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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP SYNTHESIS 66

**Lessons Learned from
Airport Sustainability Plans**

A Synthesis of Airport Practice

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AIRPORT COOPERATIVE RESEARCH PROGRAM

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Cover figure: Portland International Jetport (PWM) terminal gates at night by Robert Benson, Robert Benson Photography.

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FOREWORD

Airport administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to the airport industry. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire airport community, the Airport Cooperative Research Program authorized the Transportation Research Board to undertake a continuing project. This project, ACRP Project 11-03, “Synthesis of Information Related to Airport Practices,” searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an ACRP report series, *Synthesis of Airport Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

*By Gail R. Staba
Senior Program Officer
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There are thousands of small, nonhub, reliever, and general aviation airports that might want to develop a program of sustainable practices to enhance their economic, operational, environmental, and social interests, but lack the expertise and resources, both financial and labor, to develop and implement sustainability programs. Some smaller commercial airports received Airport Improvement Program funding to hire external consultants and launch projects that would have been otherwise prohibitively expensive. Other smaller airports may already have adopted “sustainable” practices without having adequate funding to develop a comprehensive sustainability plan.

Although the ad hoc initiatives are noteworthy and are moving airports toward embracing sustainability as a core planning and operational concept: (1) there is a lack of information on how airports define sustainability and how they are managing programs long term; (2) there is little data on whether airports are successfully implementing commitments outlined in sustainability plans; (3) more information is needed on barriers and aids to implementation; and (4) it is not clear whether comprehensive airport sustainability plans are more beneficial than implementing projects on an ad hoc basis. The objective of this research is to provide information that addresses these problems to meet the needs of airport leadership and employees considering, developing, or implementing sustainability plans.

Information used in this study was acquired through a review of the literature, a survey, and interviews with airport operators.

Renee Martin-Nagle, A Ripple Effect, Oakton, Virginia, and Adam Klauber, ICF International, Cambridge, Massachusetts, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

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LESSONS LEARNED FROM AIRPORT SUSTAINABILITY PLANS

SUMMARY This synthesis presents the findings of ACRP Synthesis S14-02-11, Lessons Learned from Airport Sustainability Plans, a TRB project to analyze and provide a benchmark for sustainability initiatives at smaller U.S. airports. The report included a literature review, a web-based survey of 31 U.S. airports with a 100% response rate, and telephone interviews with airport personnel at 12 selected facilities. The synthesis presents and analyzes the survey responses and provides information gained from the telephone interviews in the form of case examples.

Sustainability has many definitions. One commonly accepted definition of sustainability comes from the “Report of the World Commission on Environment and Development: Our Common Future,” better known as the Brundtland Report, which was commissioned by the United Nations and issued in 1987. The Brundtland Report challenged humanity to “make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland and World Commission on Environment and Development, *Our Common Future: Report on the World Commission on Environment and Development*, Oxford University, 1986, para. 27). Another definition of sustainability identifies three principal actions that support social, environmental, and economic goals, also referred to as the “triple bottom line” (people, planet, and profits). The airport community has adopted its own definition of sustainability. Called EONS, for Economic viability, Operational excellence, Natural resource conservation and preservation, and Social responsibility, it was developed by Airports Council International–North America and adds operations to the triple bottom line components (ACI-NA March 2006).

In 2010 FAA issued interim guidance on sustainability plans, which stated, “Airport Sustainability is a broad term that encompasses a wide variety of practices applicable to planning, design, building and operating airport facilities” (Black 2010). In view of the wide diversity and unique challenges of individual airports, the Sustainable Aviation Guidance Alliance (SAGA) recommends that each airport develop its own definition and approach to sustainability (SAGA 2009). Most survey respondents and interviewees involved with this synthesis followed the SAGA advice to develop their own definitions of sustainability, and this report features working definitions of sustainability adopted by some of those airports.

Like other industry sectors, airports view sustainability as a process of continuous improvement, not an end goal. When embraced as a process of continuous improvement, sustainability initiatives can contribute to almost every facet of airport operations and thus can serve to facilitate future growth. However, limited financial and human resources often constrain sustainability initiatives at small airports. For this reason, like some larger airports, small airports are pursuing sustainability activities in several ways, including incorporating sustainability principles into a master plan (sustainable master plan); developing a formal, stand-alone sustainability plan (sustainable management plan); and implementing sustainability actions on an ad hoc basis.

Airports that developed sustainable master plans and sustainable management plans had the option to apply for FAA funding through the Sustainable Master Plan Pilot Program or to develop the plans using their own or other resources. Airport applications for FAA funding require reference to airport sustainability plans, which could occur within the master plan or as a stand-alone plan.

The survey for this synthesis found that many smaller airport respondents are in the early stages of implementing sustainability plans. Lack of available financial and staff resources is cited most often as the reason for delayed sustainability performance improvements. Nearly all of the respondent airports are reducing energy consumption, and initiatives related to energy reduction are often financed by outside parties and implemented independently of a formal sustainability plan. Airport survey participants viewed sustainability programs as costly to design. Consultants are often necessary at the planning stage, and contractors may be needed for implementation. Respondents perceive the programs as being labor-intensive because staff members add sustainability performance activities and tracking to their existing responsibilities. However, despite the initial costs and continuous effort required, most respondents see benefits from adopting formal sustainability plans and recommend sustainability planning to other airports. Eleven survey respondents who have sustainability programs stated that they were “highly likely” to recommend a sustainability program to another airport, and eight stated that they were “somewhat likely” to recommend such a program. None stated that they would advise against pursuing a sustainability plan.

Sixteen of the airports participated in the FAA-funded Sustainable Master Plan Pilot Program, comprising the majority of medium and small airports in that program. Thirteen other airports that either have pursued self-funded sustainability plans or have implemented sustainability initiatives on an ad hoc basis also participated. Based on survey results, airports with self-funded sustainability plans have made greater progress toward adoption of sustainability planning and implementation than have FAA-funded sustainability grant recipients. Both airports with self-funded sustainability plans and airports without a formal plan have adopted a broader range of energy and climate initiatives than have airports with FAA-funded plans. However, recipients of FAA-funded sustainability planning grants have adopted a broader range of actions based on social responsibility. With respect to management, tracking, and natural resource initiatives, the survey found no difference in outcomes between recipients of FAA sustainability plan grants and airports without a formal plan.

The survey found certain consistencies among the respondent airports. Sustainability initiatives adopted by smaller airports, regardless of the existence of a formal sustainability plan, included the following:

- Lighting upgrades, including LED lights
- Solar and geothermal energy systems
- Recycling of municipal and construction waste
- Planting trees and native plants
- Community and stakeholder outreach
- Employee programs
- Funding from nontraditional sources.

In addition to the survey results, this synthesis presents more in-depth information on sustainability initiatives at 12 airports that are featured as case examples in chapter six. The approaches to sustainability vary with airport size, location, priorities, and management, and each of the case examples offers a window into real-life issues, situations, and solutions.

CHAPTER ONE

INTRODUCTION**BACKGROUND**

As environmental, societal, and economic pressures increase, sustainability has become an important concept to ensuring long-term viability. Many organizations and governmental entities now understand the value of sustainable practices, and the U.S. airport community has enthusiastically joined the movement. Indeed, airports are discovering how sustainability considerations can improve management for their complex operations (see Figure 1). Early adopter airports have pursued sustainability certifications such as the U.S. Green Building Council's (USGBC) Leadership in Energy & Environmental Design (LEED) for construction projects, created their own sustainable design and construction manuals, and utilized the Institute for Sustainable Infrastructure (ISI) Envision framework. FAA recognized the value of sustainability initiatives by promoting airport sustainability and advancing funds to support ACRP airport-specific sustainability projects to serve as resources for airports. Appendix E provides a list of those ACRP projects. The FAA also offers Voluntary Airport Low Emissions Program (VALE) and zero-emission vehicle (ZEV) grants that can fund specific sustainability actions, such as electric supply for gates and alternative-fuel passenger transport.

For some airports, sustainability plans are a central component of successful sustainability programs. If airports want a systematic approach for establishing a sustainability program that includes functions across the organization, a formal sustainability plan is an optimal method. Formal plans enable airports to engage with stakeholders and identify shared goals and strategies to improve performance. However, formal plans are not the only way that an airport can advance sustainability.

Sustainability generally falls into two distinct areas—design and operations—with each requiring a different analysis and set of tools. In the design phase, an airport generally seeks guidance from outside consultants and looks at current trends and operations while planning for a more sustainably focused future. Capital improvement projects present ideal opportunities for integrating sustainable features into infrastructure. Operational sustainability can take many forms, such as more efficient traffic flow, access to low-interest financing, and employee wellness programs.

As stated, there is no uniform sustainability approach that is suitable for all airports, and sustainability practices at airports are complicated by airports' range of sizes, from large, international hub airports to small general aviation fields. In addition, governance structures vary, with state, county, and/or city airport ownership, airport authority ownership, and in some cases private ownership. Sustainable operations require ongoing support and sustainability tools, such as annual reporting and environmental management systems.

Although airports benefit from sustainability-related projects that ultimately save money, staff time, or both, the early stages can be hampered by tight budgets that can support only limited capital projects and by small staff teams that sometimes work overtime hours to maintain basic operations. Smaller airports often experience these challenges more acutely than do larger ones. Small airports with a desire to adopt sustainability programs must approach sustainability with ingenuity and flexibility. A common approach for smaller airports is to adopt an ad hoc project, such as recycling waste, planting trees, or installing LED lighting, as an initial demonstration of the benefits from sustainability-oriented actions. If an airport has the funding and commitment from its management, staff, and stakeholders, it can adopt larger, more complex projects.

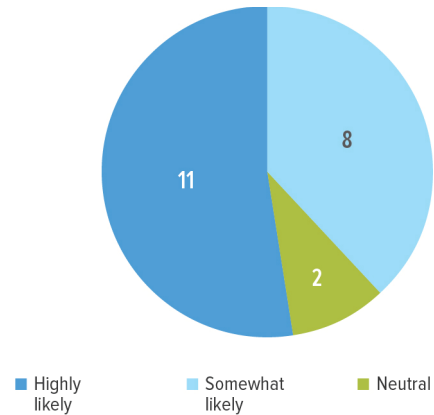


FIGURE 1 Recommend sustainability planning to other airports (number of airports with plans).

The resources used to inform sustainability initiatives vary widely, from green construction manuals, to industry publications, to outside experts. ACRP publications frequently are cited as helpful resources, including *ACRP Synthesis 10: Airport Sustainability Practices* (Berry et al. 2008), which studied sustainability practices at a wide range of airports, and *ACRP Synthesis 53: Outcomes of Green Initiatives: Large Airport Experience* (Thomson and Delaney 2014), which described effective environmental practices at large airports. Appendix C places both of these ACRP syntheses and other sustainability guidelines and programs in historical context. A full list of ACRP publications addressing various elements of sustainability is included in Appendix E, along with sustainability-related plans from certain airports.

SCOPE OF THIS SYNTHESIS

This synthesis was proposed, adopted, and commissioned to gain greater insight into sustainability planning. The scope of this synthesis included:

- Review of existing airport sustainability planning documents, with an emphasis on nonhub commercial service and general aviation (GA) airports, to determine definitions of sustainability, initiatives included, major focus areas, and scope of the planning documents.
- Interviews that examine delivery on commitments outlined in the plans, long-term program management, barriers and aids to implementation, and whether comprehensive airport sustainability plans are more beneficial than is implementing projects on an ad-hoc basis. Interview results are presented as case examples and lessons learned in summary format.
- Identification of costs or benefits realized from the existence (or absence) of an airport sustainability plan.

CHAPTER TWO

STUDY METHOD AND RESULTS

To gain insight into and knowledge about sustainability practices, a survey was designed to learn more about the needs and practices of smaller airports. Appendix A includes a copy of the survey, as well as selected respondent comments. To maximize volunteer participation, a list was compiled of smaller airports, and telephone calls were placed to each airport on the list. Thirty-one airports in 21 states across the United States agreed to participate and received electronic invitations to complete the survey. In two cases—the Port Authority of New York and New Jersey and the city of Phoenix Aviation Department—a single individual responded for two airports, resulting in 29 respondents for 31 airports. Appendix B lists the participating airports. Initial telephone screening and generous commitments from airport personnel to donate their time to an industry effort helped to achieve a 100% response and completion rate.

For ease of completion, the survey was branched into three pathways. One branch covered airports with sustainability plans funded by FAA grants, the second branch addressed airports with self-funded sustainability plans, and the third branch focused on airports that have implemented ad hoc sustainability actions without a plan or framework. Of the 29 survey respondents, 15 stated that they received the majority of funding for the sustainability plan and program from FAA, six stated they obtained funding through other sources including self-funding, and eight indicated they had no formal plan but engaged in ad hoc sustainability projects. However, the survey responses were validated, and it was found that one airport received FAA funding even though the airport self-identified as having “no plan.” For comparative analysis, that airport was assigned to the FAA-funded group, resulting in a survey population consisting of 16 airports receiving FAA sustainability plan grants, six airports self-funding their own plans, and seven airports proceeding without formal sustainability plans.

To expand on and verify the survey results, interviews were conducted with personnel from 12 airports to learn more about the sustainability efforts at those airports. Chapter six presents summaries of those interviews as case examples.

AIRPORT RESPONDENT DEMOGRAPHICS

Size, Location, and Tenants

The participating airports are among the larger small airports, with most providing regional service. Two airports service international flights, and a few are part of larger airport systems, such as the city of Phoenix Aviation Department and the Port Authority of New York and New Jersey. Most of the airports are significant local employers, with 22 employing more than 200 people. A majority occupied large structures: 18 own and/or operate more than 160,000 square feet of building space, and eight control between 80,000 and 160,000 square feet of building space. States represented in the survey are:

- Arizona (2)
- Arkansas
- California (4)
- Colorado
- Florida
- Indiana (2)
- Kansas
- Kentucky
- Maine
- Massachusetts

- Nevada
- New York (4)
- Ohio (2)
- Oregon
- Pennsylvania (3)
- Tennessee
- Texas
- Washington
- West Virginia
- Wisconsin

US Code Title 49 § 47102 of U.S. federal law categorizes airports into large hub, medium hub, and nonhub, according to passenger enplanements. The categories are defined as follows:

- Large hub airport—a commercial service airport that has at least 1.0% of total U.S. passenger enplanements (in 2010 this was at least 7,100,000 enplanements).
- Medium hub airport—a commercial service airport that has at least 0.25% but fewer than 1% of U.S. passenger enplanements (in 2010 this was more than 1.8 million enplanements, but fewer than 7.1 million).
- Small hub airport—a commercial service airport that has at least 0.05% but fewer than 0.25% of total U.S. passenger enplanements (in 2010 this was more than 380,000 flights but fewer than 1.8 million).
- Nonhub airport—a commercial service airport that has fewer than 0.05% of the passenger boardings (in 2010 this was more than 2,500 flights but fewer than 380,000).
- General aviation (GA) airport—an airport that either does not have scheduled service or has scheduled service with fewer than 2,500 enplanements each year. This airport type is the largest single group of airports in the U.S. system.

The following sizes are represented by the 31 airports in the survey [Stewart International and Teterboro Airports (New Jersey/New York) comprise a single response, as do Deer Valley and Good-year Airports (Arizona)]:

- six medium hub,
- five small hub,
- 12 nonhub, and
- six GA airports

One survey question queried respondents regarding tenants. Twenty-eight of the 29 respondents rented space to fixed-base operators (FBOs), and in addition, 26 hosted food and beverage facilities and car rental agencies, 24 hosted airlines and retail outlets, 19 hosted flight instruction, 18 hosted air charter companies and line maintenance providers, and 17 hosted freight or distribution organizations. The FAA and other federal agencies also occupied floor space on airport property for 22 respondents. Fourteen offered tourist information centers. Only nine offered heavy maintenance, repair, and overhaul (MRO) services (see Figure 2).

Other tenants listed by the respondents included contract air traffic control (ATC) services, hangar lessees, Air National Guard facilities, an Army field maintenance shop, a commercial manufacturer, aviation storage facilities, and fire and police departments.

SUSTAINABILITY PLAN FUNDING AND IMPLEMENTATION

The survey provided information on funding sources for sustainability planning and initiatives. When the respondents were asked about funding, the significant role played by FAA became clear because half of them stated that FAA provided the bulk of the funds required for the sustainability plan. As explained previously, 16 airports received FAA funding for their sustainability planning and programs (see Figure 3). Eleven of the airports receiving FAA funds stated that the FAA program was essential or that the sustainability program might not have been possible without federal support (see Figure 4). One respondent was clear about the necessity of FAA funding for the airport's sustain-

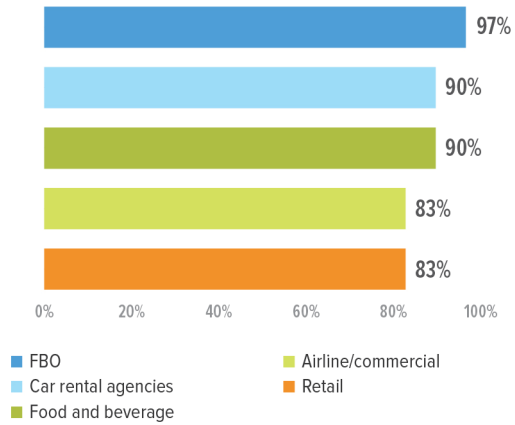


FIGURE 2 Major airport tenants (percentage of airports in study).

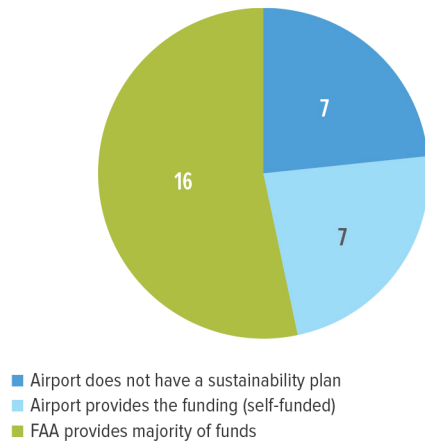


FIGURE 3 Plan funding source (number of airports in study).

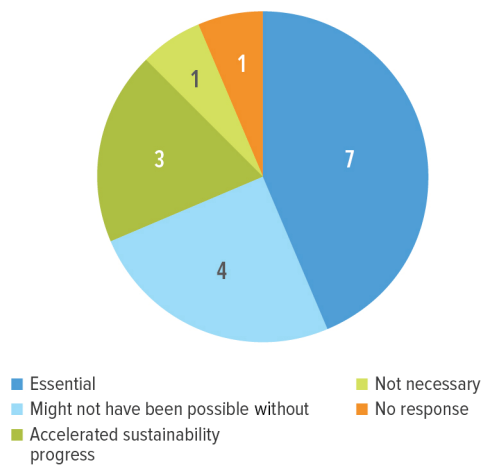


FIGURE 4 Value of FAA funding (number of FAA grant recipients).

ability plan: “It is my feeling that we would not have performed a sustainability master plan without the funding from FAA. They asked us to participate in a pilot program, and we agreed to combine the sustainability master plan with our overall Master Plan.” FAA funding came through several channels: 11 respondents received sustainability planning grants and general Airport Improvement Program (AIP) grants, and two received funding to implement sustainability-related projects through the Voluntary Airport Low Emissions Program (VALE).

Twenty-one of the respondents self-funded by investing the airport’s own monies into the sustainability efforts, even if the airport received other sources of funding. Reasons cited for self-funding included greater flexibility (three respondents), speed (two respondents), and fewer constraints (two respondents). However, airports accessed a variety of other funding sources, demonstrating that financial support is available for sustainability programs but an airport may have to seek it from multiple, and sometimes previously unexplored, sources. For example, 13 of the respondents received rebates from utilities, and 10 obtained energy efficiency subsidies from state and local entities. Six respondents benefited from utility-funded energy audits, and a similar number entered into power purchase agreements for renewable energy. Five received state grants for electric vehicle charging stations.

Other sources of funding suggested by the respondents in separate comments included the airport operating budget, unnamed state and local funding, and renewable energy credits under the American Recovery and Reinvestment Act. Another ACRP publication, *Synthesis 24: Strategies and Financing Opportunities for Airport Environmental Programs* (Molar 2011), provides a comprehensive guide to funding opportunities at the federal, state, and regional levels for general and specific environmental issues and includes case examples from airports that have acquired financing through these various sources.

INTERNAL RESPONSIBILITY FOR SUSTAINABILITY ACTIVITIES

For 16 of the respondents, management staff is primarily responsible for implementing sustainability initiatives. For seven respondents, a committee with representatives from multiple business lines implements the sustainability initiatives, bringing the associated benefits of a broader perspective and cross-functional investment in sustainability goals. In one case, the town’s energy office implements sustainability programs at the airport (see Figure 5).

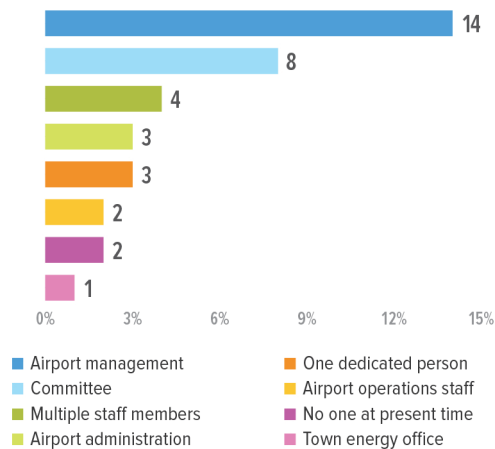


FIGURE 5 Who implements sustainability (number of airports in study; multiple responses possible).

