation or warranty not materially misleading, and

such defect is not cured within fifteen (15) days after receipt of notice from Provider identifying the defect.

(ii) Host obstructs commencement of installation of the Facility or fails to take any actions necessary for the interconnection of the Facility, or fails to take electric energy produced by the Facility, and fails to correct such action within thirty (30) days after receipt of notice thereof from Provider;

(iii) Host sells the Site without the buyer assuming the obligations of Host hereunder and Buyer does not provide adequate assurance, including appropriate credit support, to Provider for purchasing quantities of electric energy from the Facility comparable to that purchased (or anticipated to be purchased) by Host hereunder.

(iv) Host fails to perform any obligation hereunder, such failure is material, such failure is not excused by the provisions of Section 20(b) (relating to Force Majeure Events), and such failure is not cured within: (x) ten (10) days if the failure involves a failure to make payment when due or maintain required insurance; or (y) thirty (30) days if the failure involves an obligation other than the payment or the maintenance of insurance, after receipt of notice from Provider identifying the failure.

(v) Host (A) applies for or consents to the appointment, or the taking of possession by, a receiver, custodian, trustee or liquidator of itself or a substantial portion of its property; (B) admits in writing its inability, or be generally unable, to pay its debts as such debts become due; (C) makes a general assignment for the benefit of its creditors; (D) commences a voluntary case under any bankruptcy law; (E) files a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding up, or composition or readjustment of debts; (F) acquiesces in, or fails to contest in a timely manner, any petition filed against Host in an involuntary case under bankruptcy law or seeking to dissolve Host under other Applicable Law; or (G) takes any action authorizing its dissolution.

(b) Upon an Event of Default by Host, Provider may terminate this Agreement, sell electricity produced by the Facility to persons other than Host and recover from Host any loss in revenues resulting from such sales and pursue other remedies available at law or in equity.

24. LIMITATIONS ON DAMAGES. NEITHER PARTY NOR ANY OF ITS INDEMNIFIED PERSONS SHALL BE LIABLE TO THE OTHER PARTY OR ITS INDEMNIFIED PERSONS FOR ANY SPECIAL, PUNITIVE, EXEMPLARY, INDIRECT, OR CONSEQUENTIAL DAMAGES, OR LOSSES OR DAMAGES FOR LOST REVENUE OR LOST PROFITS, WHETHER FORESEEABLE OR NOT, ARISING OUT, OR IN CONNECTION WITH THIS AGREEMENT.

25. DISPUTE RESOLUTION

(a) The Parties shall negotiate in good faith and attempt to resolve any dispute, controversy or claim arising out or relating to this Agreement (a "Dispute") within 30 days after the date that a Party gives written notice of such Dispute to the other Party.

(b) If; after such negotiation in accordance with Section 25(a), the Dispute remains unresolved, either Party may require that a non-binding mediation take place. In such mediation, representatives of the Parties with authority to resolve the dispute shall meet for at least three (3) hours with a mediator whom they choose together. If the Parties are unable to agree on a mediator, then either Party is hereby empowered to request the American Arbitration Association to appoint a mediator. The mediator's fee and expenses shall be paid one-half by each Party.

(c) In the event any Dispute is not settled to the mutual satisfaction of the Parties pursuant to Sections 25(a) or 25(b), both Parties shall retain the right, but not the obligation, to pursue any legal or equitable remedy available to it in a court of competent jurisdiction.

26. NOTICES

All notices or other communications which may be or are required to be given by any party to any other party pursuant to this Agreement shall be in writing and shall be either (i) delivered by hand; (ii) mailed by first-class, registered or certified mail, return receipt requested, postage prepaid; (iii) delivered by a recognized overnight or personal delivery service; (iv) transmitted by facsimile (such transmission to be effective on the day of receipt if received prior to 5:00 pm local time on a business day or in any other case as of the next business day following the day of transmittal); or (v) transmitted by email if receipt of such transmission by email is specifically acknowledged by the recipient (automatic responses not being sufficient for acknowledgement), addressed as follows:

If to Host:

Airport Director
601 Norman Firestone Road Santa
Barbara, CA 93117
Facsimile: (XXX) XXX-XXXX

If to Provider:

_____

_____

Notices shall be effective when delivered (or in the case of email, when acknowledged by the recipient) in accordance with the foregoing provisions, whether or not (except in the case of email transmission) accepted by, or on behalf of, the Party to whom the notice is sent.

