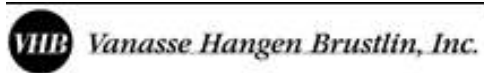




Sustainability Master Plan

Prepared for: City of Dayton Department of Aviation
Prepared by:



101 Walnut Street
Watertown, MA 02472

With:



INCORPORATED



August 29, 2014



The following is our Sustainability Master Plan for the Dayton International Airport.

Implementing a strategy based on Sustainability is necessary to maintain the economic viability of the Airport and the Region as a whole. The Development of our Sustainability Master Plan takes our program to the next level and ensures its success. The Plan is our guide to improving our operations while reducing our environmental impact. You will find detailed descriptions on what Sustainability means to the Aviation Industry and a prioritized list of initiatives designed to advance our sustainability goals in the areas of Energy Conservation, People, Environmental Stewardship, Sustainable Investment and Resiliency.

We want to thank the many folks who helped us, including the FAA for seeing the value in sustainability and having the foresight to encourage airports to include sustainability in their master planning process.

If we're going to protect the long-term use of airports in an increasingly populated area, we need to be less intrusive and find ways to contribute in a positive way to our surroundings.

Sincerely,



Terrence G. Slaybaugh
Director of Aviation



Acknowledgments

The consultant team worked directly with the City of Dayton’s Department of Aviation, Division of Airport Facilities and Operations staff in the development of this study. The consultant team would also like to thank the following individuals and groups for their valuable input and participation on this project:

- DAY Executive Leadership – Director of Aviation, Terrence Slaybaugh
- DAY Sustainability Committee
- Federal Aviation Administration (FAA) Great Lakes Region and Detroit Airports District Office
- DAY tenants
- Aullwood Audubon Center and Farm, especially Charity Krueger, Executive Director

The Sustainability Master Plan was prepared for the City of Dayton’s Department of Aviation by a consultant team led by Vanasse Hangen Brustlin, Inc. (VHB):

Vanasse Hangen Brustlin, Inc	www.vhb.com
KB Environmental Sciences, Inc.	www.kbenv.com
LWC Incorporated	www.lwcinspires.com
Passero Associates	www.passero.com



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Executive Summary

The Department of Aviation has been engaged in environmentally-friendly and sustainable practices for years; many of which are described throughout this report. The Sustainability Master Plan provides a summary of the operational performance, goals, and recommended sustainability initiatives and implementation program for the James M. Cox Dayton International Airport (DAY or the Airport). The Airport's Sustainability Master Plan is partially funded through a grant from the Federal Aviation Administration (FAA) as part of the agency's Sustainable Master Plan Pilot Program.

The planning process depicted in **Figure E-1** provided flexibility for DAY to consider its operating environment and resources.

Sustainability Baseline Assessment

This plan focuses on the most current readily available information,¹ as well as calculating current rates of resource consumption, identifying any gaps in data tracking, and highlighting current and potential initiatives related to sustainability. Understanding DAY's current levels of sustainability performance will enable its owner and operator – the City of Dayton Department of Aviation – to evaluate the impact of future sustainability efforts as well as to track progress on achieving its sustainability goals and objectives. In addition to understanding the Airport's sustainability performance in each of the areas outlined above, this plan seeks to outline how the Airport can approach, manage, and track sustainability. Understanding this is critical to understanding how best to implement initiatives in order to achieve the Airport's sustainability goals.

What is "Sustainability"?