CHAPTER THREE

DEVELOPING SUSTAINABILITY PLANS

DEFINITIONS

Defining sustainability is useful because a definition provides a focus for sustainability planning and consensus-based goals. Because sustainability programs at smaller airports often begin with informal, ad hoc initiatives, the definition and understanding of sustainability and its elements may differ significantly. As stated, most definitions of sustainability mention three core performance areas—social, economic, and environmental—and the airport community has added operations as a fourth component. The *Sustainable Aviation Resource Guide* (2009) states, “When embarking on a sustainability program, it is critical for each airport to determine its specific definition of sustainability,” and the surveyed airports appeared to follow that advice. In addition to the widely accepted definitions of sustainability, the surveyed airports developed their own context-specific mission statements for sustainability. A selection of illustrative mission statements are presented here, with more definitions of sustainability and mission statements provided in Appendix A:

1. At the crossroads of innovation and sustainability, to strive to conserve natural resources, operate efficiently, enhance passenger experience, and serve as a vital asset to [the] region and beyond.
2. Doing what makes sense for the environment.
3. Provide the region [with] convenient commercial and general aviation access to the national air transportation system, operate the airport in a safe, efficient, sustainable, and fiscally responsible manner, and develop the airport to meet future needs.
4. Sustainability refers to the mutually beneficial, life-supporting, and perpetual balance among economic, social, and environmental considerations and goals. It is a “basket” concept similar to justice or health that incorporates many ideas and approaches.
5. Sustainability principles:
 - Minimize negative environmental impacts.
 - Integrate sustainable practices into daily operations.
 - Work with partners throughout the airport system.
 - Implement sustainable design/construction practices.
 - Maximize life of our assets.
 - Engage with local community in positive manner.
 - Provide a positive and safe working environment.
 - Report on progress in meeting sustainability principles.

SUSTAINABILITY PLANNING CONSIDERATIONS

Sustainability planning is a single component of a sustainability program. Planning is useful as a way to convene discussions on the topic and connect stakeholders across the airport enterprise. In addition, plans are an effective way to achieve consensus on airportwide goals and performance targets. A sustainability plan is not an end point but rather an effective starting point and a foundation for continuous improvement. Other common airport sustainability elements include some or all of the following: sustainable design and construction guidance, sustainability mission statement, individual sustainability actions, performance tracking mechanisms, management system(s), and annual sustainability reporting. Airports can implement sustainability actions on an ad hoc basis without a formal plan. However, at a minimum, adopting a formal sustainability plan is useful for setting priorities for actions, and airports participating in this synthesis project agreed that a formal plan is a desired part of a sustainability program.

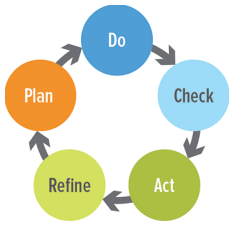


FIGURE 6 Continuous improvement (figure adapted from ISO 14001).

Airport sustainability programs also benefit from performance management and continuous improvement in economic, social, operational, and environmental activities (Figure 6). Through a lens of continuous improvement, airport sustainability follows a repeating and evolving cycle. An airport first commits to a sustainability policy or mission, then uses its policy as a basis for establishing a plan, which sets objectives and targets for improving performance. The next step is implementation. After that, an airport evaluates its performance to see whether the objectives and targets have been achieved. If targets have not been reached, corrective action is taken. The results of this evaluation are then reviewed to evaluate sustainability performance. The airport revisits sustainability policy and goals and afterward sets new targets in a revised plan that is subsequently implemented. The cycle repeats, and continuous improvement evolves. This approach is often referred to as the “plan-do-check-act-refine” cycle. The steps, which have been adapted from the International Organization for Standardization (ISO) 14001, are further detailed here:

- Plan—Based on a sustainability policy or mission, gain a comprehensive understanding of what an airport is trying to manage, including the potential risks and opportunities, and develop a systematic way to evaluate and prioritize sustainability actions. Plans can include implementation on ongoing management approaches.
- Do—Implement the plan and improve your airport’s ability to ensure selected actions are actually implemented.
- Check—Monitor key parameters and metrics to gauge performance, then recalibrate and adjust, ensuring management processes are meeting their intended goals.
- Act—Based on evaluation of monitoring results, review sustainability performance results and lessons learned to refine the plan and adjust implementation as necessary.
- Refine—Adjust the plan based on information gathered during the check and act steps.

Although the surveyed airports did not make specific reference to international sustainability frameworks and standards, there are several that are worth mentioning and may be considered or consulted while planning or implementing a sustainability program. The Global Reporting Initiative (GRI) provides advice and reporting guidelines for sustainability programs in general, and in 2011 GRI issued the *Sustainability Reporting Guidelines & Airport Operators Sector Supplement*, which presents information pertaining to airports. The ISO develops voluntary standards and has published several standards relating to sustainability, such as ISO 14001 (environmental management), ISO 26000 (social responsibility), ISO 50001 (energy management), ISO 20121 (sustainable events), and ISO 15392 and the ISO 21000 series (sustainability in building construction). Other sustainability frameworks that have achieved global acceptance are the CDP (formerly the Carbon Disclosure Project), which focuses on greenhouse gases, and the Dow Jones Sustainability Index (DJSI), which is similar to GRI in providing guidance for managing and reporting on the three sustainability pillars of finance, environment, and society.

Survey findings suggest most respondents are still in the process of formulating sustainability plans. Only six of 21 airports that answered the “sustainability level” question have completed a formal plan, and only two have fully implemented the plan (see Figure 7). Full implementation of a sustainability plan or program can mean different things to different airports, but at a minimum, a fully implemented plan includes adoption of clear, sustainability-focused goals that are part of a formally adopted plan; implementation of those goals; and a means to track performance against those goals to encourage continuous improvement. Given that many airports are still in the early stages of building a sustainability program, this synthesis focuses on the sustainability planning process and current initiatives, rather than on measurable outcomes.

There is a common perception that resource constraints limit the potential scope of viable airport sustainability activities. Although there is a feeling among smaller airports that they are more hampered by lack of resources than are their larger counterparts, full-time employees dedicated to single assignments are rare for many airports of all sizes. Airport employees perform multiple tasks within the scope of a broad set of responsibilities; an airport director may operate the snowplow on the same day that he or she negotiates a multiyear, multimillion dollar contract.

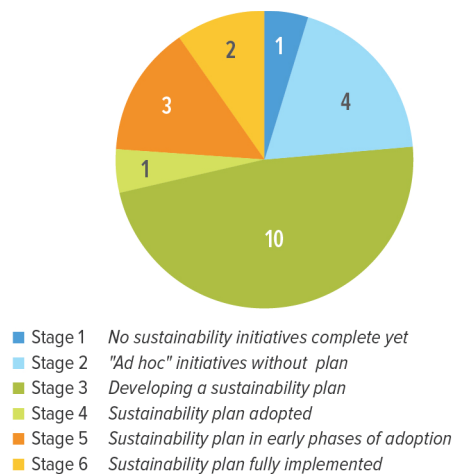


FIGURE 7 Sustainability level (number of airports in study).

BUILDING THE TEAM

For airports that committed to developing and implementing a formal sustainability plan, the design resulted from a collaborative team effort with input from the airport, tenants, sustainability consultants, and FAA. Airports providing information for the case examples agreed that active involvement of stakeholders in the design and implementation of the sustainability program was critical to its success for several reasons. Most importantly, stakeholders such as tenants, employees, and the local community were more willing to embrace the program if they actually helped develop it. Second, no single person or department has a monopoly on good ideas, and soliciting suggestions from a variety of sources helps create a more robust and well-informed product. Indeed, the case examples indicate that numerous staff and various departments can be involved in developing and improving sustainability.

The sustainability plans of 18 respondents resulted from a collaboration of airport personnel and external sustainability experts, whereas 12 airports worked with FAA, and ten collaborated with resident tenants. Nine airports established an advisory committee with representatives from each of the key stakeholder groups. Those airports emphasized the value of establishing the committee at an early stage of program development and encouraged frequent meetings to solicit input and feedback and communicate planning and progress. Seven survey respondents and several airports interviewed for this synthesis, such as Kent State and Ithaca, highly recommended taking advantage of the presence of local colleges and universities to obtain access to research, educate students about aviation, and build good relationships with the community (see Figure 8).

RESOURCES

Airport respondents consulted a wide range of resources for guidance to draft the sustainability plan. Because only five of the surveyed airports (those owned and operated by the city of Phoenix, the Port Authority of New York and New Jersey, and Kent State University) have in-house sustainability or environmental experts, outside sources contributed much of the information that supported program implementation. Respondents used ACRP publications most often, with 19 respondents citing those publications as a resource. Conference presentations are the next most consulted resource, with 16 airport respondents using presentations from conferences organized by ACI-NA, AAAE, and NASAO. Airports indicated that they gathered much information and many helpful ideas while talking with colleagues at these conferences. One interviewed airport stated that, for smaller airports, regional conferences could sometimes be more valuable than attending large, national conferences. Regional conferences require lower travel costs and are more likely to accommodate presenters from medium and small airports that share similar issues and challenges. The FAA Sustainability Planning Lessons Learned was cited by

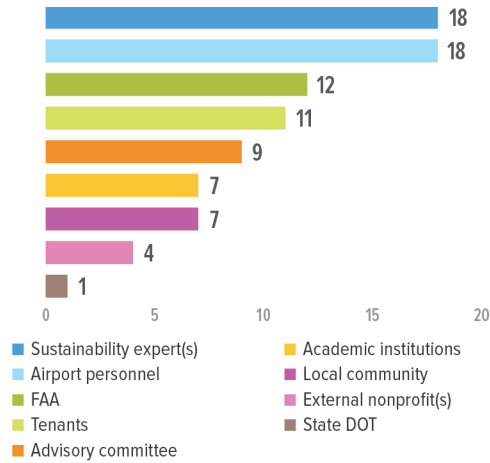


FIGURE 8 Groups contributing to sustainability plan (number of airports in study; multiple responses possible).

14 respondents (FAA 2012). The Sustainable Aviation Guidance Alliance (SAGA 2009) database also proved popular and was cited by 12 respondents as being helpful (see Figure 9).

Airports without a formal plan depended more heavily on conference materials and publications than did airports with a formal program. This difference may be related to smaller staff sizes with less specialization. Several of the airports without formal programs used SAGA tools and in-house experts. One airport without a formal program also relied on the local utility provider. Respondents providing additional comments all stated that they used outside consultants and the consultants' information as resources.

MANAGING THE PROCESS

Sustainability programs require active management for successful implementation, and support from top management is critical to providing resources and building morale. Surveyed airports deploy a range of management methods, demonstrating that no one approach fits all organizational cultures.

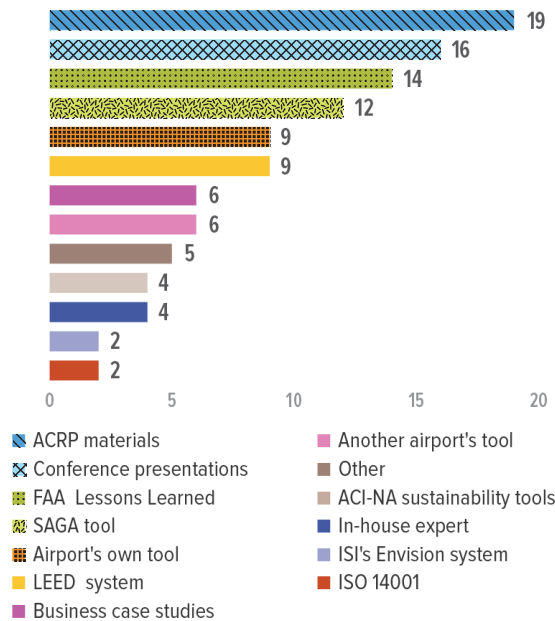


FIGURE 9 Sustainability resources consulted (number of airports in study; multiple responses possible).

Fourteen of the respondents managed the sustainability process through developing and tracking baseline performance indicators, and 12 used a defined list of sustainability categories and a prioritized list of actions. Eleven used a process to track implementation. Eight tracked performance and performance against goals. A lesser number defined stakeholder roles, reported regularly on progress, and linked sustainability with environmental compliance.

Having the right data makes managing easier, and respondent airports used a variety of methods collect data to monitor sustainability program progress and inform decision making. No one method was clearly preferred by the respondents, although monthly reporting on the volume or weight of waste garnered more votes (13 airports) than did any other tracking method, with utility submetering close behind (11 airports). Other tracking methods included establishing a financial record on the return on investment for sustainability initiatives (nine airports) and use of surveys of the community (eight airports), employees (six airports), and tenants (five airports). The survey results revealed that most of the smaller airports do not currently use formal tracking programs such as GRI indicators, the Airport Carbon Accreditation Program, the Energy Star Portfolio Manager, or LEED for Existing Buildings Operations & Maintenance. Several respondents offered sustainability management practices that were not included in the survey, such as reporting quarterly on new initiatives, using software provided by the utility, adopting a storm water pollution prevention plan, and developing a checklist for sustainable construction practices.

For the most part, small airports have airport personnel who track sustainability performance by means of spreadsheets. Spreadsheet functions and layout are customized and determined by each airport. Airports such as Outagamie, which use this method to track energy, water, and waste information, uniformly endorsed it, stating that the time invested is well worth the benefits.

STEPS TO DEVELOPING A SUSTAINABILITY PLAN

The surveys and interviews produced a consensus on suggested steps for developing a sustainability plan:

- Obtain support from either top management or the airport owner/authority
- Inform and engage stakeholders, including employees, tenants, and the community
- Determine priority items, starting with low hanging fruit (quick wins)
- Set a budget and seek funding
- Set clear and achievable goals
- Draft a plan and communicate it to stakeholders
- Track performance, perhaps by entering data into a spreadsheet
- Review performance and revise goals if necessary
- Communicate plan progress to stakeholders
- Manage sustainability as an ongoing process.

CHAPTER FOUR

DRIVERS, AIDS, AND BARRIERS TO SUSTAINABILITY PROGRAMS

The idea of making human activities more sustainable gained traction in the 1980s. During the past 30 years, the concept has grown into a movement widely adopted by both the public and private sectors. Many corporations have adopted sustainability programs and guidelines, and airports are following the trend by adopting sustainable practices. However, any new program usually starts with a driver, which can be one or more persons who want to create change or a combination of internal and external influences. New programs often require implementation assistance or aids of some sort to address implementation barriers. Table 1 summarizes the top drivers, aids, and barriers to designing, adopting, and implementing an airport sustainability program that were identified in the survey.

TOP DRIVERS FOR AIRPORT SUSTAINABILITY

Airports adopt sustainability programs for a number of reasons, and 21 of the respondents listed cost reductions as a top driver. Sustainability-related initiatives, such as energy reduction and enhanced maintenance and waste management, can improve environmental performance and reduce costs. Eighteen of the survey respondents ranked airport management and FAA funding as top drivers (see Figure 10). Several interviewed airports explained that their sustainability efforts originated from an airport director's firm belief that making the airport's operations more sustainable is the right thing to do environmentally, financially, and/or socially. Having a vibrant sustainability program can raise the airport's profile in its community and position the airport as a local and even national leader in environmental, financial, and/or social initiatives. The key role of FAA funding in sustainability initiatives at some airports was clear from the survey results and was validated during follow-up interviews.

In several cases, the airports followed directives from their governing bodies to adopt a sustainability program or followed the program of the governing body. Sixteen respondents listed community relations as a top driver, 13 pointed to environmental compliance, and 11 believed that sustainability initiatives offered revenue generation opportunities. The survey results precisely mirror the three main pillars of sustainability programs—people, profit, and planet—when cost reductions and revenue generation are added to environmental compliance and community relations.

Only seven respondents stated industry or global trends, tenant interest, or local officials were real drivers. This finding suggests that an airport's internal and local motives are a larger factor in advancing sustainability than are popular trends and other larger-scale influences.

The Sustainable Aviation Resource Guide: Planning, Implementing and Maintaining a Sustainability Program at Airports (2009) lists potential drivers for adoption of sustainable practices by airports:

- New federal, state, and local directives
- Management belief in doing the right thing
- Worldwide awareness and a global economy
- Airline industry financial pressures
- Rising energy costs
- Green and environmental mandates
- Resource conservation
- Aging infrastructure
- Facility life-cycle costs
- Enabling technologies.

TABLE 1
TOP 5 AIRPORT SUSTAINABILITY DRIVERS, AIDS, AND BARRIERS

Top 5 Drivers	Top 5 Aids	Top 5 Barriers
<ul style="list-style-type: none"> ■ Cost reductions ■ FAA funding availability ■ Management support ■ Community relations ■ Environmental compliance 	<ul style="list-style-type: none"> ■ FAA and other funding ■ Management support ■ Tools for tracking resource use and cost/benefit ■ Stakeholder support ■ ACRP publications 	<ul style="list-style-type: none"> ■ High cost; lack of funding ■ Limited staff availability ■ Lack of operational control ■ Lack of data on resource use ■ Entrenched culture

TOP AIDS FOR AIRPORT SUSTAINABILITY

The survey asked airports to list and prioritize three factors that aided sustainability program design and implementation. Table 2 divides the responses into three parts, with cross-functional aids to both planning and implementation listed first, followed by aids to the planning process and then aids to the implementation process.

The list of cross-functional aids to both planning and implementation includes social aspects of sustainability, in that support of executive management, local and federal government, the community, tenants, and employees were all deemed important to starting and growing the program. In the planning stages, data, analyses, and consultants helped to provide a foundation for building a sustainability platform. Once a sustainability plan has been drafted, its implementation is assisted by a variety of factors, such as funding, training, analytic tools, employee engagement, and internal communications.

In the survey, the respondents were asked to list aids according to their importance to the airport’s sustainability efforts, and although the indicated priorities are not reflected in Table 2, a review of the

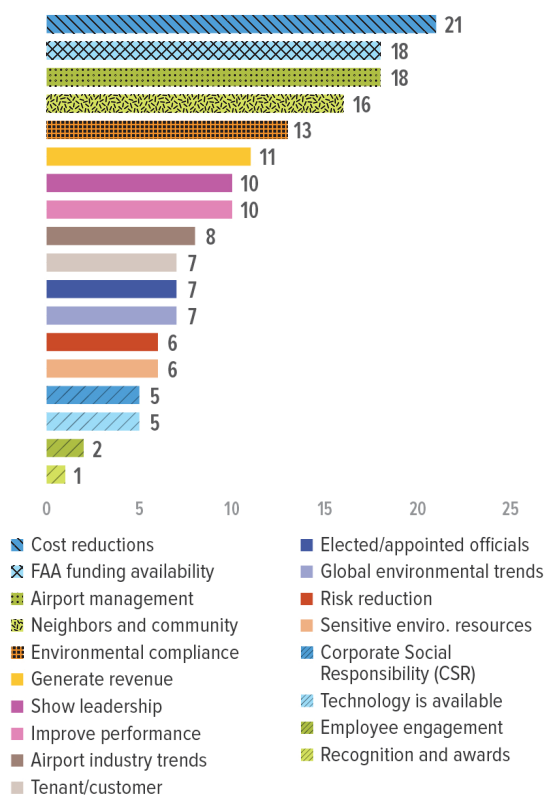


FIGURE 10 Top five drivers for airport sustainability (number of airports in study; multiple responses possible).

TABLE 2
AIRPORT SUSTAINABILITY AIDS

Cross-functional Planning and Implementation Aids	Planning Aids	Implementation Aids
<ul style="list-style-type: none"> ■ Board, CEO, and management support ■ State funding ■ ACRP publications ■ Community support ■ Momentum within the organization ■ SAGA website and database ■ ACI-NA resources ■ Messaging and corporate culture changes ■ Outreach and education ■ FAA regional staff ■ Support of the elected airport officials to fund efforts ■ Tenant support 	<ul style="list-style-type: none"> ■ Public demands ■ Consultant team that developed plan and tools ■ City/county planning and efforts, including lighting upgrades to LED ■ Evaluating total cost of ownership, especially maintenance cost savings ■ Cost/benefit analyses ■ Data from audits 	<ul style="list-style-type: none"> ■ Engineering/design staff training ■ FAA AIP funding ■ Utility incentives and rebates ■ Carbon dioxide and return on investment measurement tool ■ Benefits from installing solar panels on terminal roof ■ Demonstrating pavement recycling cost savings ■ Land management spreadsheet tool ■ Benefits from installation of new solar isolation meters ■ Staff willingness to go the extra mile ■ Improved internal communications

top aids mentioned by the respondents highlights the diversity of views and approaches to sustainability at the airports. Some airports ranked outreach, education, improved internal communications, and organizational and community support as the most significant aids, all of which could be viewed as relating to the social component of sustainability. Others noted that financial support in the form of federal and state funding and incentives from utilities was most important. As mentioned, nearly three-quarters of the airports receiving federal funds for their sustainability plans stated that the plan would not have been possible without FAA AIP funding. Other financial components that were noted included data produced by audits, cost-benefit analyses, and tools for tracking CO₂, costs, and return on investments.

Secondary aids consisted of some social components, such as internal training programs and community support. Financial factors appeared again, such as measuring program effectiveness, evaluating costs of sustainability initiatives, determining reductions of maintenance costs, and installing metering capability. The secondary aids mentioned tools and resources available in the industry through organizations such as ACI-NA, the SAGA website and database, and consultants. A third tier of aids addressed the social aspects of sustainability—support of local officials, tenants and FAA regional staff, and changes in organizational culture.

TOP BARRIERS FOR AIRPORT SUSTAINABILITY

The survey similarly asked airports to list and prioritize the barriers they had encountered in designing and implementing sustainability measures or a sustainability program. Table 3 follows the same pattern as the presentation of aids, with barriers to both planning and implementation listed first, followed by barriers to the planning process, and then barriers to the implementation process.