Each Party may designate by Notice in accordance with this section to the other Party a new address to which any notice may thereafter be given.

27. MISCELLANEOUS.

(a) Governing Law. This Agreement shall be governed by the laws of the State of California.

(b) Rules of Interpretation. Section headings are for convenience only and shall not affect the interpretation of this Agreement. References to sections are, unless the context otherwise requires, references to sections of this Agreement. The words "hereto", "hereof' and "hereunder" shall refer to this Agreement as a whole and not to any particular provision of this Agreement. The word "person" shall include individuals; partnerships; corporate bodies (including but not limited to corporations, limited partnerships and limited liability companies); non-profit corporations or associations; governmental bodies and agencies; and regulated utilities. The word "including" shall be deemed to be followed by the words "without limitation". In the event of any conflict between the text of this Agreement and the contents of an Exhibit hereto, the text of this Agreement shall govern

(c) Severability. If any non-material part of this Agreement is held to be unenforceable, the rest of the Agreement will continue in effect. If a material provision is determined to be unenforceable and the Party which would have been benefited by the provision does not waive its unenforceability, then the Parties shall negotiate in good faith to amend the Agreement to restore to the Party that was the beneficiary of such unenforceable provision the benefits of such provision. If the Parties are unable to agree upon an amendment that restores the Party's benefits, the matter shall be resolved under Section 25(c) in order to restore to the Party that was the beneficiary of the unenforceable provision the economic benefits of such provision.

(d) Amendment and Waiver. This Agreement may be amended only in writing signed by both Parties. Any waiver of any of the terms hereof shall be enforceable only to the extent it is waived in a writing signed by the Party against whom the waiver is sought to be enforced. Any waiver shall be effective only for the particular event for which it is issued and shall not constitute a waiver of a subsequent occurrence of the waived event nor constitute a waiver of any other provision hereof, at the same time or subsequently.

(e) Assignment. Subject to the prior written approval of Host, Provider may assign its rights and obligations hereunder to an affiliate of Provider and may mortgage, pledge, grant security interests, assign, or otherwise encumber its interests in this

Agreement to any Persons providing financing for the Facility. Host acknowledges that Provider will be financing the acquisition and installation of the Facility either through a Facility Lessor, Lender, or with financing accommodations from one or more financial institutions and that Provider may sell or assign the Facility and/or may secure Provider's obligations by, among other collateral, an assignment of this Agreement and a first security interest in the Facility. In order to facilitate such necessary sale, conveyance, or financing, and with respect to any Lender or Facility Lessor, as applicable, Host agrees as follows:

(i) Consent to Collateral Assignment. Subject to the prior written approval of Host, Host may consent to the sale of the Facility to a Facility Lessor and the collateral assignment to the Lender or Facility Lessor of the Provider's right, title and interest in and to this Agreement.