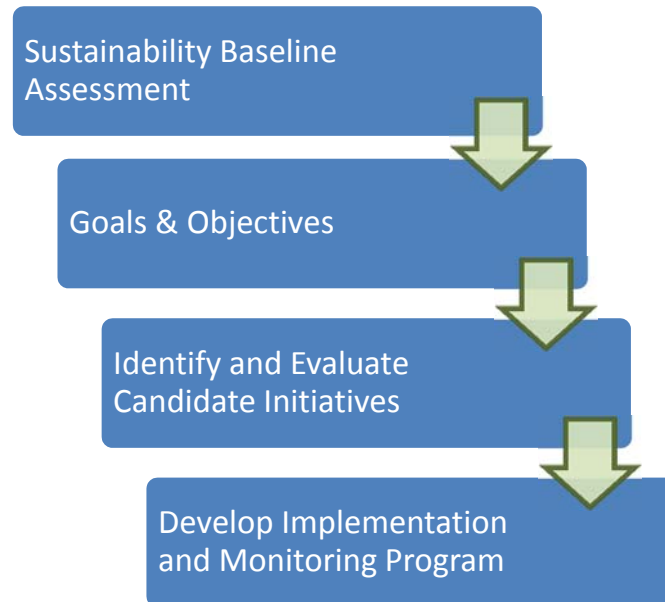
Sustainability has redefined the values and criteria for measuring organizational success by using a "triple bottom line" approach that considers economic, ecological and social well-being. Applying this approach to decision-making is a practical way to optimize economic, environmental and social capital. Consistent with the Airports Council International - North America's (ACI-NA) definition of Airport Sustainability, DAY is focused on a holistic approach to managing its airport to ensure **Economic** viability, **Operational** efficiency, **Natural** resource conservation, and **Social** responsibility (EONS).



¹ Data was collected through September 2013.

FIGURE E-1

DAY Sustainability Master Planning Process



Source: VHB, 2013.

Goals & Objectives

The intent of identifying a mission statement, goals, and objectives is to define DAY's commitment to financial, social, and environmental sustainability. High level goals have been developed for each area of sustainability, supported by objectives that are measurable and specifically designed to help the Airport achieve each goal. These goals and objectives also support the overall vision of sustainability for the Airport.

DAY Sustainability Mission Statement

At the crossroads of innovation and sustainability, Dayton 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.



Based on the information obtained during the baseline assessment and coordination meetings with Airport management, goals were developed to enhance DAY's sustainability efforts for each focus area. The following sustainability goals were developed in support of this Sustainability Master Plan (PRESS):

- People:** DAY will implement actions to enhance the passenger experience and promote the well-being of Airport employees.
- Resiliency:** DAY will embrace regional efforts to implement actions to enhance the Airport's resilience to impacts associated with climate change.
- Energy:** DAY will utilize design and operational techniques to maximize energy efficiency and the use of clean and renewable energy sources.
- Stewards of the Environment:** DAY will play a leadership role in the community by minimizing the Airport's impacts to the natural environment and consumption of natural resources.
- Sustainable Investment:** DAY will engage in sustainable and responsible investment of its land, capital, and human resources to contribute to a thriving regional economy that attracts and retains business partners.

Candidate Initiatives and Implementation/Monitoring Program

In an effort to implement and track the sustainability initiatives and strategies developed for the DAY, the Sustainability Advisory Committee (SAC) and the Airport's planning team developed a strategy of implementing a "Playbook", which could be used by the Airport's support staff to achieve sustainability goals and monitor the progress over a period of time. The "Playbook" concept focuses on Airport owned and operated facilities only and not facilities/equipment occupied or operated by Tenants. It is the goal of the SAC that the methodologies and strategies employed by the Airport will also serve as a reference or guide for Airport Tenants as they implement their own improvement projects. The "Playbook" includes detailed information or Highlight Sheets for each of the priority short term initiatives for each sustainability goal category. This document can be used as a quick reference guidance document for members of the Airport's staff who volunteer to be part of the "DAY Sustainability Green Team".

Performance Monitoring spreadsheets were developed for each of the primary goal categories. Each spreadsheet contains the progress to date of the top ranked initiatives, responsible party (or parties), and the opportunity to provide self-scores or grades for the team.

In addition to monitoring the performance of implementing various initiatives, the Airport will also be monitoring its overall sustainability performance with an Annual Sustainability Report Card, or "Scoreboard". Sustainability performance tracking is an important focus to ensure that the plan and initiatives are implemented effectively and progress is reported. The Scoreboard is an Excel-based tool that can be updated with appropriate data over time by the Airport, and provides a snapshot of sustainability performance with metrics.

1 Introduction

1.1 What is “Sustainability”?

Sustainability has redefined the values and criteria for measuring organizational success by using a "triple bottom line" approach that considers economic, ecological and social well-being. Applying this approach to decision-making is a practical way to optimize economic, environmental and social capital. Consistent with the Airports Council International - North America's (ACI-NA) definition of Airport Sustainability,² DAY is focused on a holistic approach to managing its airport to ensure **E**conomic viability, **O**perational efficiency, **N**atural resource conservation, and **S**ocial responsibility (EONS).