By a wide margin, the respondents indicated that availability of financial resources was the primary barrier to both the planning and implementation stages of a sustainability program, with the cost of the initiatives and lack of funding cited most often. However, social aspects were also barriers to planning and implementation, through competing priorities, lack of buy-in from management and/or employees, and lack of cooperation, interest, and awareness. In the planning stages, airports faced barriers through lack of data and information, lack of engagement, and lack of resources. Grandfathered leases and

TABLE 3
AIRPORT SUSTAINABILITY BARRIERS

Barriers to Both Planning and Implementation	Planning Barriers	Implementation Barriers
<ul style="list-style-type: none"> ■ Cost (listed 8 times overall) ■ Funding (listed 7 times overall) ■ Staffing resources (listed 7 times overall) ■ Airport priorities ■ Recent economic downturn ■ Midmanagement buy-in ■ Obtaining cultural buy-in ■ Lack of data, such as information on utility use ■ Lack of interdepartmental cooperation ■ Lack of sustainability awareness throughout organization ■ Lack of interest 	<ul style="list-style-type: none"> ■ Lack of initiative or direction ■ Cultural inertia blocks proactive measures ■ Resource availability ■ Lack of cost/benefit analysis ■ Willingness of employees ■ Lack of common goals between airport users ■ Grandfathered lease agreements ■ Limited scope of VALE program (needs to include attainment areas) ■ Priority of infrastructure needs 	<ul style="list-style-type: none"> ■ Changing old habits ■ Lack of time/mental bandwidth to report progress on goals/strategies ■ Inconvenience ■ Education/training on sustainability ■ Competition between business partners ■ Limited scope of federal AIP program (needs more sustainability focus) ■ Procurement law ■ Lack of solar isolation meters to determine initiative payoff ■ County procurement policies ■ High requirements for return on investment ■ Lack of operational control ■ Limited capacity of renewable energy generation

competing priorities also hindered planning. Once the plan has been developed, its implementation can be slowed or stopped by a wide variety of impediments, such as old habits, lack of available time, limited education and training, lack of operational control and inadequate capacity of renewable energy resources, constrained financial resources, and procurement processes and laws.

The respondents were asked to indicate whether the barriers they faced in planning and implementing sustainability initiatives were primary, secondary, or tertiary. Table 3 does not present those priorities, but not surprisingly, the primary financial barriers respondents mentioned were the high rate of return required for sustainability programs and staffing resources. Previous ACRP findings identified lack of management support as a barrier (Berry et al. 2008; Thomson and Delaney 2014), but for small airports with fewer staff and resources, lack of management support was not listed as a barrier. Perhaps in smaller airports with low staff numbers, no new initiative can progress without support from management. Other primary barriers included a lack of data, lack of operational and procurement control, and lack of a supportive organizational culture.

Secondary barriers cited by the respondents spanned a wide spectrum of issues. Internal organizational dynamics were cited, including a lack of sustainability awareness, a lack of support from management and employees, and limited staffing. Different types of inadequate supporting infrastructure were also noted as secondary barriers, such as lack of cost-benefit analyses of initiatives, nonalignment of goals with tenants and other users, grandfathered leases, and competing priorities. Secondary restrictions included limited capacity of renewable energy resources and an absence of submeters. Two financial barriers mentioned were the eligibility requirements for VALE and AIP grants.

In addition to primary and secondary barriers, survey respondents noted other barriers they have encountered. Some were financial, such as the recent economic downturn, and some were social, such as a culture of putting out fires (also known as “airport whack-a-mole”), lack of interdepartmental cooperation, apathy, and inadequate sustainability training. Procurement procedures and competition between business partners were listed as barriers to implementing sustainability initiatives. One airport noted that its procurement procedures were especially burdensome barriers because all procurement requests go through the city that owns the airport, and the contract generally is awarded to the lowest bidder, regardless of the vendor’s airport experience or product/service quality.

CHAPTER FIVE

EONS COMPONENTS

Because the airport industry has adopted an EONS approach to sustainability, this chapter of the synthesis discusses each of the four components of EONS—Economic viability, Operational excellence, Natural resource conservation, and Social responsibility—and includes relevant findings from the case example interviews.

In many cases, a single initiative can affect more than one EONS component. For example, implementing an initiative that increases energy efficiency, such as installing LED lighting, has an economic impact through lower utility bills and an environmental impact through a reduced demand for electricity from the local power plant. Similarly, an initiative to streamline ground traffic has an economic impact through fuel savings, an operational impact through more efficient surface transportation, an environmental impact through less exhaust and better air quality, and a social impact through reduced wait time. Many of the initiatives cited here produce benefits in more than one of the EONS components, but for ease of reference they are discussed in the context of one category.

ECONOMIC VIABILITY

Unless an airport can ensure its economic viability, either through its own resources or through its governing body, the airport will cease to exist. Economic viability is a fundamental operational requirement underlying all aspects of sustainability. Airports can enhance economic viability in several ways, including through increased revenue generation, decreased costs, and long-term investment in projects with a return on capital expenditure. Without access to passenger facility charges (PFC) that accrue to airports offering commercial service, smaller airports must generate revenue in other ways, including fuel sales, government grants, and facility and land leases. Financial pressures force airports to consider carefully which projects to prioritize or pursue. Despite the critical role played by financial concerns, the vast majority of surveyed airports did not require a defined minimum return on investment or minimum cost savings when implementing sustainability initiatives.

Many of the early projects can involve replacing older, less sustainable infrastructure and equipment, although those projects require a capital outlay. Recycling programs can reap financial rewards through sale of the recyclable material, but an airport must still invest cash in obtaining proper bins and visible signage. Often, expert consultants must be retained to design and draft a sustainability management or master plan, although some airports stated that expert consultants actually saved them staff and financial resources by providing direction on where to focus efforts.

Survey Findings

Several of the surveyed airports have installed LED lighting to reduce energy costs, and 20 airports viewed a recycling program as a viable no-cost or low-cost initiative that could enhance their sustainability profile (see Figure 11). In some locations, specific waste materials with a market value (e.g., metals, mixed paper, and cardboard) can be sold to a recycling service provider to generate revenue. One airport collaborates with a local wastewater treatment plant, receiving payment from the plant to take biosolids that are then used as fertilizer for an airport property farm; this arrangement reduces emissions that would have been produced from transporting the biosolids and diverts the material from landfill. A full list of airport no-cost and low-cost suggestions provided in the survey is presented in a table within Appendix A.

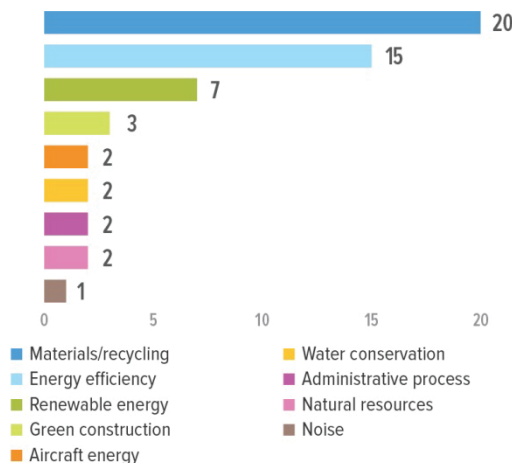


FIGURE 11 Types of no-cost or low-cost initiatives (number of airports in study; multiple responses possible).

As stated, alternate sources of financial support for sustainability initiatives are available. Utilities offer rebates, energy audits, and purchase agreements for renewable energy, and state and local entities provide subsidies for energy efficiency projects and electric vehicle charging stations (see Figure 4).

Case Example Insights

During the interview for this synthesis, Huntington Tri-State (HTS) stated that having a sustainability master plan contributes to an airport’s economic viability by safeguarding the public’s investment in the airport and allowing the airport to focus on cutting costs. Teterboro and Stewart (TEB/SWF) agreed that sustainability can be viewed both as a tool to achieve better bottom line results and as a revenue driver because having a sustainability plan helps airports to think strategically and ultimately serve customers more effectively. However, according to Redmond (RDM), in the event of

Lowering Mowing Costs

Renton (RNT) was able to reduce the cost of maintaining its landscape by replacing an existing mower with a faster and more fuel-efficient alternative. Conserving resources often involves extending the functional life of current airport assets. However, in cases in which the existing equipment generates a staff time burden that can be reduced with current products on the market, the investment in replacement equipment may make sense. Effective economic sustainability requires factoring in the total costs, including labor. In the case of mowers, there are additional benefits from fuel savings and air quality enhancement. Older mowers produce more emissions on a per mile basis than do cars, and replacing inefficient models can help improve local air quality.



a conflict between sustainability initiatives and financial responsibilities such as maintenance, the airport's financial responsibilities must take priority.

Operational activities that are viewed as no cost or low cost can yield environmental performance benefits and are a reasonable place to begin sustainability efforts. Some airports question the premise that any initiative could be no cost or low cost because projects require commitment of human resources and often funding as well. For this reason, Ithaca (ITH) advised that, although initiatives must make financial sense, airports should avoid dismissing a sustainable alternative simply because the up-front costs may appear a little higher than expected. Nantucket (ACK) was able to take advantage of zero percentage on-bill financing for its energy efficiency improvements. With zero percentage on-bill financing, the customer borrows funds from the utility to finance energy efficiency improvements and repays the loan as part of its utility bill. This mechanism is available in certain states, and in some cases the reduction in energy use must be at least equivalent to the loan payment. Goodyear and Deer Valley (GYR/DVT) recommended that to gain greater acceptance and involvement for sustainability initiatives, it is important that financial savings be demonstrated before, during, and after implementation.

With respect to enhancing revenue, Kent State (IG3) serves as a good example of an airport that has become financially self-sustaining by seeking revenue streams in a variety of places. The airport sells fuel for its primary revenue stream, but it also leases unneeded space, provides aircraft washing, runs a bookstore, and collects rent from Kent State University for flight training.

OPERATIONAL EFFICIENCY

Airports exist to serve air travel and thus house a wide variety of related operations, from aircraft and vehicle movements to building construction and maintenance. Sustainability measures that are well integrated with airside and/or facility operations have the greatest opportunity to succeed. Cross-functional collaboration is often essential and may require cultural shifts to implement sustainability priorities. Operational efficiency can take many forms, and smaller airports are especially keen to implement projects that increase their operational efficiency because such measures often translate directly into bottom-line savings.

Survey Findings

Within the survey, operational efficiency actions relate in some way to energy or climate resiliency. To limit the length of the survey, actions that may reduce staff and resource demands, such as consolidating facilities, were not included.

The responses showed clear preferences for operational initiatives that support sustainability efforts. Every one of the 27 respondents to the question stated that they had installed LED lighting. Twenty-two reported that they had pursued improved energy controls or routine operational improvements, which can take the form of smart meters, motion-sensitive lighting and higher or lower temperature settings. Twenty of the respondents installed energy-efficient upgrades to their heating, ventilation, and air conditioning (HVAC) systems, 10 took measures to reduce emissions from on-ground aircraft, and nine conducted greenhouse gas inventories. The survey results suggest that energy use reduction has been widely integrated within operations (see Figure 12).

Another initiative included replacing a small infield mower with a larger mower to reduce fuel consumption and staff time spent mowing. One airport built a cogeneration power plant that makes electricity from natural gas and provides 90% of all power for the terminals and parking structures. The plant is energy efficient because it uses waste heat from lean-burn engines to make chilled water for air conditioning for the terminals.

Other respondents modeled building energy use, acquired electric or alternative fuel vehicles, retro-commissioned equipment, installed solar panels, and insulated buildings.

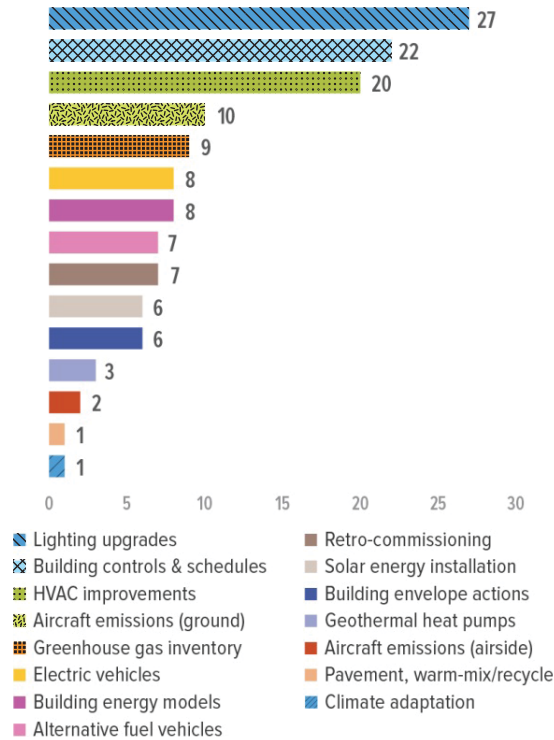


FIGURE 12 Energy and climate actions (number of airports in study; multiple responses possible).

Nantucket Carbon Neutrality

Nantucket (ACK) is currently on Phase 2 of a carbon neutral project that includes a broad range of energy efficiency actions. Detailed energy audits have revealed opportunities to reduce electricity consumed by appliances and equipment “plug-load,” as well as detailed energy modeling of airport buildings. The indoor plug load audit provided a formal process to objectively assess every item at the airport that may otherwise keep drawing electrical energy, such as outdated IT equipment, without an intentional process to determine if the function was necessary. Mechanical system audits revealed a design deficiency in the terminal that required a supplemental propane heat source as a result of an historic building renovation project. Establishing a formal assessment for energy conservation measures revealed potential cost-effective actions for ACK.



Case Example Insights

In the interview for its case example, Buffalo (BUF) staff explained how the airport found synergy between one of its sustainability initiatives and operational improvement. Surface transportation was recognized as a major focus area for the airport. By installing an overpass for flyovers to improve the circulator load system around the airport property, airport traffic is reduced and the carbon footprint is lowered. In addition, construction of a high-speed turn-off will save fuel and reduce taxi time, as will installation of a parallel taxiway near the FBO.

Outagamie (ATW) was prompted by rising utility costs and a volatile air service industry to champion sustainability initiatives and reduce energy usage in the passenger terminal and other buildings. A building energy assessment led to numerous changes, including the addition of a 50-kW photovoltaic array and a 12-panel solar thermal system on the airport terminal, removal of high-energy-use equipment, and installation of energy-efficient lighting and room occupancy sensors.

Prioritizing Airport Operational Efficiency

Because operations are at the heart of an airport's activities, the airport community identified operational efficiency within the EONS framework to refine the conventional sustainability "triple bottom line" focus. Airports have direct control of infrastructure operations and have an ability to influence airside operations. Well-run facilities cost less to operate and maintain, and efficient management of aircraft on the ground lowers costs for operators. In addition, managing both areas of operations effectively provides sustainability benefits. The following are two key examples that profile operational efficiency within airport sustainability plans.

Airside Operational Efficiency

Teterboro Airport (TEB) advances multiple efficiency initiatives for aircraft operations. TEB coordinates with the FAA on a number of initiatives that include reducing existing approach distances, establishing "automatic" aircraft releases so that pilots can save fuel by delaying engine start until scheduled time, and adopting NextGen air traffic technologies, such as direct descent. All three of the TEB operational efficiency initiatives make the airport more attractive to operators, save money, and reduce emissions. In addition, TEB is improving the aircraft taxiway, holding areas, and surface transportation network to increase efficiency and enhance airport safety.

Facility Operational Efficiency

Renton Airport (RNT) prioritizes operational efficiency for its existing facilities. The RNT sustainability plan identifies tracking monthly utility charges to manage the airport's consumption of energy, water, and other resources. RNT has adopted an initiative to partner with energy firms to maximize potential revenue generation on land that was not producing revenue benefits to offset airport operational costs and reduce fossil fuel energy consumption. As a way of broadening the analysis of operational decisions, RNT is launching an initiative to make investment decisions based on the total cost of ownership. All three facility operational efficiencies enhance RNT's sustainability performance.

NATURAL RESOURCE CONSERVATION

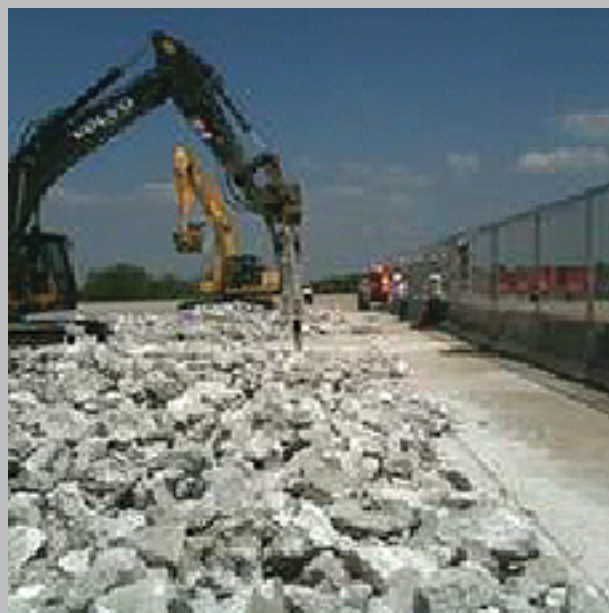
Many people associate the term "sustainability" with environmental protection, so it is not surprising that the surveyed airports had implemented measures focused on the environment and natural resource conservation. The surveyed airports reported a wide variety of environmentally oriented sustainability priorities, with a few initiatives adopted most frequently. In an effort to condense survey content, some actions that are not typically labeled as "natural resources" were included within this category, such as green buildings, green procurement, and environmental management systems (EMSs).

Survey Findings

Twenty-five of the respondents took measures to reduce waste, which in many cases probably included recycling. A significant majority of respondents addressed water, with 20 reducing consumption to conserve water and 19 implementing storm water management to enhance local water quality. Given that noise from aircraft may be the most enduring environmental issue in aviation, it is not surprising that

Protecting Endangered Species from Runoff

When Northwest Arkansas Regional Airport (XNA) was built in the late 1990s, an environmental impact study revealed the presence of blind Ozark cavefish in the airport rainfall discharge area. The Ozark cavefish has been on the U.S. List of Endangered and Threatened Wildlife and Plants since 1984, so the airport had to find a way to protect the creature's habitat. The resulting design combined beauty and functionality while creating other types of habitat. The first half inch of rain is collected from the pavement after each shower or significant event and diverted to ditches with liners or concrete swales. The overflow ditches are lined with riprap composed of repurposed ramp pavement that was removed for construction of a concourse. The riprap prevents particles from infiltrating and having an impact on the blind cavefish habitat. All runoff is then stored in three retaining ponds and overflow areas. Water is held until testing reveals that it is safe.



18 of the surveyed airports reported having active noise management programs. No other environmental initiatives received a majority of votes in the survey, although airports did engage in managing air quality, conserving biodiversity, ensuring appropriate land use, and procuring environmentally friendly products. A few pursued green building certification and formal environmental management systems (see Figure 13). One respondent commented that ad hoc initiatives are often not perceived as sustainability efforts, even though they clearly function within a sustainability program: “Implementing the ‘stormwater program’ or the ‘air quality’ initiatives makes more sense to the staff, than putting it under the ‘sustainability umbrella.’ Everything we do is for sustainability; if not, we wouldn’t be in business.”

Case Example Insights

As stated in the previous section, the high cost of energy consumption can lead to adoption of operational behaviors that have environmental benefits. In some instances, the environmental component of sustainability can place pressure on the airport from the local community or the governing body. For example, 1G3 is owned by Kent State University, and environmentally conscious students prompted the university, and therefore the airport, to adopt and implement a sustainability program. In other cases, the airport can become a leader in conserving natural resources. As described in the case examples in the next chapter, Portland (PWM) took an imaginative and aggressive approach to manage deicing fluid, and the resulting process protects water quality and serves as a revenue source through recycling of the fluid for others.

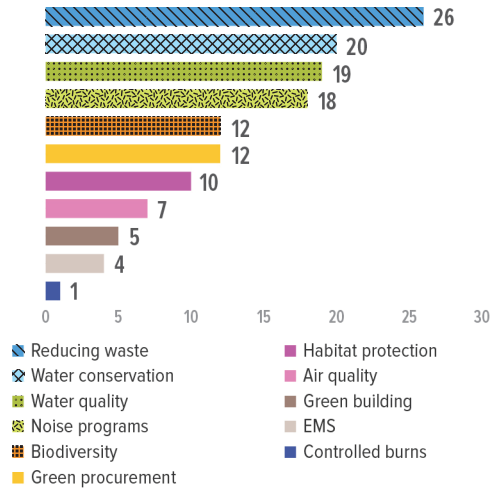


FIGURE 13 Natural resource actions (number of airports in study; multiple responses possible).

SOCIAL RESPONSIBILITY

By the essence of their operation and function, airports function in a social setting. Airports exist to host and facilitate movement of people and of the goods that people need, providing a vital link between local communities and distant locations. Through these and other activities, airports gather various communities of people for pleasure and commerce and thus serve as a forum in which employees, tenants, aircraft owners, operators, passengers, service providers, and others can interact socially. In addition, airports support social networks by providing jobs that supply income to local citizens and families and making purchases that bolster local businesses. In return, airports benefit from actions that foster effective social engagement within the airport and with the surrounding community. Social practices may offer a promising area of sustainability initiatives for smaller airports. Many social practices can have little or no costs or can be part of standard effective human resource management, such as providing volunteers for local charities, allowing a greater work-life balance for employees (e.g., flexible hours), and offering airport facilities for community activities.