(ii) Rights Upon Default by Provider Under a Sale/Leaseback Transaction. Notwithstanding any contrary term of this Agreement: (1) The Facility Lessor, as owner of the Facility, or the Facility Lessor or Lender as collateral assignee of this Agreement, respectively, shall be entitled to exercise, in the place and stead of Provider, any and all rights and remedies of Provider under this Agreement in accordance with the terms of this Agreement. The Facility Lessor or Lender shall also be entitled to exercise all rights and remedies of owners or secured parties, respectively, generally with respect to this Agreement and the Facility; (2) The Facility Lessor or Lender shall have the right, but not the obligation, to pay all sums due under this Agreement and to perform any other act, duty or obligation required of Provider thereunder or cause to be cured any default of Provider thereunder in the time and manner provided by the terms of this Agreement. Nothing herein requires the Facility Lessor or Lender to cure any default of Provider under this Agreement or (unless the Facility Lessor or Lender has succeeded to Provider's interests under this Agreement) to perform any act, duty or obligation of Provider under this Agreement, but Host hereby gives it the option to do so; (3) Upon the exercise of remedies, including any sale of the Facility by the Facility Lessor or Lender, whether by judicial proceeding or under any power of sale contained therein, or any conveyance from Provider to the Facility Lessor or Lender (or any assignee of the Facility Lessor or Lender as defined below) in lieu thereof, the Facility Lessor or Lender shall give notice to Host of the transferee or assignee of this Agreement. Any such exercise of remedies shall not constitute a default under this Agreement; (4) Upon any rejection or other termination of this Agreement pursuant to any process undertaken with respect to Provider under the United States Bankruptcy Code, at the request of Facility Lessor or Lender made within ninety (90) days of such termination or rejection, Host may, but is not obligated to do so, enter into a new agreement with Facility Lessor or Lender or its assignee having substantially the same terms and conditions as this Agreement.

(iii) Acknowledgement and Confirmation. Host shall provide an Acknowledgement and Confirmation in substantially the same form as Exhibit G, Exhibit H, or Exhibit I to this Agreement, as applicable, from Host's landlord or lessor, if any, that the ownership of the Facility remains in Provider and further acknowledging that the Facility is personal property of Provider.

(iv) Right to Cure. (1) Host will not exercise any right to terminate or suspend this Agreement unless it shall have given the Facility Lessor or Lender prior written notice of its intent to terminate or suspend this Agreement, as required by this Agreement, specifying the condition giving rise to such right, and the Facility Lessor or Lender shall not have caused to be cured the condition giving rise to the right of termination or suspension within thirty (30) days after such notice or (if longer) the periods provided for in this Agreement; provided that if such Provider default reasonably cannot be cured by the Facility Lessor or Lender within such period and the Facility Lessor or Lender commences and continuously and with due diligence pursues cure of such default within such period, such period for cure will be extended for a reasonable period of time under the circumstances, such period not to exceed an additional ninety (90) days. The Parties' respective obligations will otherwise remain in effect during any cure period. (2) If the Facility Lessor or Lender or its assignee (including any purchaser or transferee), pursuant to an exercise of remedies by the Facility Lessor or Lender, shall acquire title to or control of Provider's assets and shall, within the time periods described in Section 27(e)(iv)(1) above, cure all defaults under this Agreement existing as of the date of such change in title or control in the manner required by this Agreement and which are capable of cure by a third person or entity, then such Person shall no longer be in default under this Agreement, and this Agreement shall continue in full force and effect.

Neither Party may assign, sell, transfer or in any other way convey its rights, duties or obligations under this Agreement, either in whole or in part, without the prior written consent of the other Party which consent shall not be unreasonably withheld or delayed. For purposes of this Section 27(e), transfer does not include any sale of all or substantially all of the assets of Provider or any merger of Provider with another Person, whether or not Provider is the surviving entity from such merger, or any other change in control of Provider.

(f) Counterparts. This Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

(rest of page left blank intentionally — signatures appear on next page)

IN WITNESS WHEREOF, intending to be legally bound hereby, Provider and Host have executed this Power Purchase Agreement as of the date first set forth above.

By: _____

By: _____

Name (printed): _____

Title: _____

City of Santa Barbara, a municipal corporation:

_____

Airport Director

ATTEST:

_____

City Clerk

APPROVED AS TO CONTENT:

_____

Assistant Airport Director

APPROVED AS TO INSURANCE:

_____

Risk Manger

APPROVED AS TO FORM:
City Attorney

By _____

EXHIBIT A
EXPECTED ANNUAL OUTPUT AND ENERGY PURCHASE RATES

Year	Expected Annual Output in kWh	Purchase Rate per kWh
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

EXHIBIT B
RESERVED

EXHIBIT C
DESCRIPTION OF SITE

EXHIBIT D
DESCRIPTION OF PREMISES

EXHIBIT E
DESCRIPTION OF FACILITY

The Facility will be constructed substantially in conformance with the technical criteria shown in this Exhibit E. The following specific provisions shall apply:

1. In accordance with the provisions of Host's Request For Proposals, installation of the Facility shall be in accordance with the City of Santa Barbara Solar Design Guidelines, shall require neat and orderly installation of all equipment, and shall not include any overhead wires.