Source: Airports Council International - North America's (ACI-NA)

A key principle of sustainability is recognizing that addressing one concern does not necessarily come at the expense of another. Optimally, evaluating a project or activity based on environmental and social concerns will spur innovation that ultimately reduces costs over the life of the project.

² Airport Sustainability: A Holistic Approach to Effective Airport Management; accessed July 17, 2013: <http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf>



1.2 The DAY Sustainability Master Plan

The Sustainability Master Plan provides a summary of the operational performance, goals, and recommended sustainability initiatives and implementation program for the James M. Cox Dayton International Airport (DAY or the Airport). The Airport's Sustainability Master Plan is partially funded through a grant from the Federal Aviation Administration (FAA) as part of the agency's Sustainable Master Plan Pilot Program.

This plan focuses on the most current readily available information,³ as well as calculating current rates of resource consumption, identifying any gaps in data tracking, and highlighting current and potential initiatives related to sustainability. It also identifies DAY's goals and objectives in regards to sustainability and opportunities for improvements. This Sustainability Master Plan focuses on the following key areas (PRESS):

- People
- Resiliency
- Energy
- Stewards of the Environment
- Sustainable investment

Understanding DAY's current levels of sustainability performance will enable its owner and operator – the City of Dayton Department of Aviation - to evaluate the impact of future sustainability efforts as well as to track progress on achieving its sustainability goals and objectives. In addition to understanding the Airport's sustainability performance in each of the areas outlined above, this plan seeks to outline how the Airport can approach, manage, and track sustainability. Understanding this is critical to understanding how best to implement initiatives in order to achieve the Airport's sustainability goals.

The Department of Aviation has been engaged in environmentally-friendly and sustainable practices for years; many of which are described throughout this report. In 2007, the City of Dayton adopted a Sustainable Practices Policy, which calls for waste reduction practices, recycling, energy conservation measures, an environmentally preferable procurement policy, fuel-efficient vehicles, and vehicle anti-idling measures. The Department of Aviation is engaged in carrying out these efforts throughout its own facilities and operations.

FAA Sustainable Master Plan Pilot Program

FAA's objective is to make sustainability a core objective in airport planning. The agency is providing airports across the U. S. with funding to develop comprehensive sustainability planning documents, which include initiatives for reducing environmental impacts, achieving economic benefits, and increasing integration with local communities.

SOURCE:

<http://www.faa.gov/airports/environmental/sustainability/>

³ Data was collected through September 2013.



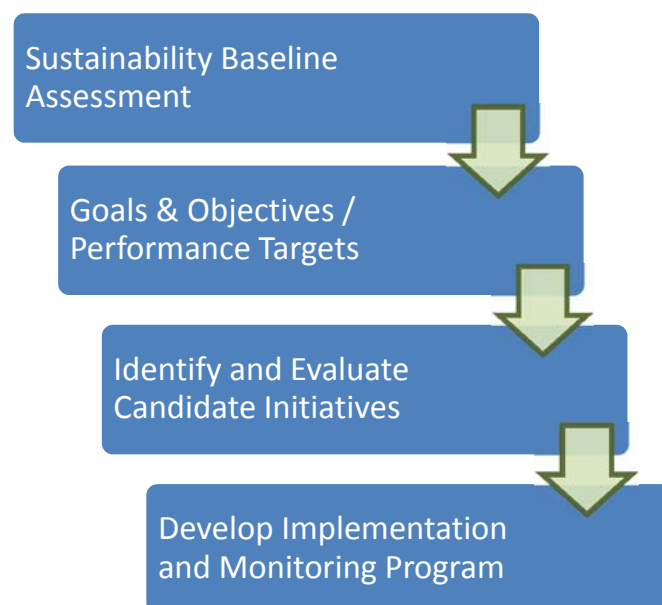
In 2012, the Airport was awarded the Dayton Regional Green 3 (DRG3) Green Business Certification by Montgomery County for promoting green practices and was re-certified in 2014. The Green Business Certification program is a voluntary program designated to help businesses take basic green measures to reduce their ecological footprint, reduce their energy and resource use, and save money in the process. Earning Green Business Certification indicates that DAY is a part of an innovative leadership movement to green their business operations and help transition to a sustainable future.