Survey Findings

When asked about the social component of their sustainability programs, the surveyed airports gave a wide variety of responses, with only community contributions such as volunteerism featuring in a majority of practices (15 of 28). Fourteen airports had adopted initiatives to enhance employee well-being, such as health and wellness programs, and an equal number also tried to increase comfort for employees, passengers, and tenants through indoor environmental quality practices, such as better light, ventilation, and temperature management. Twelve of the respondents instituted equal opportunity programs, 11 provided sustainability training for staff, and ten assisted career development and improved accessibility to the airport for disabled and/or elderly stakeholders. Eight respondents had programs to ensure staff retention. Note that nearly all of the social responsibility initiatives required little to no financial investment, although the allocation of staff time represents an investment of valuable human capital and resources as an organizational priority (see Figure 14).

Case Example Insights

Another critical aspect of an airport’s social responsibility is maintaining a good relationship with its stakeholders, which include the customers, passengers, tenants, employees, governing body, and community. Nearly all interviewed airports emphasized the importance of involving stakeholders in every stage of a sustainability plan and program, from early design to active implementation to continuous improvement. Some, such as Huntington Tri-State (HTS), developed an advisory task force

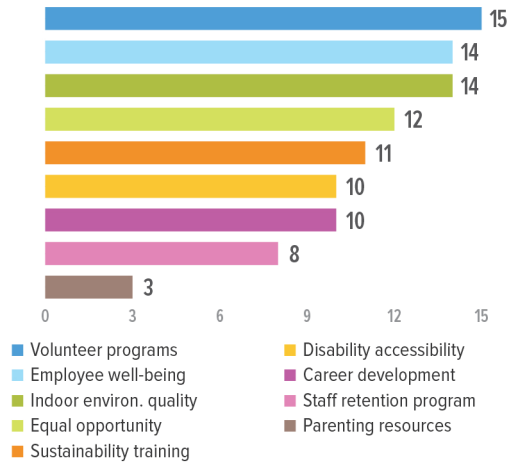


FIGURE 14 Social responsibility actions (number of airports in study; multiple responses possible).

composed of the local universities, city and county officials, and all airport tenants; the task force contributed ideas and generated buy-in from stakeholders. Ithaca (ITH) invested time in educating the applicable stakeholders to gain the support of the local community and the governing legislative body. In an effort to enhance passenger experience and gain support from that stakeholder, Northwest Arkansas (XNA) introduced floor games and a meditation/yoga room in the terminal. The social aspect can also be a negative force for adoption of sustainability initiatives. Entrenched behaviors and cultural resistance can inhibit adoption of simple actions, such as turning out lights in unoccupied rooms and recycling office waste.

DVT and GYR Training the Next Generation

DVT and GYR offer a robust program to introduce aviation and airport careers to local colleges and universities. The airports work with Phoenix Sky Harbor to partner with the local institutions and recruit students who take aviation classes and provide the opportunity for students to learn firsthand what it takes to run an airport. This partnership enhances connections with the local community and region by providing this direct experience. It also serves to develop the next generation of airport employees and expose airport jobs to a group of students who might not otherwise consider careers in aviation.



CHAPTER SIX

CASE EXAMPLES

To supplement the results obtained through the web-based survey, interviews with personnel from a dozen airports were conducted during the summer of 2014, with each interview lasting at least an hour. The airport personnel were extremely generous with their time and knowledge, giving deeper insights into the drivers, aids, and barriers encountered when designing and implementing sustainability initiatives and programs at smaller airports. The airports that granted interviews are listed in Table 4, and the interviews are summarized in the case examples presented. All of the case examples followed a similar format, providing information in each of the following categories: special circumstances, drivers, definition of sustainability, airport sustainability planning, aids/barriers to implementation, major focus areas and sample initiatives, and lessons learned and sage advice. In each case, additional information was provided with respect to a particular topic, called the case example focus; those topics are noted in Table 4.

**CASE EXAMPLE 1: BUFFALO NIAGARA INTERNATIONAL AIRPORT
AND NIAGARA FALLS INTERNATIONAL AIRPORT, NEW YORK**



Special Circumstances

The Niagara Frontier Transportation Authority (NFTA), which is a public benefit corporation, owns Buffalo Niagara International Airport (BUF), Niagara Falls International Airport (IAG), and all public busing and light rail rapid transit in Buffalo. Having one entity control both air and surface transportation provides synergies in planning, funding, and implementation. IAG is owned jointly by NFTA and the United States Air Force Reserve.

Drivers

NFTA is beginning a systemwide sustainability program and will draw on the experience of BUF and IAG.

Definition of Sustainability

Sustainability projects and programs have to be practical while addressing economic, social, and environmental issues.

Airport Sustainability Planning

Both airports had sustainability master plans and wanted to update them through the mechanism of overall master plans. The master plan for BUF was completed in 2013, and the IAG master plan is set for completion by the end of 2015. Master plan projects will be established under the 5-year capital improvement plan (CIP), and sustainability will be integrated at both airports on a project-by-project basis within the 5-year CIP. Every new project will weigh sustainability and National Environmental Policy Act impacts, and airport sustainability projects will be folded into the NFTA umbrella sustainability plan. The BUF plan was funded by a combination of FAA entitlement funds,

TABLE 4
AIRPORT SUSTAINABILITY CASE EXAMPLE LIST

	Airport	Case Example Focus
1	Buffalo Niagara International Airport (BUF) and Niagara Falls International Airport (IAG), New York	Identifying capital and diverse funding sources
2	Deer Valley Airport (DVT) and Goodyear Airport (GYR), Arizona	Leveraging resources from large hub airport
3	Huntington Tri-State Airport (HTS), West Virginia	Building comprehensive program from ad hoc roots
4	Ithaca Tompkins Regional Airport (ITH), New York	Harnessing the power of a sustainability champion
5	Kent State University Airport (IG3), Ohio	Ensuring airport viability with effective noise control
6	Nantucket Memorial Airport (ACK), Massachusetts	Pioneering carbon neutrality
7	Northwest Arkansas Regional Airport (XNA), Arkansas	Generating clear objectives and focus areas
8	Outagamie County Regional Airport (ATW), Wisconsin	Advancing energy-efficient building
9	Portland International Jetport (PWM), Maine	Pursuing deicing excellence
10	Renton Municipal Airport (RNT), Washington	Integrating sustainability plans with construction
11	Roberts Field, Redmond Municipal Airport (RDM), Oregon	Delivering sustainability linked to customer service
12	Teterboro Airport (TEB) and Stewart International Airport (SWF), New Jersey and New York	Enhancing strategic use of reliever airports

New York State Department of Transportation, and NFTA allocation of PFCs. The IAG plan was funded by local (NFTA/PFCs and Bridge Commission) monies, the Empire State Development, New York State Department of Transportation support, and a small portion of FAA AIP funds. Neither BUF nor IAG participated in FAA pilot sustainability programs.

Aids/Barriers to Implementation

Aids—Access to federal, state, and local funding. Having an airport planner who is passionate about sustainability. Being part of a larger entity (NFTA) that is implementing sustainability measures.

Barriers—Having bills for energy and water sent to a central office and paid by NFTA staff and not airport staff makes tracking of usage difficult.

Major Focus Areas and Sample Initiatives—Reducing Carbon Footprint and Managing Surface Transportation

Surface transportation is a major focus area.

Initiatives:

- Reconfiguration of the circulator load system around BUF by installing an overpass for fly-overs, thus reducing airport traffic and lowering the carbon footprint.

- Construction of a high-speed turn-off to save fuel and reduce taxi time.
- Installation of a parallel taxiway near the FBO to enhance safety and shorten taxi time.

Lessons Learned and Sage Advice

- Have someone in airport leadership take ownership of sustainability.
- Build sustainability into the master planning process.
- Involve tenants and the local community by conducting workshops on the sustainability program.
- Enlist the local colleges and universities to get ideas on sustainability projects.
- Be aware that the community may be more interested in cheap flights than in environmental issues, and ultimately the airlines care most about efficient operations.
- To support tracking of utilities, meter tenants individually where possible.
- Consider that some projects, such as surface transportation improvements, can benefit both the sustainability program and the daily operations.

Case Example Focus—Identifying Capital and Diverse Funding Sources

BUF and IAG provide good examples of how airports can be creative in finding funding for sustainability programs. At IAG, development of the master plan, including the consulting contract, cost approximately \$1.5 million and was funded by a combination of the Empire State Development (which covered the bulk of the cost), FAA AIP, and the local bridge commission. However, the Empire State Development pays only upon completion of a project, so the airport self-funded nearly a million dollars and then sought reimbursement. The FAA provided additional funds for administrative purposes. The BUF master plan was funded through a different allocation: 75% of the funds were from AIP, 12.5% from Empire State Development, and 12.5% were sourced locally and through NFTA.

CASE EXAMPLE 2: DEER VALLEY AIRPORT AND GOODYEAR AIRPORT, ARIZONA



Special Circumstances

Goodyear (GYR) and Deer Valley (DVT) airports are owned and operated by Phoenix Sky Harbor International Airport (PHX), which allows the smaller, reliever airports to have access to sustainability experience and dedicated staff resources from PHX. DVT is one of the busiest general aviation airports in the United States, with more than 350,000 aircraft operations a year. GYR has more than 120,000 aircraft operations annually and is the home of the Lufthansa Flight Training Center and an aircraft maintenance, repair, and overhaul facility.

Drivers

The city of Phoenix adopted requirements that all new buildings use LEED standards and has goals of a 20% energy reduction for the period 2009 to 2020; a reduction of 15% by 2015 of the 2005 levels of greenhouse gas emissions; and a 50% waste stream diversion by 2020.

Definition of Sustainability

The city of Phoenix Aviation Department is committed to incorporating sustainability principles and practices into our operational, management, and administrative processes. Our vision is to have an informed workforce and engaged business partners that deliver a well-planned, accessible, and world class airport experience for our customers. Further, we demonstrate our environmental responsibility to our community as we strive to enhance local, regional, and national economic benefits from the Phoenix airports.

Airport Sustainability Planning

Sustainability planning at PHX and its airports began as part of the strategic plan, which lists sustainability as one pillar for its vision. Recently, Phoenix airports have been developing a self-funded sustainability management plan.

Aids/Barriers to Implementation

Aids—Staff involvement and training. City requirements for LEED certification for buildings and energy conservation.

Barriers—Money. Staff time. Entrenched practices. Tendency for resources to go to larger airport (PHX).

Major Focus Areas and Sample Initiatives—Recycling and Resource Conservation

Initiatives:

- Extensive use of recycled asphalt for new pavement projects.
- Installation of LED lights.
- Expansion of recycling program.
- Energy and water conservation.
- Storm water management, including a quarterly newsletter for most effective management practices and tenant communication.
- Tracking of costs (including tipping fees) and savings from recycling programs.

Lessons Learned and Sage Advice

- Get staff and tenants involved to increase ideas and enhance implementation.
- To save time, effort, and money, include sustainability planning from the beginning of a project so that facilities, operations, and maintenance are aware and can contribute ideas.
- For smaller airports, it is important that sustainability initiatives be easy to implement.
- Recycling and energy reduction are low-cost, low-hanging fruit.
- Smaller airports can take advantage of resources from the larger airport.
- Use experts from consulting firms to help design the sustainability initiatives and plan implementation.
- Even if tenants cannot be separately billed for energy use, have discussions with them to raise awareness and consider submetering to track usage.
- To gain greater acceptance and involvement for sustainability initiatives, demonstrate the financial savings before, during, and after implementation.

Case Example Focus—Leveraging Resources from a Large Hub Airport

The city of Phoenix Aviation Department uses USGBC LEED standards for building design and construction and in 2010 developed an engineering design and construction guide for nonbuilding “horizontal” projects, such as pavements. This *Design and Construction Green Guide* includes life-cycle cost analysis tools that are used for these projects. Engineering staff at PHX are trained in LEED (six are accredited) and the *Design and Construction Green Guide*, and therefore they engineer the projects at the DVT and GYR reliever airports using these standards. Likewise, maintenance staff from PHX sent to perform work at the two airports are aware of opportunities for energy conservation. It is important for these subject matter experts to be available and use the same approaches and procedures for the general aviation airports as they do at PHX.

During the recent development of the sustainability management plan, the managers of DVT and GYR and their staff were involved during interviews of current initiatives, in the review of tenant

interest surveys, and in discussions of “next steps” for their current sustainability programs. This collaboration clearly brought into focus that the staff and users at DVT and GYR are ready for more robust sustainability programs at their airports.

CASE EXAMPLE 3: HUNTINGTON TRI-STATE AIRPORT, WEST VIRGINIA



Special Circumstances

The airport staff and police and fire departments share the same facilities at Huntington Tri-State Airport (HTS). Altogether, the three services employ 64 people—26 full-time and 38 part-time staff.

Drivers

The airport director believed that a sustainability program would encourage the airport to be a proper steward of the planet, the community, and the airport.

Definition of Sustainability

Sustainability is about people, the environment, and economic viability. The Sustainability Master Plan (SMP) will safeguard the public’s investment in the airport and allow the airport to focus on cutting costs and not just on boosting revenue.

Airport Sustainability Planning

Although discussions and ad hoc sustainability initiatives inspired by research and periodicals began in 2011, the sustainability program was started formally in 2013 with the receipt of AIP and state funding. Ad hoc initiatives included an energy assessment and policies on paper use and paper and waste recycling. By contrast, the SMP provides a more comprehensive, organized strategy. The SMP follows and is the companion document to the airport master plan, both of which have 20-year goals and objectives. SMP focus areas include social process, natural resources, carbon footprint, energy efficiency, operating costs, passenger experience, and the local and regional economies.

Aids/Barriers to Implementation

Aids—FAA AIP funding for 90% of the sustainability program and state funding for the remaining 10%, which paid for both the energy assessment and design of the SMP. The advisory task force, which was composed of the local universities, city and county officials, and all airport tenants; the task force contributed ideas and generated buy-in from stakeholders.

Barriers—Cultural resistance to changing habits regarding energy use, recycling, and other activities with environmental impacts.

Major Focus Areas and Sample Initiatives—Resource Conservation and Stakeholder Involvement

Major focus areas: energy, waste management, air quality, green construction, and community connections.

Initiatives:

- Energy assessment.
- No smoking policy.

- Storm water pollution prevention.
- Wildlife management.
- Paper and waste recycling plan (considering aluminum recycling).
- Signs regarding recycling (considering signs and motion sensors for lights).
- Spill prevention and clean-up plan.
- Instant rewards to employees in the form of \$25 gift cards.
- Paperless board meetings.
- Tenant outreach regarding energy conservation and programs such as the fuel-recycling program.
- LED lighting in taxiways.
- Recycling asphalt from taxiways to use in other projects.
- Energy efficient backup generator for lighting.
- Stream restoration and tree planting after runway extension project.
- Plan to feature sustainability initiatives on website.

Lessons Learned and Sage Advice

- As a first step, involve the stakeholders to inform them about the goals, generate ideas, and increase their personal investment.
- Look at which projects make sense culturally and financially, and then seek funding.
- Sustainability initiatives have an added benefit of reducing operational costs, and many green initiatives can be implemented at no additional cost.
- Ultimately, everyone has a responsibility to sustain people, planet, and prosperity and to enhance the well-being of employees and the community.

Case Example Focus—Building Comprehensive Program from Ad Hoc Roots

HTS is a good example of a smaller airport that first approached sustainability through ad hoc projects. Information gained through various sources and periodicals, including ACRP studies, served as a guide for initial activities. However, the limitations of that approach soon became apparent, so the airport sought and received FAA AIP funding, which allowed HTS to retain a consultant to design a more thorough and comprehensive program. The sustainability program benefits greatly from having an SMP with written goals, objectives, and milestones, and the SMP would not have been possible without external funding. Having consultants involved in the preparation of the SMP was viewed as being extremely helpful, since their expertise in sustainability programs allowed for easier identification of projects that needed to be accomplished. For example, the energy efficiency projects at HTS would not have been as robust without input from the consultants. According to HTS, the only detriment to having an SMP would be if the plan is completed and then sits on the shelf because tax money and employee time would then have been wasted.

CASE EXAMPLE 4: ITHACA TOMPKINS REGIONAL AIRPORT, NEW YORK

Special Circumstances

The Ithaca Tompkins Regional Airport (ITH) building houses airport administration, maintenance, and a fire station. ITH is in a community with a prestigious college and university.

Drivers

The airport director was inspired by environmental initiatives of European airports and asked that sustainability projects be included in the master plan that was being developed.



Definition of Sustainability

Actions should not affect the ability of future generations to do what they want to do.

Airport Sustainability Planning

The airport's sustainability activities began in 2008, making ITH attractive to serve as a precursor airport for FAA's pilot program in sustainability. The airport has adopted a sustainable airport master plan that incorporated sustainability initiatives. The implementation occurs in three phases from 2010 through 2030. Sustainability is now considered in every airport project and in daily operations.

Aids/Barriers to Implementation

Aids—Early FAA AIP funding for the sustainability plan. County support for sustainability initiatives. Ideas contributed by students at Ithaca College and Cornell and by the community.

Major Focus Areas and Sample Initiatives—Resource Conservation and Recycling

Major focus areas: buildings and facilities, air quality, climate change, energy, materials, surface transportation, water, land use, natural resources, noise, community, design, and construction.

Initiatives:

- Removed a dozen trees to extend a parking lot and planted 50 more around the airport.
- Replaced main section of terminal roof and used shingles made of recycled materials that will last 50 years.
- Renovated and expanded administrative building, installing windows, reusing bricks from old section and putting high polish on concrete floors to avoid plastics and carpet.

Lessons Learned and Sage Advice

- Gaining the support of the local community and the governing legislative body is crucial, so invest time in educating the applicable stakeholders about why sustainability is important.
- Make presentations to the local Chamber of Commerce and Rotary Club, and display posters in the airport departures lounge to educate passengers and tenants.
- Involve the employees to get their buy-in and cooperation.
- Make sure that initiatives make financial sense, but avoid dismissing a sustainable alternative simply because the up-front costs may appear a little higher.

Case Example Focus—Harnessing the Power of a Sustainability Champion

The history of sustainability at ITH illustrates how an idea can start with one person and then take on momentum as more people get involved. Bob Nicholas, the long-time airport director who recently retired, hails from the United Kingdom and wanted to adopt more environmentally friendly practices at ITH. An additional goal was to address the airport's contribution toward global warming. Bob asked that sustainability be incorporated into the master plan that was being developed, and the consultant suggested that sustainability be treated as a separate component of the plan. Because incorporating sustainability initiatives requires higher initial expenditures, approval of the county legislature was necessary. FAA approval of the concept also had to be obtained because ITH also sought AIP funding. ITH and its consultants scheduled a meeting with FAA's head of aviation planning at ACI-NA offices in Washington, D.C. When the meeting commenced, FAA announced that it had already embraced support of sustainability and presented its plan to do a pilot project of ten airports. ITH asked to go first because it wanted to set an example for the airport industry in the United States. Because the project was new, a lot of time was required for the early stages. Local academic institutions Ithaca College and Cornell University were invited to participate, and both the students and the local community contributed ideas on projects to do at the airport. ITH received the Airports Going Green award in Chicago and several other local awards, and the county legislature was delighted with the local and national exposure.

CASE EXAMPLE 5: KENT STATE UNIVERSITY AIRPORT, OHIO

Special Circumstances

Kent State University Airport (1G3) is a general aviation airport owned by Kent State University. From 85% to 90% of its operations support flight training, and the airport is financially self-sufficient. 1G3 will become ENT/KENT as soon as it implements the Automated Weather Observing System (AWOS).

Drivers

Bolstered by increased environmental awareness among the student body, the university developed a vision for a sustainable future and retained a sustainability manager who is available to the airport. The primary driver for the sustainability program is reducing costs through energy efficiency, renewable energy, waste reduction, and increased recycling.



Definition of Sustainability

Kent State University Airport follows the definition of sustainability provided by the Airport Council International–North America as ensuring Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility (EONS). The objective is to balance the benefits and impacts to these elements while identifying synergies among them. In order to achieve this, sustainability will be integrated into each step of the Airport Master Plan.

Airport Sustainability Planning

The airport is developing a master plan with a sustainability component that is targeted for completion by late 2015. The baseline assessments have been completed, and goals and associated projects have been identified. Facility upgrades and improvements that are included in the master plan will provide opportunities for integrating sustainable designs and practices and developing sustainability elements and measurements. 1G3 is part of the second group of more than 40 airports selected for FAA sustainability program, along with other Ohio-based airports such as Dayton International, Dayton Wright Brothers, and Akron Canton Regional.

Aids/Barriers to Implementation

Aids—AIP funding. A full-time sustainability manager who serves as a resource and focal point.

The culture and leadership at the university. High student awareness of environmental issues.

Staff availability.

Barriers—Limited financial resources to implement initiatives. Airport location in a different county from main university campus. Vocal community aversion to airport noise and traffic.

Major Focus Areas and Sample Initiatives—Noise Abatement and Resource Conservation

Most activities have been ad hoc while awaiting the master plan and its sustainability component.

Initiatives:

- Active noise abatement program.
- Energy-efficient lighting (part of universitywide program).
- Storm water monitoring and control.
- Recycling program.

- Preheating systems for aircraft.
- Waste and energy audits.
- Aggressive pavement maintenance to lengthen useful life.
- Groundwater contamination prevention.

Lessons Learned and Sage Advice

- Having senior leadership buy-in and support is the most critical aspect.
- Ad hoc projects can help with initial acceptance of a sustainability program.
- Maintain good community relations and be aware of airport noise impacts on the community.
- Retain an environmental professional to get an accurate assessment of current conditions and conduct audits for waste and energy.
- Weave the sustainability plan and program into the full master plan and airport activities.
- Look at all potential revenue streams. 1G3 sells fuel as its primary revenue but also leases unneeded space, provides aircraft washing, runs a bookstore, and collects rent from the college for training.