2. Each point of connection of the Facility solar energy system to the site distribution system will be equipped with a revenue-grade meter approved by the City, such as Itron Sentinel or equivalent. The meter(s) shall be a socketed type, form 9S. Host recognizes that State-mandated metering requirements shall also dictate the selected metering equipment. All costs associated with utility interconnection shall be borne by the Project Developer.

3. Provider is responsible for all costs associated with the design, structural analysis, construction, maintenance, and repair of the Facility.

4. Provider shall consult with Host on a weekly basis during design and preparation of final construction drawings with the goal of confirming that the work is being done in conformance with this Agreement.

5. The Facility may not interfere with the safe operation of the Airport, including FAA equipment, aircraft operations, Airport operations and parking lots. If the Facility interferes in any way with FAA equipment or aircraft operations the Project Developer will immediately and entirely eliminate the source of any interference at their sole cost. The Project Developer will phase construction of the Project to minimize disruption to Airport parking activities, if necessary.

6. The PV collection system and support structure must be aesthetically pleasing and of a style and design acceptable to the Airport Department, Architectural Board of Review, Planning Commission, building department, and other review and approval bodies, while minimizing environmental impacts.

7. Project Developer shall install PV modules with a minimum manufacturer's warranty of 20 years and inverters with a minimum manufacturer’s warranty of 10 years. All solar electric generating equipment, inverters and meters used on the Project must be eligible for California Solar Initiative funding. All Project equipment and appurtenances will be installed in conformance with manufacturer's recommendations and applicable codes.

8. If the proposed Facility impacts existing lighting for public or operational areas, Project Developer will provide adequate high-efficiency replacement lighting, consistent with FAA and city requirements, as part of development of the Project. Lighting conditions will meet lighting standards appropriate for the area. All parking lot lighting should continue to be powered by SCE.

9. Support structure design must minimize perching and nest building opportunities for birds.

10. All materials used to construct the Project shall be suitable for marine environment applications, including but not limited to, the following:

a. Above-ground conduit and conduit fittings shall be rigid, liquid tight flexible metallic conduit, or equivalent, as approved by City

b. Fasteners and hardware shall be galvanized steel, stainless steel, or corrosion and sunlight resistant material, as approved by City

c. In addition to meeting the local electrical code requirements, all conductors shall be copper and carry at least a damp location rating or better if required by code.

d. Structural materials shall be suitable for use under the prevailing environmental conditions for which they are intended. This includes, but is not limited to, a marine environment. Material exposed to the marine environment shall be galvanized steel, stainless steel, anodized aluminum, or corrosion and sunlight resistant material, as approved by City.

e. PVC electrical raceways, enclosures, and/or fittings shall not be approved where exposed to sunlight.

EXHIBIT F
INSURANCE REQUIREMENTS

Insurance Requirements as to Provider

INDEMNIFICATION PROVISION

As part of the consideration for this Agreement, Provider shall provide the following:

a. Provider shall, to the extent permitted by law, investigate, defend, indemnify, and hold harmless the Host, its officers, employees, and agents from and against any and all loss, damage, liability, claims, demands, detriments, costs, charges, and expense (including reasonable attorney fees), and causes of action of whatsoever character (hereinafter collectively referred to as "claims") which the Host may incur, sustain or be subjected to on account of loss or damage to property or loss of use thereof, or for bodily injury to or death of any persons (including but not limited to property, employees, subcontractors, agents and invitees of each party hereto) arising out of or in any way connected with the work to be performed under this Agreement, except to the extent a claim arises from a professional error or omission.

b. With respect to those claims arising from a professional error or omission, the following indemnification shall be applicable: Provider shall investigate, defend, indemnify and hold harmless the Host, its officers, agents, and employees from and against any and all loss, damage, liability, claims, demands, detriments, costs, charges, and expenses (including reasonable attorney's fees) and causes of action of whatsoever character which Host may incur, sustain or be subjected to on account of loss or damage to property or loss of use thereof; or for bodily injury to or death of any persons (including but not limited to property, employees, subcontractors, agents and invitees of each party hereto) arising out of or due to the professionally negligent acts, errors or omissions of Provider.