The planning process followed in this study (**Figure 1-1**) provided flexibility for DAY to consider its operating environment and resources, and included the following general steps:

- A **Sustainability Baseline Assessment** was conducted to provide an overview of the Airport's current sustainability performance, existing initiatives, data gaps, and organizational processes. The assessment laid the groundwork for the following steps in the planning process.
- **Goals and Objectives** were developed that reflected the Airports sustainability focus areas. **Performance targets** were identified to meet each objective to ensure consistent sustainability improvement.
- **Candidate sustainability initiatives** were identified to meet each goal and objective, then screened based on criteria to determine feasibility. The criteria included cost-effectiveness, sustainability impact, and operational feasibility.
- Finally, an **implementation and monitoring program** was developed for the Airport to effectively and efficiently implement the recommended sustainability initiatives, and track the organization's sustainability performance based on its goals, objectives and performance targets.

FIGURE 1-1

DAY Sustainability Master Planning Process



Source: VHB, 2013.

1.3 Sustainability Mission and Goals

The intent of identifying a mission statement, goals, and objectives is to define DAY's commitment to financial, social, and environmental sustainability. High level goals have been developed for each area of sustainability, supported by objectives that are measurable and specifically designed to help the Airport achieve each goal. These goals and objectives also support the overall vision of sustainability for the Airport.

Sustainability Mission Statement

A sustainability mission statement was developed to support DAY's vision and guide the Airport's future sustainability focus. This mission statement informed the development of sustainability goals (and ultimately, the objectives); and together, provide a guiding framework for DAY's sustainability program.

At the crossroads of innovation and sustainability, Dayton 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.



Sustainability Goals

Based on the information obtained during the baseline assessment and coordination meetings with Airport management, goals were developed to enhance DAY's sustainability efforts for each focus area. The following sustainability goals were developed in support of this Sustainability Master Plan (PRESS):



People

DAY will implement actions to enhance the passenger experience and promote the well-being of Airport employees.



Resiliency

DAY will embrace regional efforts to implement actions to enhance the Airport's resilience to impacts associated with climate change.



Energy

DAY will utilize design and operational techniques to maximize energy efficiency and the use of clean and renewable energy sources.



Stewards of the Environment

DAY will play a leadership role in the community by minimizing the Airport's impacts to the natural environment and consumption of natural resources.



Sustainable Investment

DAY will engage in sustainable and responsible investment of its land, capital, and human resources to contribute to a thriving regional economy that attracts and retains business partners.