Case Example Focus—Ensuring Airport Viability with Effective Noise Control

The airport operates a flight training school in an urban area, resulting in aircraft noise being generated over the community. Growing the flight-training program provided a financial benefit to the airport, but it also generated noise and other social impacts, such as increased surface traffic. In response to complaints from the community, some of which demanded closure of the airport, 1G3 initiated an aggressive noise reduction and noise management program. Air traffic routing was changed, as were procedures for takeoff and landing. Enhanced reporting procedures were put into place, and the airport held monthly meetings with the tenants to review every noise complaint. Because of these proactive measures, noise complaints were reduced by 64% during the period 2010 to 2014.

CASE EXAMPLE 6: NANTUCKET MEMORIAL AIRPORT, MASSACHUSETTS



Special Circumstances

Nantucket Memorial Airport (ACK) is primarily a general aviation airport serving an island (Nantucket Island). In November 2012, ACK was selected as the pilot airport for the Carbon Neutral Airport Program (CNAP), a project administered by the Massachusetts Department of Transportation and Volpe National Transportation Systems Center, to reduce fossil fuel emissions and greenhouse gas emissions.

Drivers

Current and projected increases in cost of electricity.

Definition of Sustainability

Efficient and long-term management of resources.

Airport Sustainability Planning

Drafting of the master plan was nearing completion at the time of the interview. The master plan is funded under the AIP, and the majority of funding for the sustainability initiatives to date came from state programs, utility rebates, and ACK operating revenues.

Aids/Barriers to Implementation

Aids—Municipality with progressive attitude toward environmental protection and energy use and conservation. Island ethos to recycle materials and compost; island mandate to reduce energy consumption and recycle. Financing for energy efficiency improvements at 0% that is repaid through energy bills. Zero emissions vehicle rebates from state program. State funding for a geothermal system retro-commissioning program, in accordance with National Grid. State rebates for zero emissions vehicles.

Barriers—Procedure for obtaining bond financing. Town meetings. Burdensome state purchasing regulations. Lack of climate change awareness. Ineligibility for VALE funding as a result of primarily general aviation operations.

Major Focus Areas and Sample Initiatives—Energy Reduction and Biodiversity Protection

Energy reduction has been a major focus area.

Initiatives:

- Lighting upgrades.
- HVAC repairs.
- Solar panels.
- Biodiversity protection for indigenous plants, moss, and wildlife.
- Donation of an old administration building to a construction company.
- Donation of an old FBO to a school.

Lessons Learned and Sage Advice

- Planning needs to be a team effort, so engage stakeholders, especially employees, early and often.
- Compare utility and fuel costs against the budget quarterly, preferably on a department basis to facilitate tracking and assign responsibility.
- Submeter wherever possible.
- Establish a baseline performance level and start tracking energy use.
- Conduct an energy audit.
- Recognize that information technology equipment requires significant amounts of energy for computers, screens, servers, printers, and fax machines.

Case Example Focus—Pioneering Carbon Neutrality

Nantucket Island became connected to the mainland energy supplies only 7 or 8 years ago; until then energy had to be self-generated by the island. Airports use a lot of energy and have a baseline level of consumption that is difficult to reduce. For example, runway and control tower lights are constantly illuminated, and security operations require space, light, and HVAC. ACK's budget allocates more than \$300,000 for energy, which is 72% of the utility budget. In March 2015, a 30% increase in rates is anticipated. The incentives for ACK to address energy costs and consumption are obvious, and the airport has taken several initiatives. It applied for and was accepted as a pilot project for the CNAP. CNAP has a goal of 100% net annual energy neutrality, to be achieved 30% through energy efficiency and 70% through solar energy. CNAP funded an investment grade energy audit (IGA), which revealed specific areas for improvement.

For example, the IGA found that the geothermal system in general was not functioning properly. Phase I of the CNAP project has been completed, and the airport will begin building in 2015, with target completion in 2017. Submetering will be installed to track usage in specific departments (operations, maintenance, and buildings) and buildings (the airfield, terminal, and tower). Functions will

be also tracked, such as HVAC and lighting. For lighting upgrades, ACK accessed zero-percentage on-bill financing, which permitted the airport to finance energy efficiency measures through the utility and repay the loan as part of the utility bill. Solar energy implementation may be financed through a power purchase agreement. A payback analysis suggests that many efficiency initiatives are cost-effective, but the municipality will invest in renewables only if they are cost-effective.

CASE EXAMPLE 7: NORTHWEST ARKANSAS REGIONAL AIRPORT, ARKANSAS



Special Circumstances

For the Northwest Arkansas Regional Airport (XNA), the cities of Bentonville, Fayetteville, Rogers, Siloam Springs, and Springdale, along with Benton and Washington counties, created the Airport Authority as a separate public entity, one of only two in Arkansas. The airport site is centrally located, close to all the communities of northwest Arkansas. XNA is also far enough away from populated areas to minimize adverse impact from aircraft operations.

Drivers

The availability of FAA funding was a key driver. In addition, board members and the airport had a strong desire to be a more efficient and sustainable operation.

Definition of Sustainability

The Northwest Arkansas Regional Airport strives to provide an operationally safe and efficient airport that is financially sound, promotes economic growth in the region, and enhances environmental sustainability and social responsibility.

Airport Sustainability Planning

The airport will soon complete a sustainable master plan study, with goals of saving money, energy, and time and improving the passenger experience.

Aids/Barriers to Implementation

Aids—FAA AIP funding. Stakeholder involvement, including various airport departments, airlines, FBOs, and tenants. Community involvement, including an advisory group, regional planning processes, and a website for the public.

Barriers—Staff time to monitor results and measure benefits and costs. Prior building projects that were completed without sustainability awareness or input.

Major Focus Areas and Sample Initiatives—Resource Conservation and Passenger Comfort

Initiatives:

- Recycled all the pavement, steel, and copper from the Runway Rehab Project.
- Reduced electrical bills by retrofitting the building with more efficient lighting fixtures and removing every other light from Airport Boulevard.
- Currently installing low-flush toilets, hands-free soap dispensers and water faucets at the sinks and Dyson hand dryers in all restrooms.

- Implemented significant changes in HVAC operation, including use of controlling zones, adjusting temperatures to reflect time of day and occupancy schedules, and optimizing use of the outside air economizer.
- Changed set points on boilers and chillers for optimum operating parameters.
- Purchased rocking chairs, made with recycled seat belts, for the new concourse addition (people love them!).
- Initiated a cart service and a valet service to improve the passenger experience.
- Began providing umbrellas with XNA logo that can be used to get to the parking lot and then deposited in drop-off boxes.
- Converted old space into a small, publicly available conference room that has a TV and hook-ups for presentations.
- Converted old space into a “Quiet Room” or “Yoga Room,” complete with mats and pillows.
- Installed large (10-ft × 10-ft) floor chess and checkers games as well as card tables in terminal for passenger use.
- Refinanced and combined long-term debt, reducing annual debt service by almost a million dollars a year at a fixed rate through 2027.
- Performed a financial analysis to determine the priority of future projects and analyzed methods to fund them; a future parking garage, a 3-mile access road, and pavement replacement are the three major projects that were targeted.
- Began protecting endangered fish species by collecting, holding, and then testing rainfall runoff from pavement before releasing the water into the downstream discharge area.

Lessons Learned and Sage Advice

- Small airports have a significant challenge to deliver on the things that larger airports commit to do and must look carefully at the financial payback of sustainability initiatives.
- Adopting a sustainability program before major renovations or construction allows for inclusion of sustainability concepts from the beginning.
- Be wary of optimistic predictions of financial returns and products advertising long lives. Many LED lights are not lasting as long as promised.
- Take the time to track results, even though an Excel spreadsheet can be tedious and time-consuming to use and staff availability can be difficult to secure for monitoring and measuring benefits and costs.
- Highlight sustainability drivers when applying for FAA grants.
- Closely review the payoff of some sustainable implementations when existing equipment is nearing end of life.
- When approaching the daily operations, project planning, and financial security, take time to consider projects carefully and analyze how they can be done better.
- Find outside resources and lessons learned.
- The community of airport personnel is eager to share experiences and results from tests and trials. Use the available knowledge to make your operation more sustainable.

Case Example Focus—Generating Clear Objectives and Focus Areas

The airport formally identified the following objectives to meet the identified vision:

- Providing a high standard for safety and customer satisfaction;
- Providing a high standard for operational efficiency;
- Demonstrating environmental stewardship;
- Providing a financially and socially beneficial resource to the community/region; and
- Providing positive partnerships with tenants, neighbors, regulators, and other stakeholders.

Primary focus areas include airport finance; energy consumption/greenhouse gases; operations and maintenance of airport facilities; waste management/recycling, and construction management.

Secondary focus areas include water quality; community relations and education; and natural habitats and air quality.

CASE EXAMPLE 8: OUTAGAMIE COUNTY REGIONAL AIRPORT, WISCONSIN**Special Circumstances**

The Outagamie County Regional Airport (ATW) has 29 buildings, two runways, and numerous taxiways and paved aircraft aprons. The airport property occupies approximately 1,739 acres of land owned by Outagamie County, much of which is available for future development of new airside and landside facilities. The airport controls 29 acres of land through purchase of aviation easements. It owns an additional 9.7 acres through a runway protection zone easement. ATW

has more than 250,000 annual enplanements and hosts a FedEx cargo sorting and handling facility and a wide variety of GA activities. More than 2,400 badged employees work at the airport.

Drivers

Prompted by rising utility costs and a volatile air service industry, the airport championed sustainability initiatives and in 2008 undertook a facilities assessment to reduce energy usage in the passenger terminal and other buildings. The assessment led to numerous changes, including the addition of a 50-kW photovoltaic array and a 12-panel solar thermal system on the airport terminal, removal of high-energy-use equipment, and installation of energy-efficient lighting and room occupancy sensors. The success of that program brought Outagamie to the attention of FAA, which led to AIP funding through the Sustainable Airport Master Plan Pilot Program.

Definition of Sustainability

Sustainable practices allow the current generation to meet current needs without compromising the ability of future generations to meet their needs, and they foster environmental protection, natural resource conservation, social progress, and stable economic growth and employment.

Airport Sustainability Planning

The sustainable airport master plan was produced in 2012. The master plan's sustainability initiatives focus almost exclusively on reducing the energy use of airport-owned buildings by 70% by 2030 through a combination of new construction, energy-efficient retrofits, and the use of renewable energy sources. Under the plan, 50% of energy needs would be produced by renewables, and annual greenhouse gas emissions would be reduced by 85%.

Aids/Barriers to Implementation

Aids—Executive management support. FAA funding. Engineering consultants. Strong support from tenants and community.

Barriers—Cost. Lengthy local procurement process.

Major Focus Areas and Sample Initiatives—Energy Reduction and Employee Programs

Initiatives:

- Adopted mission statement of being carbon neutral by 2030.
- Installed energy-efficient lighting, room occupancy sensors, and ground power and a pre-conditioned air unit in a new passenger boarding bridge (PBB) to allow aircraft to shut off engines when parked on the apron.

- Conducted energy modeling that resulted in installation of timers on the baseboard heater of each PBB.
- Using a grant from the U.S. Department of Energy, installed a 50-kW solar photovoltaic panel on the terminal concourse; solar monitoring stations provide education for the public.
- Reduced energy use through variable frequency drives on equipment; high-efficiency electrical, mechanical, and plumbing systems; room occupancy sensors; and natural lighting provided by skylights and large windows in the concourse and hangar.
- Studied a net-zero energy building for the FBO operations (the ATW Platinum Flight Center).
- Created a framework for measuring, tracking, and reducing the airport's baseline energy usage and operational emissions footprints.
- Addressed employee programs, such as health risk analyses, absenteeism-reduction strategies, construction of new walking and biking paths on airport grounds, and provision of exercise facilities.
- Conducted a recycling and solid waste audit; developed strategies for diverting more waste from landfills.
- Evaluated wastewater management strategies; developed strategies for reusing water and better management of storm water runoff.
- Implemented rainwater collection, low-flow fixtures, and point-of-use hot water.
- Examined current and potential airport procurement practices to obtain sustainably produced supplies.
- Utilized enhanced wall and roof envelope insulation, in-floor radiant conditioning, high-performance Solarban 80 glazing, and a geothermal heat pump to boost efficiency and reduce the operational costs of heating and cooling systems.
- Utilized native plantings on airport grounds to reduce fertilizers and irrigation.
- Investigated ground transportation possibilities, such as mass transit, pedestrian and biking options, and plug-ins for electric cars in the parking lots.

Lessons Learned and Sage Advice

- Although ad hoc projects may build momentum, a comprehensive plan is necessary for defining goals and setting the direction.
- Owing to staff time constraints, retaining an outside consultant to conduct audits and develop a sustainability plan ultimately saves both time and money.
- Pursue both AIP and local funding.
- If budget constraints prevent design and implementation of a fully developed plan, use local electric utilities and electric supply companies for advice, especially for low-hanging fruit such as LED lighting.
- Review life cycles and have long-term data to see if the sustainability plan and projects actually save money; engineers occasionally get the projections wrong.
- To understand the impact of initiatives and build a case for future projects, track everything and use an intern to input the data.
- Be sure to link the capital improvement plan and the sustainability plan.

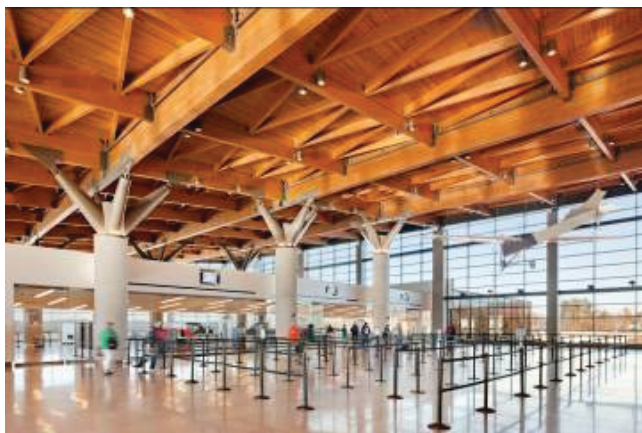
Case Example Focus—Advancing Energy Efficient Buildings

Following the planning goals set forth in the sustainable airport master plan, ATW established a GA campus south of the commercial air service passenger terminal that includes an FBO, a corporate hangar, and a storage hangar for corporate jets. The Platinum Flight Center GA terminal was designed to achieve LEED certification, and the terminal building is designed to be the nation's first aviation building to achieve Net Zero Energy status by producing renewable energy equivalent to the amount of energy it consumes for building operations in a calendar year. The building design includes the following energy efficiency measures:

- geothermal heating and cooling;
- in-floor radiant conditioning;

- photovoltaic solar energy roof panels;
- high-performance glazing;
- thermal mass with enhanced envelope insulation;
- occupancy sensors for lighting and mechanical systems;
- natural ventilation;
- rainwater capture cistern for water reuse; and
- high-efficiency electrical, mechanical, and plumbing systems.

CASE EXAMPLE 9: PORTLAND INTERNATIONAL JETPORT, MAINE



Special Circumstances

Portland International Jetport (PWM) has 45 full-time employees. The airport is owned by the city of Portland, which manages the procurement process, enacts mandatory policies and procedures, and acts as the final decision maker.

Drivers

PWM has a vocal local community with respect to environmental impacts stemming from the airport, and FAA, the U.S. EPA, and the Maine Department of Environmental Protection (DEP) have become more focused on environmental issues. Availability of FAA AIP funding for the sustainability master plan also helped spur the airport's program.

Definition of Sustainability

Use only what you need and replace what you use. Sustainability must be based on economic viability, environmental impact, and importantly, the societal/organizational effect.

Airport Sustainability Planning

PWM began work on a sustainability airport master plan (SAMP) in the summer of 2014, with an estimated completion in fall of 2015. The airport started with ad hoc projects, but the SAMP serves as a more robust and comprehensive vehicle for identifying issues and facilitates coalescing groups to set goals and find solutions.

Aids/Barriers to Implementation

Aids—AIP funding for SAMP. VALE funding for geothermal. Supportive airport director.

Barriers—Lack of awareness and/or commitment at the municipal level. Bureaucratic processes (must get three bids for any procurement over \$1,000). Staff resources. Low passenger facility charges.

Major Focus Areas and Sample Initiatives—Energy Reduction and Employee Involvement

Major SAMP focus areas: environmental compliance; air quality and greenhouse gases; economic impact; energy; governance and organizational readiness; ground transportation access; people and waste management; and recycling.

Initiatives:

- Surveyed employees to obtain opinions and suggestions.
- Conducted environmental training.

- Installed more efficient drives, lights, reflective roof, multistack heat pump system, and room occupancy sensors.
- Replacing all lights with LEDs to produce 70% energy savings plus lower maintenance costs.
- Achieved LEED Gold in new terminal expansion.
- Used VALE funds to install a geothermal system, which will pay for itself in 18 months and has a 30-year life.
- Reduced light pollution from airport deck by installing an airfoil to direct the light away from the town.
- Using software to track each flight for noise purposes.

Lessons Learned and Sage Advice

- Make a decision to be environmentally responsible and then look for funding.
- Adopt initiatives that have a positive return on financial investment but understand that nothing will work well unless the social/community pillar is solid.
- Always seek public/employee/tenant involvement.
- Sound decisions require data and trends; use spreadsheets to track metrics that are not automatically tabulated (geothermal automatically provides data).
- Seek funding from governmental and other sources such as utilities. For example, Efficiency Maine has funded the LED lights.
- Be aware that some initiatives reduce operational or maintenance costs but could have a high greenhouse gas footprint; the heat pump for geothermal units consumes surprising amounts of energy.
- Smaller airports do not have the capacity to employ a full-time sustainability coordinator, and appeals to people to do the right thing can produce significant results.

Case Example Focus—Pursuing Deicing Excellence

In 2007, the EPA demanded a study on deicing fluid mixing with storm water. Maine DEP found low oxygen levels in the local river and presented the airport with several options, which included gathering glycol and shipping it elsewhere for treatment. The American Recovery and Reinvestment Act of 2009 funded shovel-ready projects, leading the airport to apply for a grant to install pipes with a valve to direct glycol into a container. The FAA funded \$500,000 for a tank to store the glycol. Both the EPA and the Maine DEP prohibited glycol from entering the river after November 1, 2010, and by October 2010, the storage tank was operational. All storm runoff is also diverted into the tank. Through this system of direct capture and diversion of the storm water-glycol mix, approximately 70% of the glycol is retained on site, and airport glycol leaving the site is less than half the permitted amount. Originally the captured glycol mix was sent off-site for separation and distillation, but now both separation and distillation are performed on site. Indeed, during the summer, other airports send their glycol to PWM for distillation. Currently, the recycled glycol is sold to firms in Canada to coat bearings on coal-mining equipment. However, PWM would like to have its on-site distillation process certified to allow recycled glycol to be reused on aircraft; EPA funding is available for recapture but not for distillation, so other funding sources will have to be found.

CASE EXAMPLE 10: RENTON MUNICIPAL AIRPORT, WASHINGTON

Special Circumstances

Renton Municipal Airport (RNT) was built in 1922 and expanded in 1943 for B-29 production during World War II. In the 1950s, the airport was prepared for jet aircraft production and served as the departure airport for all new Boeing KC135, 707, 727, 757, and 737 and P8A aircraft delivered from the Boeing Renton factory to the U.S. military and commercial airlines worldwide.



Drivers

The airport director believed that launching a sustainability program was critical to ensuring that the airport was operated and maintained with a long-term vision while also balancing the goals of the residents living in the community around the airport. RNT was one of the 10 pilot airports for AIP sustainability funding.

Definition of Sustainability

Sustainability is not just economic and social, nor is it just environment; it also includes operations and maintenance. It is important that all airports need look at all aspects of sustainability, especially those that ensure that the airport meets its main mission to support aviation while also being fiscally responsible, maintaining the infrastructure for the next 100 years, and operating the airport in a manner that ensures the airport is an asset for the community in which it is located.

Airport Sustainability Planning

The sustainability master plan (SMP) was completed in 2012, and the airport master plan (AMP) process, which will align and implement the SMP goals, began in the fall of 2014. The goal of the 2012 SMP was to fully apply the EONS model for RNT to see if a holistic approach to sustainability would work and, most importantly, contribute to the longevity of the airport. The SMP serves as the umbrella program by addressing daily operations and balancing competing needs. The AMP is a facilities plan, one component of many in implementing the SMP. The airport has embarked on an aggressive construction program, and having the SMP allowed for more thoughtful decisions and resulted in cost savings. With ad hoc projects, the airport may not get credit for taking actions that have an impact on sustainability because lack of awareness and weak documentation prevent a clear link. A comprehensive plan explains the sustainability program and provides a framework for action.

Aids/Barriers to Implementation

Aids—AIP funding that paid consultants to help develop the plan and the data “tool” that is used to align the goals with the implementation strategies and contain the data sets for analysis. Knowledgeable FAA staff in the airport regional office. The 20-person Airport Advisory Committee, with representatives from tenant and community stakeholders.

Barriers—Sustainability viewed as only pertaining to the environment and not the financial, operational, or long-term health of the airport infrastructure. Lack of process for gathering data. Lack of standardized data sets to use in decision making. Lack of staff time for collecting data.

Major Focus Areas and Sample Initiatives—Water Protection and Community Outreach

Focus areas that are tracked: airport financials, local and airport economic values, community outreach and education, energy conservation/greenhouse gases, noise, facilities operation and maintenance, and water quality.