INSURANCE

As part of the consideration of this Agreement, Consultant agrees to purchase and maintain at its sole cost and expense during the life of this agreement insurance coverage as specified in I.,II.,III & IV. below. All insurance coverage is to be placed with insurers that: 1) have a Best rating of no less than B+: XII, and 2) are admitted insurance companies in the State of California. All other insurers require prior approval of the City.

I. General and Automobile Liability: Combined single limits of not less than Two Million Dollars ($2,000,000) of General Liability and Two Million Dollars ($2,000,000) of Automobile Liability insurance, including Bodily Injury and Property Damage.

Such insurance shall include:

A. Extension of coverage to City, its officers, employees and agents, as additional insureds, with respect to Consultant's liabilities hereunder in insurance coverage identified in item "1." above, but only as respects to the operations of the named insured. A copy of the endorsement evidencing that the City of Santa Barbara has been added as an additional insured on the policy, must be attached to the certificate of insurance.

B. A provision that coverage will not be cancelled or subject to reduction until at least thirty (30) days' prior written notice has been given to the City Clerk, addressed to P.O. Box 1990, Santa Barbara, California 93102-1990.

C. A provision that Consultant's insurance shall apply as primary, and not excess of, or contributing with the City.

D. Contractual liability coverage sufficiently broad so as to include the liability assumed by the Consultant in the indemnity or hold harmless provisions included in this Agreement.

E. A Cross Liability clause, or equivalent wording, stating that coverage will apply separately to each named or additional insured as if separate policies had been issued to each.

F. Broad form Property Damage Endorsement.

G. Policy shall apply on an "occurrence" basis.

II. Workers' Compensation: In accordance with the provisions of the California Labor Code, Consultant is required to be insured against liability for Workers' Compensation or to undertake self-insurance. Statutory Workers' Compensation and Employers' Liability of at least $1,000,000 shall cover all Consultant's staff while performing any work incidental to the performance or this agreement. The policy shall provide that no cancellation, major change in coverage or expiration shall be effective or occur until at least thirty (30) days after receipt of such written notice by City.

III. Professional Liability: Professional Liability (Errors and Omission) insurance with limits of liability of not less than One Million Dollars ($1,000,000) to cover all services rendered by the Consultant pursuant to this Agreement. Said policy shall provide that City shall be given thirty (30) days written notice prior to cancellation or expiration of the policy or reduction in coverage.

IV. Builders All Risk: Builders All Risk insurance with limits equal to the anticipated cost of construction for the facility.

Approval of the insurance by City or acceptance of the certificate of insurance by City shall not relieve or decrease the extent to which the Consultant may be held responsible for payment of

damages resulting from Consultant's services or operation pursuant to this Agreement, nor shall it be deemed a waiver of City's rights to insurance coverage hereunder.

A Certificate of Insurance supplied by the City evidencing the above shall be completed by Consultant's insurer or its agent and submitted to the City prior to execution of this Agreement by the City. Consultant shall exercise due diligence to require all subcontractors and all tiers of such subcontractors to provide General and Automobile Liability, Workers' Compensation, and Professional Liability insurance as set forth in I, II, and III of this section.

If, for any reason, Consultant fails to maintain insurance coverage which is required pursuant to this Agreement, the same shall be deemed a material breach of contract. City, at its sole option, may terminate this Agreement and obtain damages from the Consultant resulting from said breach. Alternately, City may purchase such required insurance coverage, and without further notice to Consultant, City may deduct from sums due to Consultant any premium costs advanced by City for such insurance.