1.4 Airport Background

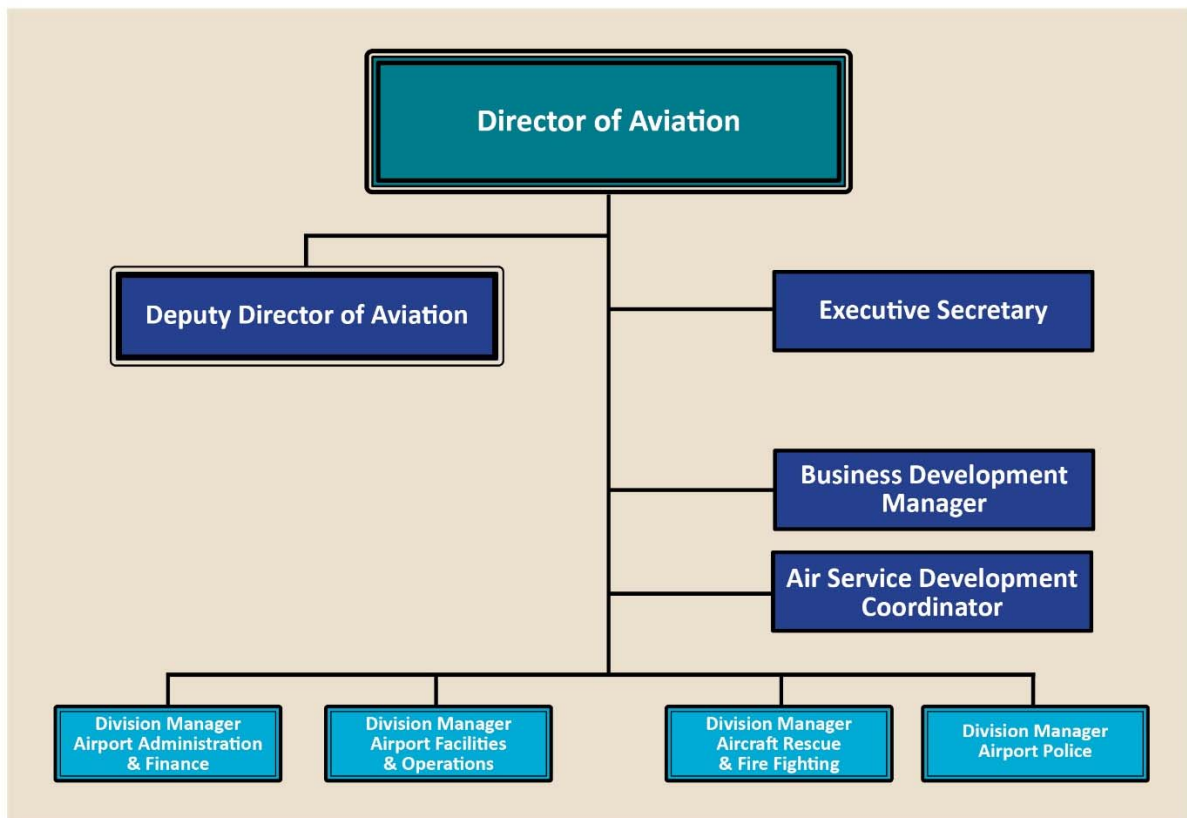
DAY is located at the “crossroads of America” at Interstate 70 and 75 in Vandalia, Montgomery County, Ohio, approximately nine miles north of downtown Dayton, with some property located in Miami County to the north. The Airport is owned by the City of Dayton and operated by the City’s Department of Aviation. The Department of Aviation also operates a general aviation reliever airport, Dayton-Wright Brothers Airport, located 12 miles south of the central business district of Dayton in Miami Township, Ohio, along State Route 741.

The Department of Aviation is led by the Director of Aviation, which reports to the City Manager. In addition to the Deputy Director of Aviation, four Division Managers lead the functional aspects of the Department (**Figure 1-2**). There are 135 full-time employees of the Department of Aviation.

FIGURE 1-2

Organizational Chart

City of Dayton Department of Aviation



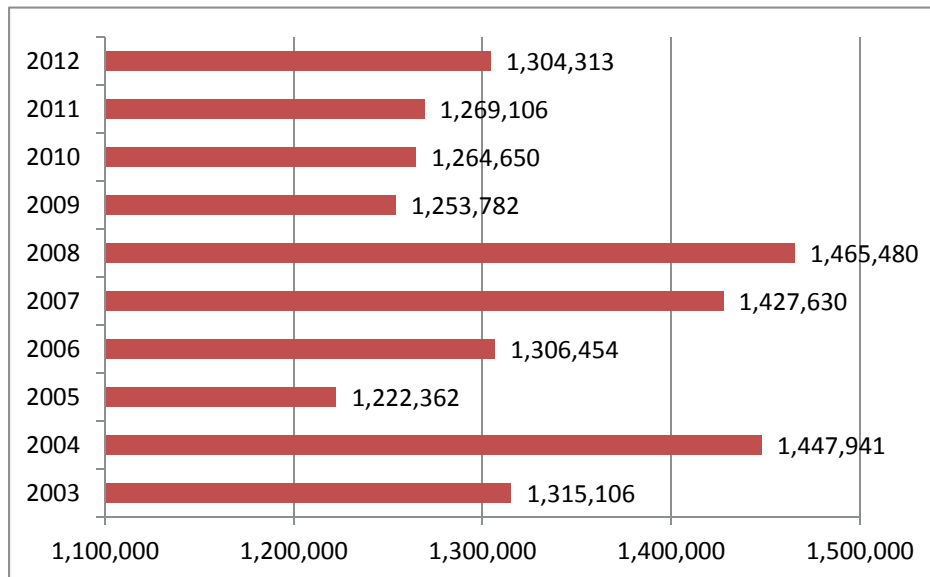


Airport Activity Levels

DAY is the third largest airport in Ohio with a total of 1,304,313 passenger enplanements and 57,914 aircraft operations in 2012.⁴ As shown in Figure 1-2, passenger enplanements peaked in 2008; after a sharp decline in 2009, enplanements are steadily increasing each year. Aircraft operations steadily decreased between 2003 and 2009, but have stabilized since 2009, as depicted in Figure 1-3. Air cargo significantly declined in 2007, when UPS Supply Chain Solutions no longer operated at DAY. The rapid decline of air cargo is clearly shown in Figure 1-4. Cargo has remained relatively stable since 2007, increasingly slightly in 2012.