Initiatives:

- Improved runway pavement rating from 30 to 100.
- To protect the adjacent river, replaced storm water pipes and installed drainage swales to sequester tire rubber and heavy metals from entering the adjacent river and lake.
- Acquired runway broom to reduce usage of E36 runway deicer and improve airport operations’ response to winter ice/snow events.
- Replaced infield mower, which reduced staff hours and diesel consumption (greenhouse gases).
- Dredged seaplane base to maintain safe operations and designed a shoreline restoration project.

- Conducted airport tours for preschool students, high school students, and Boy Scouts and held quarterly meetings with the Airport Advisory Committee to maintain and improve community acceptance of the airport.
- Maintain airport cash flow model on a weekly basis to ensure a financially healthy airport.

Lessons Learned and Sage Advice

- To succeed, the program requires a long-term focus, and there must be a commitment and understanding from the top of the organization.
- Develop a process and a tool for gathering and tracking data; RNT tracks data related to the EONS balloons in an Excel spreadsheet.
- One of RNT's six staff members inputs data into spreadsheets that track every metric, thus providing accurate, long-term data that inform decisions.

Case Example Focus—Integrating Sustainability Plans with Construction

In 2001, RNT was showing clear signs of neglect. Not much maintenance had been performed since the 1950s. The runways were in bad condition. Sections of the perimeter fence were missing. The ramp and docks for the seaplane base had rotted. Vehicles drove down taxiways and runways. Financial planning extended only a year or two into the future. Fuel spilled into the lake and river. Poor relationships and communication between and among the community, the city, the airport, and the tenants prevented problems from getting resolved. Understanding the status quo was complicated by a lack of data. Remodeling projects failed to balance public policy goals, and opinions were not based on data. New airport management began by gathering data to get a snapshot of the current situation and determined to follow a more sustainable path. Despite best intentions, the myriad demands on the small staff (six employees) made a concentrated effort difficult. RNT was awarded an FAA AIP grant to develop an SMP. After a number of drafts and iterations to address RNT's specific situations, the SMP was completed in 2012, just in time to implement sustainability strategies in the \$18 million of major construction projects that were undertaken in 2013. With the help of a robust and detailed Excel platform that aligns with the SMP, the airport now keeps accurate and precise data to enable tracking of performance against sustainability and other goals.

CASE EXAMPLE 11: ROBERTS FIELD, REDMOND MUNICIPAL AIRPORT, OREGON

Special Circumstances

Redmond Municipal Airport (RDM) is the only commercial airport serving as a regional hub in central and eastern Oregon.

Drivers

The city of Redmond owns and operates the airport and financed expansion of the terminal from 16,000 square feet to 132,000 square feet in 2010. That expansion opened opportunities to implement some ad hoc sustainability projects.

Definition of Sustainability

Sustainability involves more than just environmental aspects, and although many environmental initiatives result in cost reductions, in the event of conflict, financial responsibilities such as maintenance take priority over green initiatives.



Airport Sustainability Planning

RDM has a master plan but does not currently have a dedicated sustainability plan, so the airport has implemented sustainability measures on a self-funded, ad hoc basis.

Aids/Barriers to Implementation

Aids—Strong community support. Staff and stakeholder buy-in.

Barriers—Limited staff and budget. Potential negative cost-benefit of project.

Major Focus Areas and Sample Initiatives—Solar Panels and Energy Conservation

Initiatives:

- As part of the terminal expansion, installed glass in many areas to utilize and maximize ambient light.
- Installed a 44-kW DC solar panel array on the terminal roof in 2010; the airport web page (www.FLYRDM.com) has a monitoring link to show the total energy generated, total CO₂ offset (Total Energy Generated = X Tons of CO₂ Saved), and total gallons of gas saved.
- Performed an energy audit of the airport terminal.
- Upgraded lights in terminal and parking lots to LED.
- Changed from paper to air dryers in restrooms.
- Installed sensors in all sinks and faucets.
- Implemented recycling program.
- Working with restaurants to reduce their environmental footprint.

Lessons Learned and Sage Advice

- Having a good relationship with the community and local government is vital.
- Read the TRB reports and other information available online.
- Environmental issues are becoming more critical, as are social aspects resulting from social media, so airport priorities need to evolve with the times.
- With smaller airports, the financial aspect is critical, so initiatives must make good business sense.
- Look at nontraditional sources of funding, such federal and state environmental agencies.
- Attendance at airport conferences promotes networking and provides opportunities for people to exchange ideas.
- When completing long-term financial and capital improvement planning, consider how to incorporate sustainability aspects; build on actions taken in prior plans and allow the plans and projects to build on each other.
- Eliminate silos within the organization; build relationships with local governments and others to access the benefits of synergies and obtain information.
- With green initiatives such as solar, look carefully at the installation and maintenance costs and anticipated life cycle. Financial projections may be overly optimistic.

Case Example Focus—Delivering Sustainability Linked to Customer Service

One of the goals for the airport director has been to make the airport experience more pleasant and encourage people to come to the airport for reasons other than flights. Relationship building with the city and county has been a priority, and as a result, the airport is well supported by the community. For example, taking the local governing body for a tour around the terminal and the airport property helps familiarize the members with the airport design and operations. To engage the local community, the airport would communicate about its activities to increase understanding of the airport. However, those communications could take into account the differences in how each generation processes information. In today's environment, people want to stay electronically connected, so terminal

designs could provide more outlets for charging personal electronic devices, especially in the seating areas. At RDM, many of the older staff are nearing retirement, which requires recruitment in ways that take into account current expectations of employees.

CASE EXAMPLE 12: TETERBORO AIRPORT AND STEWART INTERNATIONAL AIRPORT, NEW JERSEY/NEW YORK

Special Circumstances

Teterboro (TEB) and Stewart International (SWF) airports are operated by the Port Authority of New York and New Jersey (PANYNJ) and are critical pieces of PANYNJ's airport network of five airports. TEB serves as a general aviation reliever airport for the region, and SWF serves as a vital gateway to the Mid-Hudson Valley. In 2010, FAA selected TEB for inclusion in its Sustainability Pilot Program.

Drivers

PANYNJ views sustainability programs as vital to the business case of an organization because a focus on sustainability can aid in evaluating long-term risk and can increase cohesion between the airport and local communities.

Definition of Sustainability

A robust sustainability program can serve as a catalyst to help an airport meet its overall business objectives, balancing the airport's financial needs with environmental and social goals. PANYNJ uses the EONS definition of sustainability and has established the following goals for all of its operations and facilities: an 80% reduction in all greenhouse gas emissions related to its facilities from 2006 levels by 2050; net zero greenhouse gas emissions from Port Authority operations; proactive engagement with tenants and others to reduce their greenhouse gas emissions; and development of strategies for climate change adaptation.

Airport Sustainability Planning

An environmental sustainability plan has been in place at SWF since 2010, with an update under way. A sustainable management plan has been in place at TEB since 2012. Sustainability management plans help serve as enterprise-level, decision-making frameworks involving staff at all levels of the organization. A comprehensive plan allows for deployment of consistent decision-making tools and optimal use of resources among facilities.

Aids/Barriers to Implementation

Aids—Articulating the business case for every sustainability initiative, whether it is a financial or a more qualitative business case. Industry momentum around sustainability and case examples of other airports successfully deploying strategies. High-level organizational and policy support for sustainability.

Barriers—Engaging field staff on a meaningful level as sustainability plans are developed. Mindset that sustainability planning is limited to the environmental field.



Major Focus Areas and Sample Initiatives—Climate Change Planning and Energy Audit

Focus areas for both airports: climate risk mitigation, air quality improvement, and cost reduction.

Initiatives:

- TEB:
 - Planning for the effects of climate change on critical infrastructure.
 - Hosts community events and career fairs.
 - Adopted operational efficiency improvements on the airfield.
 - Completed a Global Reporting Initiative sustainability report for 2013, which will serve as a template for future PANYNJ sustainability reporting.
- SWF:
 - Developed a recycling program.
 - Collaborated with local businesses on sustainability initiatives.
 - Conducted a whole facility energy audit and retrofit, including installation of smart meters.
 - Utilizing alternative-fuel vehicles.
 - Installed high-albedo roofing and pervious pavement.
 - Collecting and treating deicing fluid.
 - Engaging in community outreach and encouraging community involvement.

Lessons Learned and Sage Advice

- Sustainability planning could be a way of (1) recognizing the efforts that staff has engaged in and that are under way, (2) grouping current efforts into broader strategic initiatives where cumulative benefits can be recognized, and (3) developing an enterprise-level, decision-making framework that weaves sustainable choices into all levels of the airport business.
- Sustainability can be viewed both as a tool to achieve better bottom line results and as a revenue driver.
- Business strategy and sustainability are beginning to merge because having a sustainability program helps airports think strategically and ultimately serve customers more effectively.
- Lighting retrofits can pay for themselves; look to utilities as a funding source.
- Have workshops with local stakeholders, who can be sources of goals and initiatives.
- When brainstorming projects, consider all that appear feasible, and then make selection based on practicality and cost.
- When implementing a recycling program, first do a ground waste audit to understand what proportion of waste items is recyclable or compostable. A basic level of human sorting is probably unavoidable.

Case Example Focus—Enhancing Strategic Use of Reliever Airports

From the perspective of PANYNJ, the small reliever airports in the network can serve as ideal test cases for broader organizational initiatives. For example, the Aviation Department completed its first sustainability plan at SWF to test strategies for planning and implementation. Also at SWF, PANYNJ deployed a pilot smart-metering project to understand the benefits of submetering and active utility management. Deploying new initiatives on a small scale allows PANYNJ to limit its risk profile while determining how the initiatives can be deployed on a larger scale at the rest of its facilities.

CHAPTER SEVEN

CONCLUSIONS

Sustainability generally is defined as encompassing a process in which organizations continually improve their economic, social, and environmental performance. The airport industry has added operational improvement to the mix, and all four components can be seen as contributing synergistically to enhancing the sustainability of each individual airport and the airport community as a whole.

The 31 smaller airports surveyed for this synthesis were but a small fraction of the community of thousands of airports in the United States, but they represented diverse geographical regions and operating environments. Each of them felt strongly enough about sustainability to have adopted some form of sustainable activities, even if those activities were ad hoc and outside the framework of a formal plan. In nearly all cases, even among those who had received funding from outside sources such as FAA, the perceived financial cost of designing and implementing a formal sustainability plan was viewed as a major barrier, as was the limited time available to busy staff. The chief barrier was also found to be the top driver for adopting sustainability initiatives because smaller airports were compelled by the associated cost reductions to move forward with even ad hoc projects, such as installation of LED lighting. Completing the circle of the importance of financial support, availability of funding was listed as a primary aid for sustainability initiatives at smaller airports. Given the limited budgets under which these airports operate, it is not surprising that financial concerns are drivers, aids, and barriers to adoption and implementation of sustainability programs. However, the airports are finding ways and means to support sustainability projects by securing funding and engaging stakeholders. In most cases, adoption of sustainability initiatives and programs would not have been possible without strong and visible support from top management and/or airport owners. In many cases, FAA funding was viewed as critical.

Smaller airports can take several approaches to sustainability, from ad hoc projects to sustainability plans to fully integrated sustainability master plans. Those who are embracing sustainability understand well the main three pillars of people, planet, and profits, and view operational sustainability as something that flows naturally from their core activities. Some airports and/or their stakeholders see sustainability as chiefly an environmental concern, which in some cases can lead to pushback when budgets containing sustainable components are negotiated with the relevant governing body. Better communication about the benefits of sustainability may help overcome such perceptions. Support for sustainability is evident among the airports surveyed for this synthesis that have adopted formal planning because a large majority would be highly likely or somewhat likely to recommend the process to another airport.

AD HOC INITIATIVES

Because many of the surveyed airports began with ad hoc sustainability initiatives before embarking on a formal program, a list of the ad hoc initiatives that were provided during the interviews is presented here.

- Engage in community outreach and encourage community involvement.
- Involve tenants and the local community in sustainability initiatives by conducting workshops.
- Enlist the local colleges and universities to get ideas on sustainability projects.
- Inaugurate a paper and waste recycling program; consider recycling asphalt and building materials.
- Implement energy reduction programs, such as lighting upgrades and better insulation.
- Do an energy assessment audit.
- Establish a baseline performance level and track energy use; compare utility and fuel costs against the budget quarterly, preferably on a department basis.

- Submeter wherever possible.
- Implement a no smoking policy.
- Design and construct a storm water pollution prevention system.
- Engage in wildlife management and biodiversity protection.
- Produce a spill prevention and clean-up plan.
- Give instant rewards to employees in the form of gift cards.
- Have paperless board meetings.
- Engage in tenant outreach regarding energy conservation and programs.
- Plant trees.
- Feature sustainability initiatives on the website.
- Use preheating systems for aircraft.
- Initiate a noise abatement program.
- Consider all potential revenue streams at the airport, such as selling fuel, leasing unneeded space, washing aircraft, and operating a bookstore.
- Seek advice and funding opportunities for ad hoc projects from utilities and governmental entities.
- Install low-flush toilets, hands-free soap dispensers and water faucets at sinks, and Dyson hand dryers in all restrooms.
- For heating, ventilation, and air conditioning (HVAC) operation, use control zones, adjusting temperatures to reflect time of day and occupancy schedules, and optimize use of the outside air economizer.
- Change set points on boilers and chillers for optimum operating parameters.
- Initiate a cart service and/or a valet service to improve the passenger experience.
- Provide umbrellas for use in going to the parking lot; the umbrellas can be deposited in drop-off boxes.
- Convert old space into a small, publicly available conference room that has a TV and hook ups for presentations.
- Convert old space into a “quiet room” or “yoga room,” complete with mats and pillows.
- Install large (10-ft × 10-ft) floor chess and checkers games as well as card tables in the terminal for passenger use.
- Refinance and combine long-term debt.
- Reduce energy use through the use of variable frequency drives on equipment; high-efficiency electrical, mechanical, and plumbing systems; room occupancy sensors; and natural lighting.
- Examine current and potential airport procurement practices to obtain sustainably produced supplies.
- Conduct sustainability training for employees.
- Utilize alternative-fuel vehicles.
- Install high-albedo roofing and pervious pavement.
- Collect and treat deicing fluid.

For smaller airports wishing to initiate sustainability activities, the results of this survey and the case examples offer some guidance. Because successful programs involve acceptance from those who are affected, most of the respondents recommended forming a committee or advisory council of stakeholders at the beginning of the process. The advisory group could include representatives of the employees, the tenants, the community, and the governing body. That group would then help create the program design, communicate the goals, and support implementation. Beginning with simple, low-cost, ad hoc activities, such as recycling, helps to build support and momentum among employees and stakeholders. Retrofitting lighting systems with LEDs may require an initial financial investment, but the return on investment in lower energy costs will become apparent in time. Funding for energy retrofits and the sustainability plan is available from multiple sources, including FAA, state environmental agencies, and local utilities. In addition, information resources to guide sustainability initiatives have become widely available at no cost through ACRP, ACI-NA, Sustainable Aviation Guidance Alliance (SAGA), and other organizations. A list of references is included at the end of this synthesis.

Once the smaller, ad hoc projects have shown results, airports might consider another, further investment in an expert consultant to design a formal sustainability plan. As some respondent airports

have noted, this investment actually saves time and money in the end by streamlining the process and reducing inefficiency. Once the plan has been adopted, tracking the metrics associated with the initiatives is critical, even though tracking uses precious staff time. Communication with all constituents throughout the process is also critical, and having solid data gained through tracking metrics provides information for explaining and describing the process and results. Once a sustainability plan has been adopted and the full program has been implemented, the benefits and results will become apparent, as the economic, operational, environmental, and social components of the organization will become more robust and resilient.

In sum, according to one airport, education is the key to a successful sustainability program, and strong management support is a critical component. A funded program is not necessary to start but is highly desirable for development and implementation of a formal sustainability plan. Tracking benefits will be unique to each airport because each airport has its own priorities and culture. Significantly, none of the survey respondents or interviewees regretted adopting sustainability measures. Smaller airports in the United States are in the early phases of embracing formal sustainability efforts. If thousands of airports nationwide start engaging in more sustainable activities, the magnitude of the resulting impact will be enormous and lasting.

KEY LESSONS LEARNED

- The airport community has embraced the concept of sustainable activities and operations.
- Smaller airports often engage in ad hoc sustainability-related activities such as energy reduction without characterizing them as sustainability initiatives.
- Financial constraints present barriers to sustainability initiatives, but funding may be available from federal, state, and local governments and from utilities.
- Establishment, implementation, and viability of sustainability programs depend heavily on top management leadership and support.
- Each airport has its own unique drivers and approach to sustainability.
- Having support from stakeholders and the community is critical to a successful program, and communication before, during, and after implementation enables continued support.
- Smaller airports often consult outside sources when designing a sustainability program.
- For the most part, small airports use airport personnel to track sustainability performance by means of spreadsheets.
- Smaller airports do best with sustainability initiatives that are easy to implement.

FURTHER RESEARCH

Although the survey and interviews for this synthesis provided valuable information, other areas of interest could benefit from further research. As noted, because smaller airports are in the early stages of adopting sustainability initiatives, information on measurable outcomes was not available. Thus, additional research on quantifying cost reductions and other benefits from initiatives, such as recycling pavement and metals, would be helpful to these airports. The process of implementing initiatives after identifying them is also a fertile area for research. In addition, the link between sustainability programs and nonenvironmental components such as economic viability (growing the business) and social responsibility (community and human factors) could be explored in a subsequent research project. Finally, smaller airports would benefit from a description and analysis of tools that can be used for tracking sustainability metrics and performance.

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APPENDIX A

Survey Tool and Selected Responses

ACRP S02-11 Medium and Small Airport Sustainability
INTRODUCTION
Objective This survey has been developed on behalf of the Airport Cooperative Research Program (ACRP). ACRP is a division of the Transportation Research Board which serves as an independent adviser to the federal government and others on scientific and technical questions of national importance.
In helping the aviation industry work towards developing a framework for sustainability, ACRP has identified a number of information gaps. The purpose of this survey is to help ACRP develop a better understanding of the issues that affect the sustainability performance at medium and small airports and identify best practices to advance airport sustainability.
Survey Results The results of the survey will be collated and developed into a research report outlining response rates, performance levels and highlighted examples of best practice airport sustainability initiatives.
Access to Research Report All of the survey respondents will receive a copy of the research report once the project is complete.
Confidentiality All answers provided by survey respondents will be treated as confidential. The name of participating airports and specific respondents will not be disclosed in the research report.
Time Requirement The average user will need 15-20 minutes to complete the survey.
Many thanks for your contribution to this research project.
Please contact the survey administrator if you have any questions or would like to report a problem with the survey.