EXHIBIT G

FORM OF ACKNOWLEDGEMENT AND CONFIRMATION

This Acknowledgement and Confirmation, dated as of _____ (this "Acknowledgement"), is made by _____, the "Host" under that certain Power Purchase Agreement dated _____, 200_ (as amended from time to time, the "Agreement") with **[Project LLC],** a Delaware limited liability company ("Provider"). This Acknowledgement is provided pursuant to Section 1 of the Agreement to the Provider, Lender or Facility Lessor (as defined in the Agreement).

The solar photovoltaic facility (the "Facility") to be operated and maintained by Provider pursuant to the PPA is located at Host's facility at _____ (the "Premises").

1. Acknowledgement of Collateral Assignment.

(a) Host acknowledges the collateral assignment by Provider to the Facility Lessor, of Provider's right, title and interest in, to and under the Agreement, as consented to under Section 1 of the Agreement.

(b) The Facility Lessor as such collateral assignee shall be entitled to exercise any and all rights of lenders generally with respect to the Provider's interests in the Agreement, including those rights provided to Lenders and Facility Lessor in Section 1 of the Agreement.

(c) Host acknowledges that it has been advised that Provider has i) conveyed the ownership interest and ii) granted a first priority security interest in the Facility to Lender and that Facility Lessor has relied upon the characterization of the Facility as personal property, as agreed in the Agreement.

(d) Until further written notice, Host agrees to make all payments due Provider under the Agreement to Facility Lessor at the following address:

[address information to be added]

2. Confirmation. Host confirms the following matters for the benefit of the Facility Lessor:

(a) To Host's knowledge, there exists no event or condition which constitutes a default, or that would, with the giving of notice or lapse of time, constitute a default, under the Agreement.

(b) Host has approved the Facility as installed at the Premises.

(c) Host is aware of no existing lease, mortgage, security interest or other interest in or lien upon the Premises which could attach to the Facility as an interest adverse to Lender's or Facility Lessor's security interest therein.

3. Third-Party Beneficiary. Facility Lessor shall be a third-party beneficiary to this Acknowledgement with full right and authority to enforce the provisions hereof.

HOST

_____

By: _____

Name: _____

PROVIDER

[Project LLC]

By: _____

Name: _____

EXHIBIT H

FORM OF INDEPENDENT LANDLORD - OWNER/LESSOR ACKNOWLEDGEMENT AND CONFIRMATION

This Owner/Lessor Acknowledgement and Confirmation, dated as of _____ (this "Acknowledgement"), is made by _____, _____, ("Owner/Lessor"). Owner/Lessor is the [owner] [lessor] of real property situated in the City/Town of ___ County of _____, and State of _____having a street address of _____ (the "Premises"). The Premises are leased to _____ ("Host") by Lease dated _____ (the "Lease").

Owner/Lessor has been advised of a certain Power Purchase Agreement dated _____, 200_ (the "Agreement") between Host and **[Project LLC]** ("Provider") pursuant to which a solar photovoltaic facility (the "Facility") is to be installed, operated and maintained by Provider at Host's [_____] facility (the "Building") at the Premises. The Facility will be connected to the electrical system of the Building as a supplemental source of electrical power.

This Acknowledgement is provided pursuant to Section [_____] of the Agreement at the request of the Host to [Project LLC], a Delaware limited liability company ("Provider") and Lender or Facility Lessor (as defined in the Agreement). Owner/Lessor has been advised that part of the collateral securing such financial accommodations is the granting of a first priority security interest (the "Security Interest") in the Facility to Lender or Facility Lessor to be perfected by the filing of a Financing Statement (Form UCC-1) under the Uniform Commercial Code. The Security Interest will cover the Facility as personal property only, and not as a fixture.

Owner/Lessor hereby acknowledges and confirms to Provider and Lender or Facility Lessor the following matters with respect to the Premises:

(a) Host either has the absolute right to install the Facility and grant the Security Interest under the terms of the Lease or has it obtained the consent of the Owner/Lessor to do so.

(b) The granting of the Security Interest will not violate any term or condition of the Lease or, to the best of Owner/Lessor's knowledge, of any covenant, restriction, lien, financing agreement, or security agreement affecting the Premises.