FIGURE 1-3

DAY Passenger Enplanements



Source: DAY Passenger Enplanements and Air Cargo Trends.

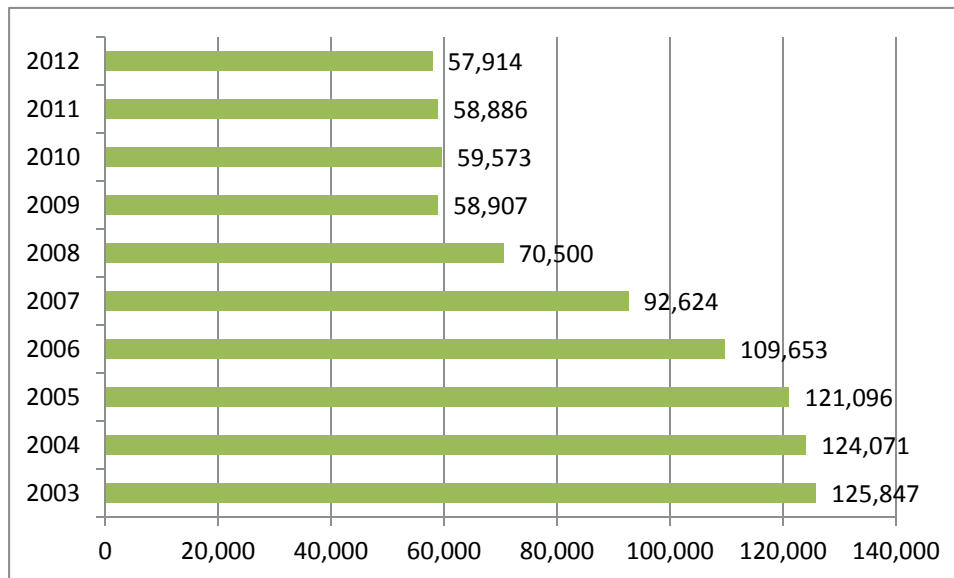
⁴ Passenger Enplanements and Air Cargo Trends For 2013

<http://www.flydayton.com/uploads/pdf/DAYStatsYTD201312.pdf>



FIGURE 1-4

DAY Aircraft Operations

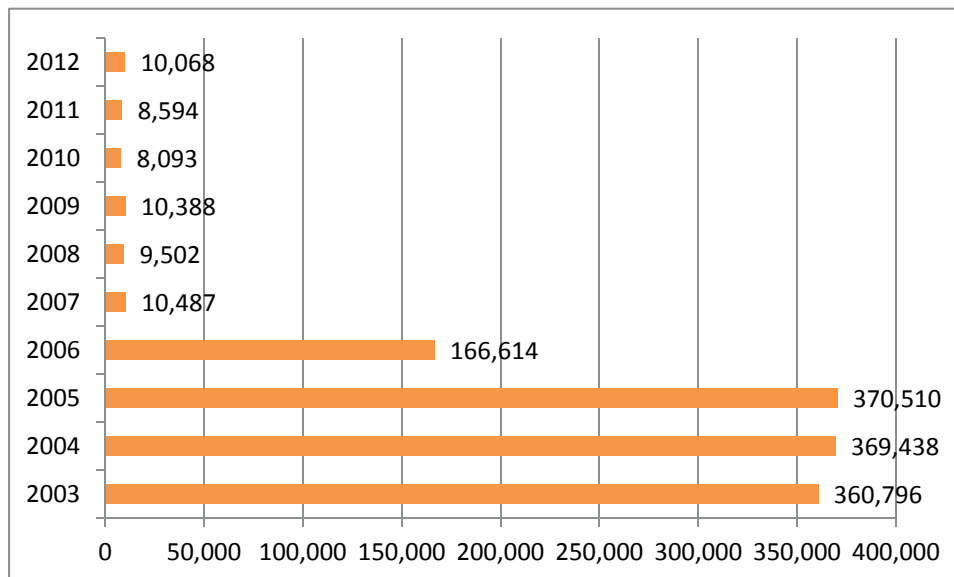


Source: DAY Passenger Enplanements and Air Cargo Trends.