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Airport Profile (AP)

*** 1. AP1 - Respondent Information**

Name:

Company:

ZIP:

Phone Number:

*** 2. AP2 - Number of people working at airport? (e.g., airport employees, tenants, airlines, etc.)**

<5

5-10

11-20

21-40

40-80

81-200

>200

*** 3. AP3 - Total square feet of building space that is either owned or operated by your airport?**

<5,000

5,000-10,000

10,001-20,000

20,001-40,000

40,001-80,000

80,000-160,000

>160,000

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***4. AP4 - List the major tenants within your airport? (Check all that apply)**

<input type="checkbox"/> Airline/commercial services	<input type="checkbox"/> Line maintenance services
<input type="checkbox"/> Aircraft charter companies	<input type="checkbox"/> Heavy MRO facilities
<input type="checkbox"/> Freight or distribution	<input type="checkbox"/> Car rental agencies
<input type="checkbox"/> FBO	<input type="checkbox"/> Tourist information services
<input type="checkbox"/> Flight instruction	<input type="checkbox"/> Federal Aviation Administration
<input type="checkbox"/> Food and beverage	<input type="checkbox"/> Other Federal agencies (e.g., TSA)
<input type="checkbox"/> Retail	<input type="checkbox"/> City departments (e.g., fire life safety)
<input type="checkbox"/> Fuel station operators	
<input type="checkbox"/> Other (please specify)	

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Roles and Mission

*** 5. RM1 - Who implements sustainability initiatives at your airport? (Check all that apply)**

- One dedicated staff person
- Multiple individual staff members
- Committee comprised of members from multiple business lines
- Airport operations staff
- Airport management staff
- Airport administrative staff
- No one is responsible at present time
- Other (please specify)

*** 6. RM2 - How does your airport define "sustainability"? Please provide a copy of any mission or vision statement here or write not applicable.**

*** 7. RM3 - How are you funding your sustainability plan?**

- Airport does not have a sustainability plan
- Airport provides the funding (self-funded)
- FAA provides majority of funds

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Without Plan

***8. WP1 - Which stakeholders are involved with sustainability actions at your airport? (Check all that apply)**

- Academic institutions
- Local community members
- External non-profit(s)
- Advisory committee
- Tenants (including FBOs)
- FAA
- Does not apply

***9. WP2 - Which resources do you use to implement sustainability initiatives at your airport? (Check all that apply)**

- In-house sustainability expert
- FAA Sustainability Planning Lessons Learned
- ACI-NA's Guide to Performance Measures
- Presentations from conferences (e.g., AAAE, ACI-NA, NASAO, etc. sustainability oriented meetings)
- ACRP publications and/or webinars
- Sustainability Aviation Guidance Alliance (SAGA) tool
- Airport's own project-based sustainability tool
- Another airport's project-based sustainability tool (e.g., CDA's Sustainable Airport Manual)
- USGBC's Leadership in Energy and Environmental Design (LEED) guidelines/certification
- ISI's Envision sustainability rating system
- ISO 14001/ Environmental Management System (EMS)
- Business case studies from aviation or beyond (e.g., business case for solar installation)
- Does not apply
- Other (please specify)

***10. WP3 - How likely is your airport to pursue a sustainability plan in the future?**

Highly Likely	Somewhat Likely	Neutral	Somewhat Unlikely	Highly Unlikely	Don't know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Self Funded Sustainability Plan

*** 11. SFP1 - What were the reasons your airport decided to self-fund the sustainability plan? (Check all that apply)**

- Procurement reduced constraints
- Process flexibility
- Ability to include additional services beyond conventional FAA sustainability framework
- Speed
- Unable to secure FAA funding
- Needed to spend expiring funds
- Philosophical preference
- Other (please specify)

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FAA Funded Sustainability Plan

***12. FFP1 - How necessary was FAA funding for your airport to pursue a sustainability management plan?**

Essential - 5 Might not have been possible without - 4 Accelerated sustainability progress - 3 Increased ability to fund other priorities - 2 Not necessary - 1

Other (please specify)

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Airport Sustainability Plans

*** 13. ASP1 - At what stage is your airport in the sustainability maturation process?**

<input type="radio"/> Stage 1 - No sustainability initiatives complete at this time	<input type="radio"/> Stage 4 - Sustainability plan adopted but not yet implemented
<input type="radio"/> Stage 2 - "Ad hoc" sustainability initiatives implemented without formal sustainability plan	<input type="radio"/> Stage 5 - Sustainability plan in early phases of adoption
<input type="radio"/> Stage 3 - Developing a sustainability plan	<input type="radio"/> Stage 6 - Sustainability plan fully implemented

*** 14. ASP2 - Has your sustainability plan utilized any of the following processes or resources? (Check all that apply)**

- FAA Sustainability Planning Lessons Learned
- ACI-NA's Guide to Performance Measures
- Presentations from conferences (e.g., AAEE, ACI-NA, NASAO, etc. sustainability oriented meetings)
- ACRP publications and/or webinars
- Sustainability Aviation Guidance Alliance (SAGA) tool
- Airport's own project-based sustainability tool
- Another airport's project-based sustainability tool (e.g., CDA's Sustainable Airport Manual)
- USGBC's Leadership in Energy and Environmental Design (LEED) guidelines/certification
- Institute for Sustainable Infrastructure's (ISI's) Envision sustainability rating system
- ISO 14001/ Environmental Management System (EMS)
- Business case studies from aviation or beyond (e.g., business case for solar installation)
- Does not apply
- Other (please specify)

*** 15. ASP3 - Which groups contributed to the sustainability plan? (Check all that apply)**

<input type="checkbox"/> Sustainability expert(s)	<input type="checkbox"/> Advisory committee
<input type="checkbox"/> Airport personnel	<input type="checkbox"/> Tenants (including FBOs)
<input type="checkbox"/> Academic institutions	<input type="checkbox"/> FAA
<input type="checkbox"/> Local community members	<input type="checkbox"/> Does not apply
<input type="checkbox"/> External non-profit(s)	
<input type="checkbox"/> Other (please specify) <input style="width: 250px; height: 15px;" type="text"/>	

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*** 16. ASP4 - Based on your experience how likely would you recommend sustainability planning to an airport that does not have a plan? (Choose one answer)**

Highly likely Neutral Highly Unlikely

Somewhat likely Not likely Does not apply

Please share the reason for your recommendation (optional)

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Management and Performance Tracking

*** 17. MPT1 - Which sustainability management elements does your airport currently use? (Check all that apply)**

<input type="checkbox"/> Dedicated staff person to support sustainability	<input type="checkbox"/> Reporting on a regular basis
<input type="checkbox"/> Defined roles for airport stakeholders	<input type="checkbox"/> Performance goals
<input type="checkbox"/> Defined list of sustainability categories	<input type="checkbox"/> Prioritized list of actions
<input type="checkbox"/> Baseline performance indicators (energy/water/waste)	<input type="checkbox"/> A process to track initiative implementation
<input type="checkbox"/> Method to track performance	<input type="checkbox"/> Linking sustainability with environmental compliance
<input type="checkbox"/> Other (please specify)	

*** 18. MPT2 - What has your airport used to track sustainability performance? (Check all that apply)**

<input type="checkbox"/> Environmental Management System (EMS)	<input type="checkbox"/> LEED for Existing Buildings Operations & Maintenance (EBOM)
<input type="checkbox"/> Utility sub-metering	<input type="checkbox"/> Monthly waste weight/volume reporting
<input type="checkbox"/> Real-time utility consumption dashboard	<input type="checkbox"/> Employee satisfaction surveys
<input type="checkbox"/> Monthly management performance scorecards	<input type="checkbox"/> Tenant satisfaction surveys
<input type="checkbox"/> Global Reporting Initiative (GRI) indicators	<input type="checkbox"/> Community surveys/comments
<input type="checkbox"/> Airport Carbon Accreditation Program reporting	<input type="checkbox"/> Financial returns on investment in initiative
<input type="checkbox"/> ENERGY STAR Portfolio Manager	<input type="checkbox"/> Not applicable
<input type="checkbox"/> Other (please specify)	

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Financial Performance

19. FP1 - What is the minimum annual cost savings threshold necessary to pursue a sustainability action? (Choose one)

\$0-1000
 \$40,001-\$80,000
 \$1001-5000
 \$80,001-\$160,000
 \$5,001-10,000
 >\$160,000
 \$10,001-20,000
 Don't have one
 \$20,001-\$40,000
 Not applicable

*** 20. FP2 - Which of the following methods has your airport used to fund sustainability programs? (Check all that apply)**

FAA sustainability planning grant
 FAA Voluntary Airport Lower Emissions (VALE) grant
 FAA zero emissions vehicle and infrastructure grant
 FAA general AIP grant
 Department of Energy (DOE) demonstration technology grant
 State government electric vehicle charging station grant
 State/local energy efficiency subsidies
 Utility rebates
 Utility funded energy audits
 Third party efficiency financing (e.g., performance contracting)
 Power purchase agreements (PPAs) for renewable energy
 Electrical grid demand response participation with ISO
 Self-financing
 Not applicable
 Other (please specify)

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Economic viability, Operational efficiency, Natural resources conserv., Soc...

***21. EONS1 (Economic) - Please list one to three (1-3) no or low cost successfully implemented sustainability actions at your airport:**

No/low cost action #1

No/low cost action #2

No/low cost action #3

Have not found any appropriate ones yet

***22. EONS2 (Operational) - Which energy and climate related initiatives has your airport pursued? (Check all that apply)**

<input type="checkbox"/> Energy efficient equipment upgrades to heating ventilation and air conditioning (HVAC)	<input type="checkbox"/> Building energy modeling
<input type="checkbox"/> Improved energy "controls" or operational routine improvements	<input type="checkbox"/> Pavement with lower embodied energy (e.g., aprons with "warm-mix" asphalt)
<input type="checkbox"/> Retro-commissioning of equipment	<input type="checkbox"/> Installation of solar energy generation on site
<input type="checkbox"/> Building envelope measures to airseal and insulate	<input type="checkbox"/> Installation of geothermal space conditioning
<input type="checkbox"/> Lighting upgrades	<input type="checkbox"/> Greenhouse gas inventory
<input type="checkbox"/> Reducing emissions from aircraft on ground (e.g., reducing taxiing and APU use)	<input type="checkbox"/> Climate adaptation formal planning
<input type="checkbox"/> Reducing emissions from aircraft in air (e.g., influencing descent and stacking patterns)	<input type="checkbox"/> Climate adaptation action to reduce operations risk(s)
<input type="checkbox"/> Electrification of vehicles	<input type="checkbox"/> Climate adaptation action to reduce infrastructure risk(s)
<input type="checkbox"/> Alternative fuel vehicles	
<input type="checkbox"/> Other (please specify)	

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*** 23. EONS3 (Natural resources) - Please indicate which environmentally oriented sustainability priorities your airport is pursuing (Check all that apply)**

- Water conservation (reduced consumption)
- Water quality enhancement (e.g., storm water management)
- Air quality (management/monitoring)
- Noise programs
- Land use (e.g., conservation easements and remediation projects)
- Bio-diversity (e.g., non-lethal bird control)
- Procuring environmentally friendly products
- Reducing waste
- Green building certification(s)
- Environmental management system (EMS)
- Not applicable
- Other (please specify)

*** 24. EONS4 (Social) - Which social sustainability actions has your airport pursued? (Check all that apply)**

- Sustainability training for staff
- Community contributions (e.g., volunteering)
- Equal opportunities and diversity programs
- Career development
- Staff retention program
- Support for families (e.g., childcare and maternal nursing rooms)
- Initiatives to support employee well-being (e.g., health & wellness programs, etc.)
- Accessibility for disabled or older stakeholders
- Indoor environmental quality (e.g., optimal ventilation, thermal comfort, etc.)
- Not applicable
- Other (please specify)

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Aids, Barriers, and Drivers

***25. ABD1 - Please list up to three (3) barriers to implementing sustainability initiatives at your airport in order of significance: (Skip if not applicable)**

Barrier #1

Barrier #2

Barrier #3

***26. ABD2 - Please list up to three (3) implementation aids that advanced the sustainability process at your airport: (Skip if not applicable)**

Implementation aid #1

Implementation aid #2

Implementation aid #3

***27. ABD3 -Please list the top five (5) drivers of your future sustainability initiatives: (Check up to five below)**

<input type="checkbox"/> Environmental compliance	<input type="checkbox"/> Airport management interest
<input type="checkbox"/> Improved sustainability performance	<input type="checkbox"/> Tenant/customer interest
<input type="checkbox"/> Corporate Social Responsibility (CSR)	<input type="checkbox"/> Elected/appointed officials
<input type="checkbox"/> Airport industry-wide trends	<input type="checkbox"/> External organization or academic institution interest
<input type="checkbox"/> Global environmental trends	<input type="checkbox"/> Risk reduction
<input type="checkbox"/> FAA funding availability	<input type="checkbox"/> Sensitive environmental resources
<input type="checkbox"/> Cost reductions	<input type="checkbox"/> Revenue generation opportunities
<input type="checkbox"/> Neighbors and community	<input type="checkbox"/> Improved airport employee engagement
<input type="checkbox"/> Demonstrate leadership in the industry	<input type="checkbox"/> Advances in sustainability product/service quality
<input type="checkbox"/> Achieve recognition and win awards	
<input type="checkbox"/> Other (please specify)	

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Sustainability Lessons Learned

28. SLL1 - Please use this space to provide lesson learned or to share insights that might not be captured in the other survey questions. (Question is optional)

29. SLL2 - Are you willing to participate in a phone interview to create a sustainability case study featured in this research?

Yes

No

ACRP S02-11 Medium and Small Airport Sustainability

Thank you!

Thank you very much for taking the time to complete this survey.

To submit your responses, please click "Done" below.

Responses from open narrative questions are provided in this table.

No.	How does airport define “sustainability”? Please provide a copy of any mission or vision statement here. (RM-2)
1	Using and reusing items for future development.
2	(Airport) embraces four pillars (Customer & Community Value; Economic Sustainability; Operational Excellence; and Environmental Stewardship) equally to support its sustainable future.
3	SUSTAINABILITY: A holistic approach to managing an airport that ensures economic viability, operational efficiency, natural resource conservation, and social responsibility of the airport. SUSTAINABILITY PRINCIPLES: 1. Minimize negative environmental impacts 2. Integrate sustainable practices into daily operations 3. Work with partners throughout the airport system 4. Implement sustainable design/construction practices 5. Maximize life of our assets 6. Engage with local community in positive manner 7. Provide a positive and safe working environment 8. Report on progress in meeting sustainability principles
4	At the crossroads of innovation and sustainability, [This] International Airport will strive to conserve our natural resources, operate efficiently, enhance our passenger experience, and serve as a vital asset to Southwest Ohio and beyond.
5	We are currently defining our mission as we speak. As we are conducting a sustainable master plan, we are currently inventorying our footprint. Once we know where we are, we can define our future.
6	Not applicable - airport does not currently have a detailed mission statement other than: The Airport Fund provides for the operation and capital improvement resources for Airport. The fund operates as an Enterprise Fund, as it is self-supporting. Airport is the regional commercial airport and provides facilities for general aviation, air cargo and the USDA Forest Service Air Center.
7	Goals & Objectives are 1. Energy Efficiency; 2. Economic Vitality; 3. Environmental Stewardship; 4. Partnerships
8	The mission of the Airport Authority is to preserve and improve Airport as an economically and socially sustainable facility from which to provide the best transportation service operations possible. This must be accomplished with financial responsibility and without sacrificing the utmost level of safety that has always been at the core of all airport operations and it must continue to promote economic development that is beneficial to the airport and the communities that it serves.
9	ACI EONS. “To sustain the heartbeat of the Mid-South by cherishing its resources to ensure City keeps flying high.”

10	Doing what makes sense for the environment.
11	A vibrant, forward-looking airport serving the aeronautical needs of our community, while contributing to the growth of the local economy and honoring the historic and natural heritage of the area.
12	Sustainability Vision (based on the EONS model): Provide a high standard for safety and customer satisfaction; Provide a high standard for Operational Efficiency; Provide an economically stable asset that contributes to the community; and Demonstrate environmental stewardship and community/social responsibility.
13	A holistic approach to protecting the people, planet, and prosperity.
14	Mission: Provide the region convenient commercial and general aviation access to the national air transportation system, operate the airport in a safe, efficient, sustainable, and fiscally responsible manner, and develop the airport to meet future needs.
15	Fresno is committed to continuing on the path to sustainability in the built environment by integrating sustainable principles into every project undertaken and procedure employed.
16	We define Sustainability as practical ways to reduce costs and impact on the environment without creating undue expenses.
17	Agency Wide: EONS. Individual mission statements: Stewart: • To develop the Airport into an efficient, economical, and sustainable gateway for (regional) travelers and cargo. • To develop the Airport into a vibrant regional airport that serves the needs of the residents and businesses in the region. • To develop the Airport so that it functions as an economic engine that promotes economic growth in the region in a sustainable manner. Airport (the Airport) is a critical general aviation and reliever airport for the airports system; Airport management is dedicated to integrating sustainability principles and practices into the Airport's long-term business strategy and day-to-day operations. Building on its past achievements in sustainability, the Airport Authority will seek a holistic management approach to enhance: (1) the Airport's operational efficiency, safety, and economic viability; (2) regional economic growth; (3) the conservation and conscientious use of natural resources; and (4) our social responsibilities to our local and regional communities. The Airport Authority will continue to support local, state, and regional efforts to improve sustainability and meet our mission for the Airport.
18	The Airport strives to provide an operationally safe and efficient airport that is financially sound, promotes economic growth in the region, and enhances environmental sustainability and social responsibility.
19	Per the Brundtland Commission of 1983: "...development that meets the needs of the present without

	compromising the ability of future generations to meet their own needs.”
20	Mission statement in progress, but sustainability is defined/applied across all business operations.
21	Sustainability refers to the mutually beneficial, life-supporting, and perpetual balance among economic, social, and environmental considerations and goals. It is a “basket” concept similar to justice or health that incorporates many ideas and approaches.
22	As an important gateway to the region, Airport is committed to a sustainable future by setting a high standard for customer satisfaction and security; maintaining a safe and efficient airport that meets the needs of the (region); and demonstrating environmental stewardship and community/social responsibility.
23	One of our core values states “Sustainable with an inherent sense of ‘Place’”—Our mission statement reads “The Airport commits to be a premier New England Airport. We will provide a convenient safe and environmentally conscious gateway that exceeds out travelers expectations while reflecting the essence of the (state) experience.”
No.	List of no and low-cost initiatives successfully implemented at airport? (EONS-1)
1	Tracking resource consumption
2	Optimization of Energy Management Systems
3	Pavement reuse (3 responses); Use of TRB’s PaLATE pavement model on project saved \$1.5M
4	Battery Recycling—Free disposal
5	Timers for pre-heating equipment and aircraft for 30 aircraft fleet
6	Implementation of cost centers
7	Lighting upgrades (8 responses)
8	Install liquid drain stations at passenger security checkpoint
9	Lowered hot water temperatures
10	Replaced incandescent bulbs with LEDs on hangar to reduce power consumption and staff time changing bulbs
11	Recycling program (4 responses)
12	Bio Solids from local wastewater plant for property that is farmed under license agreement. The

	airport receives revenue from the wastewater utility and the farmer/tenant receives free fertilizer. The utility saves on transportation costs associated with taking it to the landfill. Also, reduced emissions as the distance to the airport is a fraction when compared with the distance to landfill. The solid waste utility scores also as it helps with its efforts to meet/sustain diversion rules.
13	Photovoltaic System (2 responses)
14	Once completed, reduction of fuel and carbon footprint when airport circulatory roadway system is revised
15	Waste Audit (2 responses)
16	Recycling Construction waste materials
17	Adding trees to a parking lot expansion project
18	135 kW Solar System
19	Utilize conference calls
20	Restaurant food composting
21	Fly Quiet program
22	3rd Party solar (with utility incentives)
23	Comingled Recycling—Free Tipping Fee
24	Adjusted set point for heating and cooling
25	Dredged seaplane base to maintain water depths and floatplane access to the airport and aircraft maintenance shops
26	New taxiway high speed turnoffs reduces taxiing time, thus reducing fuel burn
27	Anti-idling training for vehicles
28	Vehicle charging stations
29	Encourage the use of Single Engine Aircraft Taxi
30	Single stream recycling
31	We have not introduced any no or low cost initiatives. All of our attempts have had financial

	impacts with an ROI of below three years
32	Commute solutions
33	Nature Park Partnership
34	Various energy retrofits
35	Daylight controls
36	Replaced 30 sodium vapor street lights with LED to reduce power costs
37	Integrating sustainable/green principles into projects during design development
38	Automated aircraft releases
39	HVAC temperature control space management
40	Electric GSE
41	Construction Sustainability checklist

APPENDIX B

List of Airports Responding to the Survey

Allegheny County Airport Authority (Pittsburgh Int'l Airport)	PA
Aspen/Pitkin County Airport	CO
Austin–Bergstrom International Airport	TX
City of Phoenix Aviation Dept. (Deer Valley Airport and Goodyear Airport)	AZ
Dayton International Airport	OH
Fresno Yosemite International Airport	CA
Huntington Tri-State Airport	WV
Indianapolis Airport Authority (Indianapolis Int'l Airport)	IN
Ithaca Tompkins Regional Airport	NY
John Wayne Airport	CA
Kent State University Airport	OH
Louisville Regional Airport Authority (Louisville Int'l Airport)	KY
Monterey Peninsula Airport District	CA
Metropolitan Nashville Airport Authority (Nashville Int'l Airport)	TN
Nantucket Memorial Airport	MA
Newton City–County Airport	KS
NFTA–BNIA (Niagara Falls Int'l Airport and Buffalo Niagara Int'l Airport)	NY
Northwest Arkansas Regional Airport	AR
Outagamie County Regional Airport	WI
Port Authority of NY & NJ (Stewart Int'l Airport and Teterboro Airport)	NY
Portland International Jetport	ME
Redding Municipal Airport	CA
Roberts Field, Redmond Municipal Airport	OR
Reno–Tahoe Airport Authority (Reno–Tahoe Int'l Airport)	NV
Renton Municipal Airport	WA
South Bend International Airport	IN
University Park Airport (State College)	PA
Vero Beach Municipal Airport	FL
Westmoreland County Airport Authority (Arnold Palmer Regional Airport)	PA

APPENDIX C

Historical Context of Synthesis S14-02-11

The path leading to the funding for this synthesis began a number of years ago with a synergy of sustainability-focused activities.

ACRP Synthesis 10: Airport Sustainability Practices, which was published in 2008, explored and explained sustainability initiatives and practices at a wide variety of airports based on 25 survey responses from large, medium, small, and non-hub U.S. airports, and from airports in the United Kingdom, Europe, Asia, and Canada. Respondents from non-U.S. airports and large U.S. airports self-rated their airports' own performance at a higher level compared with medium and small U.S. airports. At that time, regulation and airport policy were identified as key drivers for implementation of sustainability practices. Out of the 25 airports responding to the Synthesis 10 survey, only one was non-hub and two were small hub airports. Therefore, the Synthesis 10 results, while illustrative and comprehensive, are less relevant for the medium and small airports covered in this Synthesis.

ACRP Report 80: Guidebook for Incorporating Sustainability into Traditional Airport Projects followed in 2012 and presented a guidebook and an evaluation tool, the Airport Sustainability Assessment Tool (ASAT), to assist airport personnel in selecting which practices would be most applicable and useful for their individual situations and environments.

With ever-increasing public and private sector concern about the environmental impacts from airport operations, ACRP commissioned two publications that highlighted environmental protection practices. *ACRP Report 43: Guidebook of Practices for Improving Environmental Performance at Small Airports*, published in 2011, served as a detailed and comprehensive resource on compliance with federal environmental laws for small hub, non-hub, reliever, and general aviation airports. The report guides airports on how to set and achieve environmental goals. Turning from smaller to larger airports, ACRP commissioned a study of environmental practices at large U.S. airports, and in 2014, *ACRP Synthesis 53: Outcomes of Green Initiatives: Large Airport Experience* was published. That document presented a summary of drivers, barriers, outcomes and lessons learned from green initiatives at fifteen large airports in the U.S. and Canada and offered examples of successful projects in the form of case studies derived from twelve of the airports. The focus of the report covered conventional environmental initiatives. Other components of sustainability programs, such as economic, social and operations were not specifically addressed.