(c) Owner/Lessor acknowledges that Lender or Facility Lessor has relied upon the characterization of the Facility as being and remaining at all times personal property, as agreed in the Agreement in accepting the Security Interest as collateral for its financing of the Facility.

(d) Owner/Lessor is aware of no existing lease, mortgage, security interest or other interest in or lien upon the Premises that could attach to the Facility as an interest adverse to Lender's or Facility Lessor's Security Interest therein.

(e) To the Owner/Lessor's knowledge, there exists no event or condition which constitutes a default, or which would, with the giving of notice or lapse of time, constitute a default, under the Lease.

(f) Owner/Lessor will use commercially reasonable efforts to place its successors, assigns, and lienors on notice of the ownership of the Facility by Provider, the existence of the Security Interest, and the fact that the Facility is not a part of the Premises or a fixture thereof, as necessary and appropriate to avoid confusion or adverse claims.

(g) Owner/Lessor disclaims any right to receive any rebate, subsidy, tax credit, or renewable energy credits or other environmental attributes based upon the installation of the Facility at the Premises.

Provider and Lender or Facility Lessor shall be third-party beneficiaries to this Acknowledgement with full right and authority to enforce the provisions hereof.

OWNER/LESSOR	HOST
By: _____	By: _____
Name:	Name:
Title:	Title:

EXHIBIT I

FORM OF HOST LANDLORD - OWNER/LESSOR ACKNOWLEDGEMENT AND CONFIRMATION

This Owner/Lessor Acknowledgement and Confirmation, dated as of , 200_ (this "Acknowledgement"), is made by _____ ("Owner/Lessor"). Owner/Lessor is the owner of real property situated in the City/Town of , County of _____ and State of _____ having a street address of _____ (the "Premises").

Owner/Lessor is party to that certain Power Purchase Agreement dated _____ (the "Agreement") between Owner/Lessor and **[PROJECT LLC]** ("Provider") pursuant to which a solar photovoltaic facility (the "Facility") is to be installed, operated and maintained by Provider at Owner/Lessor's facility (the "Building") at the Premises. The Facility will be connected to the electrical system of the Building as a supplemental source of electrical power. Owner/Lessor is the "Host" under the Agreement

This Acknowledgement is provided pursuant to Section 1 of the Agreement to Provider and Lender or Facility Lessor (as defined in the Agreement, which is providing financial accommodations to Provider to finance the installation of the Facility. Owner/Lessor has been advised that part of the collateral securing such financial accommodations is the granting of a first priority security interest (the "Security Interest") in the Facility to Lender to be perfected by the filing of a Financing Statement (Form UCC-1) under the Uniform Commercial Code. The Security Interest will cover the Facility as personal property only, and not as a fixture.

Owner/Lessor hereby acknowledges and confirms to Lender or Facility Lessor the following matters with respect to the Premises:

(a) Host has the absolute right to install the Facility and grant the Security Interest.

(b) To the best of Owner/Lessor's knowledge, the granting of the Security Interest will not violate any term or condition of any covenant, restriction, lien, financing agreement, or security agreement affecting the Premises.

(c) Owner/Lessor acknowledges that Lender or Facility Lessor has relied upon the characterization of the Facility as being and remaining at all times personal property, as agreed in the Agreement, in accepting the Security Interest as collateral for its financing of the Facility.

(d) Owner/Lessor is aware of no existing lease, mortgage, security interest or other interest in or lien upon the Premises that could attach to the Facility

as an interest adverse to Lender's or Facility Lessor's Security Interest therein.

(e) Owner/Lessor will use commercially reasonable efforts to place its successors, assigns, and lienors on notice of the ownership of the Facility by Provider, the existence of the Security Interest, and the fact that the Facility is not a part of the Premises or a fixture thereof, as necessary and appropriate to avoid confusion or adverse claims.

(f) Owner/Lessor disclaims any right to receive any rebate, subsidy, tax credit, or renewable energy credits or other environmental attributes based upon the installation of the Facility at the Premises.

OWNER/LESSOR
[Type in name of Host/Owner/Lessor]

By: _____

Name: _____

Title: _____

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