Meanwhile, the U.S. Federal Aviation Administration ("FAA") decided to make sustainability a core objective in airport planning by supplying federal funding through its Airport Improvement Program ("AIP"). In December 2009, the Airport Planning and Environmental Division (APP-400) asked all regions to nominate airports that would be interested in participating in a pilot program focused on sustainability, and in May 2010 FAA published "Sustainable Airport Master Plans, Pilot Program Guidance" ("2010 FAA Interim Guidance"). The 2010 FAA Interim Guidance listed the elements that must be included or addressed in FAA AIP-funded plans: All plans must begin with a sustainability mission statement, and must then identify sustainability categories at the specific airport, such as socioeconomics, airport facilities and procedures and environmental resources. Airports must perform a baseline inventory or assessment of each defined sustainability category and establish measurable goals for each category. Next, airports identify and describe various sustainability initiatives for each goal. Public participation and outreach tailored to the needs of the airport and the community were encouraged. Designed to support sustainability as part of master plans as well as stand-alone sustainability management plans, FAA launched the program in 2010 by funding the first Sustainable Master Plan at Ithaca-Tompkins Regional Airport in Ithaca, New York, and the first Sustainable Management Plan at Northeast Florida Regional Airport in St. Augustine, Florida. The success of those two precursor programs led to funding for an additional ten pilot programs in that same year, and another 33 airports subsequently received funding through AIP for their sustainability programs. At the end of 2012, FAA published its "Report on the Sustainable Master Plan Pilot

Program and Lessons Learned” (“2012 FAA Lessons Learned”) to summarize the progress of the programs. The 2012 FAA Lessons Learned divides those lessons learned into five categories:

1. Plan Preparation: Document Types, Development Process, and Timelines
2. Sustainability Categories
3. Baseline Assessments
4. Sustainability Goals and Objectives
5. Outreach and Stakeholder Engagement

Contemporaneously with ACRP and FAA efforts, a group of volunteers formed the Sustainable Aviation Guidance Alliance (“SAGA”) in 2008 to advise airports on sustainability actions that work for their sector. SAGA offers a database of sustainability initiatives, and the survey results of this Synthesis mirror SAGA’s recommendations. For example, SAGA suggests each airport adopt its own definition of sustainability, and the surveyed airports each had a different working definition of sustainable activity. SAGA recommends a consensus-based approach, and a number of the airports surveyed for this synthesis involved key stakeholders in developing the sustainability program. SAGA also recommends selecting a champion, an advisory council, a steering committee and implementation teams, all of which were part of sustainability programs at airports interviewed for this Synthesis. SAGA’s database currently lists 972 sustainability practices.

Contributing to the synergy of sustainability focus within the airport community, Airports Council International-North America (“ACI-NA”) proposed in February 2008 to add sustainable operations to the conventional triple bottom line framework of financial, environmental and social sustainability. ACI-NA adopted a sustainability policy based on what it called the EONS approach. Airports accept the standard and use it to structure sustainability programs. EONS is defined as follows:

- Economic Viability
- Operational Excellence
- Natural Resource Conservation and Preservation
- Social Responsibility

APPENDIX D

Airport Sustainability Tracking Tools

OUTAGAMIE COUNTY REGIONAL AIRPORT SUSTAINABILITY TRACKING TOOL

Copy of Airports_Outagamie_ACRP Gas kWh Trends.xlsx

Historical energy usage data for selected airport-controlled buildings.

HISTORICAL ELECTRICITY CONSUMPTION								
	2006	2007	2008	2009	2010	2011	2012	2013
	[kWh]	[kWh]	[kWh]	[kWh]	[kWh]	[kWh]	[kWh]	[kWh]
Passenger Terminal	3,156,840	3,412,920	3,368,280	3,316,680	3,336,000	3,051,960	3,011,160	2,867,640
SRE*	116,400	125,560	136,640	111,280	114,480	121,040	124,840	110,480
ARFF**	--	--	97,240	105,480	118,160	115,600	104,720	102,560
Glycol Building	--	--	--	--	5,036†	20,134	21,261	19,871
Annual Total	3,273,240	3,538,480	3,602,160	3,533,440	3,568,640	3,308,734	3,261,981	3,100,551
HISTORICAL NATURAL GAS CONSUMPTION								
	2006	2007	2008	2009	2010	2011	2012	2013
	[therm]	[therm]	[therm]	[therm]	[therm]	[therm]	[therm]	[therm]
Passenger Terminal	43,992	53,881	67,415	71,363	57,769	57,807	52,443	62,203
SRE*	9,803	13,339	18,473	15,007	11,570	15,149	12,229	19,828
ARFF**	--	--	10,462	9,440	8,191	7,196	6,498	9,519
Glycol Building	--	--	--	--	2987†	2,519	4,060	5,671
Annual Total	53,795	67,220	96,350	95,810	77,530	82,671	75,230	97,221
<i>*Snow Removal Equipment; **Air Rescue and Fire Fighting; †Partial year</i>								

TETERBORO AIRPORT SUSTAINABILITY TRACKING TOOL

GRI Airport Operators Sector Supplement Metrics							
EC1: Economic Performance		2006	2009	2010	2011	2012	2013
Revenues							\$38,901,000
Operating Costs							\$24,640,000
Capital Investments							\$39,424,090
FAA Grants (AIP)							\$13,300,000
Employee Compensation							\$7,623,000
Donations/Community Investment							N/A
Retained earnings							N/A
Payments to capital providers/governments							\$40,000
Non aeronautical income as percentage of total revenues							
Total Revenue							\$38,901,000
Total Expenditure							\$32,303,000
EC4		2006	2009	2010	2011	2012	2013
Financial Assistance Received from Government (AIP Funding)							\$13,300,000
A02: Aircraft Movements		2006	2009	2010	2011	2012	2013
Commercial Passenger Aircraft Movements	Domestic						
	International						
	Total	0	-	-	-	-	-
Cargo Aircraft Movements	Domestic						
	International						
	Total	0	0	0	0	0	0
Government and General Aviation Aircraft Movements	Domestic	187,840	137,890	149,530	152,247	145,690	
	International						
	Total	187,840	137,890	149,530	152,247	145,690	0
Total Movements (all aircraft types)		187,840	137,890	149,530	152,247	145,690	155,032
Day/Night Ratio							
EN3-Direct Energy Consumption (Vehicle fuel and Building Natural Gas)		2006	2009	2010	2011	2012	2013
Energy Consumption-Renewable Sources (GJ)			0	0	0	0	0
Energy Consumption-Non-Renewable Sources (GJ)			10,907	12,576	13,846	8,193	8,322
Energy Consumption-Total (GJ)		0					
EN4-Indirect Energy Consumption (Electricity)		2006	2009	2010	2011	2012	2013
Energy Consumption-Renewable Sources (GJ)			0	0	0	0	0
Energy Consumption-Non-Renewable Sources (GJ)			7,272	6,402	7,586	6,977	8,140
Energy Consumption-Total (GJ)		0					
EN5-Energy Saved through Conservation		2006	2009	2010	2011	2012	2013
Energy Conserved (kJ)							
A04-Quality of Stormwater by Regulatory Standards		2006	2009	2010	2011	2012	2013
Sample Locations (number)		2	2	2	2	2	2
Sample Frequency		Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Incidences of non-compliance		0	2	2	0	2	3

EN16-Total Direct and Indirect GHG Emissions by Weight	2006	2009	2010	2011	2012	2013
Direct GHG Emissions -Tons CO2e					415	
Indirect GHG Emissions -Tons CO2e		90,725			78,747	
Total GHG Emissions -Tons CO2e		90,725			79,162	
EN17-Other Relevant Indirect GHG Emissions by Weight	2006	2009	2010	2011	2012	2013
Aircraft LTO Emissions -Tons CO2e	120,198	88,230			61,924	
EN19-Emissions of Ozone Depleting Substances by Weight	2006	2009	2010	2011	2012	2013
Ozone Depleting Substances-Tons CO2e					34.72	
EN22-Waste by Type and Disposal Method	2006	2009	2010	2011	2012	2013
Waste for Landfill-Tons						198
Waste for Recycling-Tons						18
EN23-Total Number and Volume of Significant Spills	2006	2009	2010	2011	2012	2013
Number of Significant Spills	8	3	6	5	6	3
Volume (total) of Significant Spills	290	55	125.5	86	202	16
A06-Aircraft and Pavement Deicing/Anti-Icing Fluid	2006	2009	2010	2011	2012	2013
Aircraft Deicing/Anti Icing Fluid Used, Gallons (neat fluid)		28,504	42,183	73,171	21,384	85,050
Pavement deicers, Gallons	58,300	133,225	110,500	182,500	119,360	235,000
Pavement deicers, tons	0	19	32	43	13	15
EN28-Environmental Fines	2006	2009	2010	2011	2012	2013
Monetary value of fines paid for non-compliance with environmental regulations and sanctions						0
A07-Noise Impacts	2006	2009	2010	2011	2012	2013
Number of people residing within DNL 85		680				680
Percentage change of people residing within DNL 85						0

Section 2. Additional Sustainability Metrics							
Airport Profile		2006	2009	2010	2011	2012	2013
Port Authority-controlled floor space (sq. ft.)		20,000	26,500	26,500	26,500	26,500	26,500
Total number of fixed-base operators	Number of FBO's	5	5	5	5	5	5
	Square Footage Area		798,900	798,900	798,900	798,900	798,900
GHG Emissions Summary		2006	2009	2010	2011	2012	2013
Total Direct and indirect GHG emissions (MT CO2e)		122,538	90,708			79,635	
CO2e emissions per operation (MT CO2e/operation)		0.652	0.658			0.548	
Scope I & II CO2e emissions (MT CO2e)		5	2			1,379	
Scope III CO2e emissions (MT CO2e)		122,538	90,708			78,156	
Tons per year savings (compared to 2006) (MT CO2e)			31,830			44,382	
Offsets procured - including RECs (MT CO2e)		0	82,500				
Air Quality		2006	2009	2010	2011	2012	2013
Criteria air pollutant emissions	SO ₂	43	36		26	30.2	30.2
	NO _x	280	159		152	147.6	147.6
	PM _{2.5}	46	42		6	9.6	9.6
	PM ₁₀	49	43		6	9.6	9.6

Vehicle Fleets (# of vehicles)		2006	2009	2010	2011	2012	2013
Bifuel		--	--	--	--	--	--
BioDiesel		25	25	23	23	23	27
CNG		--	--	--	--	--	--
Flex Fuel		--	--	--	--	--	--
Gasoline		17	14	15	15	14	14
Hybrid		5	5	6	8	8	8
Hydrogen		--	--	--	--	--	--
Subtotal Alternative Fuel Vehicles							36
Total of all Vehicles							49
Alternative Fuel % of Total							71.43%
Vehicle Energy Consumption		2006	2009	2010	2011	2012	2013
Gasoline (gal)			11,600	11,777	15,010	10,547	12,298
Biodiesel (gal)		--	--	--	--	--	--
Diesel fuel (gal)		5,058	8,669	8,880	10,466	6,975	8,707
E-85 (gal)		--	--	--	--	--	--
Hybrid (gal)		--	--	--	--	--	--
CNG (gge)		--	--	--	--	--	--
Building Energy Consumption		2006	2009	2010	2011	2012	2013
kWh		1,470,000	2,020,000	1,778,352	2,107,272	1,938,182	2,261,057
Electricity (kWh, kWh/sq. ft)		73.5	76.2	67.11	79.52	73.14	85.32
kWh per square foot		44,000	90,000	105,617	113,920	69,611	68,830
Natural Gas (therms, therms/pax, therms/ft2)							
Renewable energy generated on-site (kWh output)			286,000				
Noise		2006	2008	2010	2011	2012	2013
Number of noise related complaints		894	715	520	2,687	2,438	1,999
Number of complainants		239	196	160	188	186	150
Safety		2006	2009	2010	2011	2012	2013
Total wildlife Strikes		71	95	54	65	73	92
Damaging wildlife Strikes		3	3	3	1	1	1
A09: Number of wildlife strikes per 10,000 aircraft movements		3.47	6.53	3.85	4.10	4.87	5.57
Waste		2006	2009	2010	2011	2012	2013
Total non-hazardous waste produced in PA areas (tons)		401.4	682.2				198
Total hazardous waste produced (gal)		150	150	150	150	150	150
Total construction waste recycled (tons)			0				0
Total composted (tons)		0	0				0
Water Quality		2006	2009	2010	2011	2012	2013
Total number of permit exceedances		0	2	2	0	2	3
Total number of spills			27	28	37	37	31

Community Engagement		2006	2009	2010	2011	2012	2013
Number of events for the community hosted by the airport		5	5	5	5	5	5
Economic Impacts		2006	2009	2010	2011	2012	2013
Direct jobs created by airport		1,200					1,834
Indirect jobs created by airport		16,000					13,071
Actual percent of DBE business over total contracts	MBE	14.9%	16.1%				12.0%
	WBE	6.3%	3.4%				5.0%

RENTON MUNICIPAL AIRPORT SUSTAINABILITY TRACKING TOOL

A		B	C	D	E	F	G	H	I				
1													
2						Initiative 1-2015	Initiative 2-2015						
3	Renton Municipal Airport Sustainability Management Plan Initiative Considered in 2015					Category		Key Purposes		Key Purposes			
4						Economic	Operational	Natural Environment	Social				
5													
6													
7	Airport Finance												
8	Provide an economically stable asset that contributes to the community	X			X								
9	Balance expenditures with revenue to remain financially self-sufficient in the long-term	X											
10	Improve revenue to provide for future development opportunities	X											
11	Provide financial capacity that will enable the Airport to pursue sustainability initiatives in the future	X	X	X	X								
12	Airport and Local Economic Values												
13	Attract airport tenants and aircraft operations that add economic value to the local economy	X											
14	Continuously improve as a tier one supplier for Boeing aircraft manufacturing	X	X		X								
15	Diversify tenants and aviation services for land and sea based operations	X	X										
16	Increase employment	X			X								
17	Community Outreach and Education												
18	Continuously improve the airport's relations with the surrounding community and with airport tenants				X								
19	Raise community awareness of airport services and value to regional employment				X								
20	Energy Consumption / Greenhouse Gases												
21	Reduce energy consumption without adversely affecting the Airport or its tenants	X		X									
22	Reduce Airport owned greenhouse gas emissions 15% below 2005 levels by 2020			X									
	Noise from Aircraft Operations												
		I Sum 2015	Summary of Categories	Aircraft Operations	Airport Financials	Economic Va							

READY

	A	B	C	D	E	F	G	H	I	
1										
2						Initiative 1-2015	Initiative 2-2015			
3	Renton Municipal Airport Sustainability Management Plan Initiative Considered in 2015	Economic Operational Natural Environment Social	Category			Key Purposes	Key Purposes			
4										
5										
6										
22			Reduce Airport owned greenhouse gas emissions 15% below 2005 levels by 2020			X				
23			Noise from Aircraft Operations							
24	Maintain 65 DNL noise contour on airport property			X	X					
25	Reduce aircraft noise over neighborhoods			X	X					
26	Operations and Maintenance of Airport Facilities									
27	Maintain a safe airport on a daily basis		X							
28	Maintain airport and seaplane infrastructure in good condition		X							
29	Water Quality									
30	Reduce stormwater runoff quantity			X						
31	Improve stormwater quality			X						
32										
33	IMPLEMENTED									
34										
35		Economic				0	0			
36		Operational				0	0			
37		Natural Environment				0	0			
38		Social				0	0			

NORTHWEST ARKANSAS REGIONAL AIRPORT SUSTAINABILITY TRACKING TOOL

		Category				Initiative 1-2014	Initiative 2-2014
		Economic	Operational	Natural Environment	Social	LED replacement on roadway a	Key Purposes
Northwest Arkansas Regional Airport Sustainable Master Plan Initiatives Considered in 2014						decrease energy consumption and cost	
AIRPORT GOALS							
Airport Finance							
	Increase annual revenue to enhance ability to be self-sustaining	X			X		
	Increase number of seats available and/or destinations served by commercial service air carriers at the Airport	X			X		
	Improve revenue to provide for future development opportunities	X			X		
	Provide financial capacity that will enable the Airport to pursue sustainability initiatives in the future	X	X	X	X		
Energy Consumption / Greenhouse Gases							
	Reduce the total energy consumption at the Airport without adversely affecting operations, tenants or user experience	X	X	X	X		
	Reduce greenhouse gas emissions at the Airport (Airport owned)	X	X	X	X		
	Increase the efficiency of the heating and cooling systems at the Airport	X	X	X	X		
	Reduce lighting use/costs on the landside	X	X	X	X		
Operations and Maintenance of Airport							
	Continue to provide and maintain a safe and efficient Airport		X		X		
	Maintain airport facilities and infrastructure in good condition	X	X		X		
	Use sustainability principles to maximize operational efficiency, reduce long-term maintenance costs and to improve the environment	X	X	X	X		
	Reduce potential for wildlife hazards at the Airport	X	X	X	X		
Waste Management/Recycling							
	Reduction of overall waste	X		X	X		
	Increase recycling by 5% annually	X		X	X		
	Reduce overall construction waste	X		X	X		

Initiative Affect
Choose if the initiative would be positive, neutral, or negative

1							0
2							
3							
4	Northwest Arkansas Regional Airport Sustainable Master Plan Initiatives Considered in 2014	Category Economic Operational Natural Environment Social				Initiative 1-2014 LED replacement on roadway a Key Purposes decrease energy consumption and cost	Initiative 2-2014 Key Purposes
5							
6							
7	AIRPORT GOALS						
27	Constuction Management						
28	Implement sustainable design and construction	X	X	X	X		
29	SECONDARY CATEGORIES						
30	Water Quality						
31	Continue to meet water quality standards set in the Storm Water Treatment Plan	X		X	X	Initiative Affect Choose if the initiative would be positive, neutral, or negative	
32	Ensure any additional pavement additions with respect to existing storm water treatment requirements to meet or exceed water quality regulations			X	X		
33	Maximize water efficiency within buildings and airport property to reduce the burden on the local water supply	X		X	X		
34	Community Relations and Education						
35	Continue to provide and improve user experience through sustainable improvement of facilities (including traffic flow), concessions, and service at the Airport to create a sustainable partnership with the Airport and the public			X	X		
36	Effectively communicate all airport sustainability initiatives to airport employees, tenants, users and the community.			X	X		
37	Continue to make the Airport a visible partner in the community through public outreach			X	X		
38	Natural Habitats						
39	Manage existing habitat on the airport property to protect habitat, where able, while ensuring the safe and efficient operation of the Airport		X	X			
40	Air Quality (NAAQS)						
41	Continue to implement best management practices for construction to reduce potential air quality issues			X	X		
42	Reduce the Airport's contribution to climate change, air pollution and depletion of the ozone layer			X	X		
43							
44	IMPLEMENTED						
	< > ... Airport Financials Aircraft Operations Economic Values GHG and Energy Summary						
	READY						

APPENDIX E

Publications Addressing Airport Sustainability

ACRP PUBLICATIONS (59)

2008

ACRP Synthesis 6: Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure (2008)

<http://www.trb.org/Publications/Blurbs/157067.aspx>

ACRP Synthesis 10: Airport Sustainability Practices (2008)

<http://www.trb.org/main/blurbs/160369.aspx>

ACRP Report 6: Research Needs Associated with Particulate Emissions at Airports (2008)

<http://www.trb.org/Publications/Blurbs/160036.aspx>

ACRP Report 7: Aircraft and Airport-Related Hazardous Air Pollutants: Research Needs and Analysis (2008)

<http://www.trb.org/Publications/Blurbs/160113.aspx>

ACRP Research Results Digest 2: Model for Improving Energy Use in U.S. Airport Facilities (2008)

<http://www.trb.org/Publications/Blurbs/159312.aspx>

2009

ACRP Synthesis 11: Impact of Airport Rubber Removal Techniques on Runways (2009)

<http://www.trb.org/Publications/Blurbs/160656.aspx>

ACRP Synthesis 16: Compilation of Noise Programs in Areas Outside DNL 65 (2009)

<http://www.trb.org/Publications/Blurbs/162086.aspx>

ACRP Synthesis 17: Approaches to Integrating Airport Development and Federal Environmental Review Processes (2009)

<http://www.trb.org/Publications/Blurbs/162542.aspx>

ACRP Report 9: Summarizing and Interpreting Aircraft Gaseous and Particulate Emissions Data (2009)

<http://www.trb.org/Publications/Blurbs/160507.aspx>

ACRP Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (2009)

<http://www.trb.org/Publications/Blurbs/160829.aspx>

ACRP Report 14: Deicing Planning Guidelines and Practices for Stormwater Management Systems (2009)

<http://www.trb.org/Publications/Blurbs/161758.aspx>

ACRP Web-Only Document 9: Enhanced Modeling of Aircraft Taxiway Noise, Volume 1: Scoping (2009)

<http://www.trb.org/Publications/Blurbs/162509.aspx>

2010

ACRP Report 15: Aircraft Noise: A Toolkit for Managing Community Expectations (2010)

<http://www.trb.org/Publications/Blurbs/162800.aspx>

ACRP Report 27: Enhancing Airport Land Use Compatibility, Volume 1: Land Use Fundamentals and Implementation Resources (2010)

<http://www.trb.org/Publications/Blurbs/163344.aspx>

ACRP Report 27: Enhancing Airport Land Use Compatibility, Volume 2: Land Use Survey and Case Study Summaries (2010)

<http://www.trb.org/Publications/Blurbs/163345.aspx>

ACRP Report 32: Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports (2010)

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ACRP Research Results Digest 9: Alternative Aircraft and Pavement Deicers and Anti-Icing Formulations with Improved Environmental Characteristics (2010)

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Abbreviations used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International-North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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