FIGURE 1-5

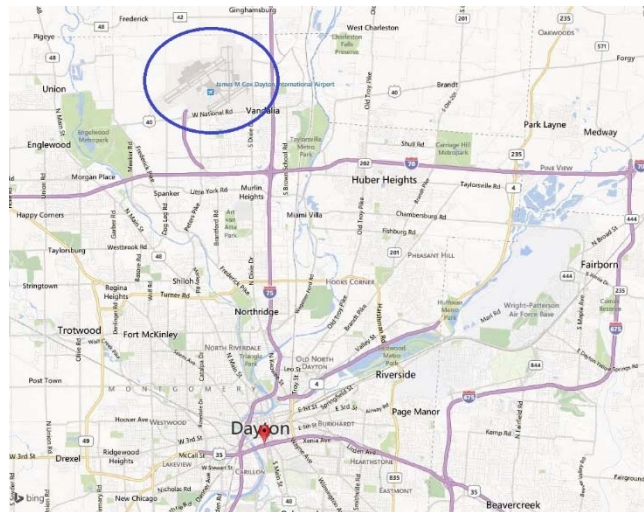
DAY Air Cargo (U.S. Tons)

Source: DAY Passenger Enplanements and Air Cargo Trends.



Ground Transportation Access and Parking

DAY is located just northwest of the intersection of Interstates 70 and 75 – commonly referred to as the “Crossroads of the America”. Typical travel times by automobile from downtown Dayton is 20 minutes. Ground access is also provided by Greater Dayton RTA which connects 23 communities in Montgomery County along with Wright State University and Wright Patterson Air Force Base. The RTA started express service to DAY in August 2013. The bus service frequency is based on the primary work shifts at DAY and other local employers.



Parking is conveniently located within walking distance to the Terminal Building. The Dayton International Airport operates 24 hours a day, seven days a week. If you are hungry or need a snack before your travel, stop by one of the Airport’s several eateries and restaurants. For passengers needing a last minute gift, amenity or just a newspaper or magazine, visit one of the many news and gift shops located throughout the Terminal Building and concourses.

Passengers parking at the Airport have several parking options. Combined, the parking lots provide more than 6,883 parking spaces (with color identification shown in Figure 1-6):

- Garage (Green): \$2 for each half hour; \$16 daily maximum – 1,375 spaces
- Valet: \$10 for 0-4 hours, \$2 for each additional hour; \$18 daily maximum
- Short Term Lot (Burgundy): Free for 0-30 minutes, \$3 for each additional half hour; \$24 daily maximum – 373 spaces
- Long Term Lot (Blue): \$2 for 0-1 hour, \$2 for each additional hour; \$14 daily maximum – 1,153 spaces
- Economy Lot (Red): \$2 for 0-1 hour, \$2 for each additional hour; \$6 daily maximum; \$36 weekly maximum – 2,382 spaces
- Overflow Lot (Brown): \$2 for 0-1 hour, \$2 for each additional hour; \$6 daily maximum; \$36 weekly maximum – 1,600 spaces
- Cell Phone Lot: Stop and wait for free.

Customers with disabilities receive the lowest hourly/daily parking rates available at the Airport in the garage, long term blue lot, and economy lot. Handicap parking spaces are available close to the elevators in the garage and near the shuttle pick-up areas in the parking lots. All Airport parking shuttles are lift-equipped.



FIGURE 1-6

DAY Parking



Source: DAY, 2013.

Airport Tenants

DAY hosts 3 fixed-base operators (FBOs), 31 tenants, and another 41 concessionaires, with a total of 1,073 full-time and 246 part-time employees. With its headquarters at DAY, PSA Airlines –operator of US Airways Express flights—is the largest single employer at the Airport.



Environmental and Sustainability Policies

The Department of Aviation has been engaged for many years with environmentally-friendly and sustainable practices, several of which are described throughout this baseline assessment. In 2007, the City of Dayton adopted a Sustainable Practices Policy, which calls for waste reduction practices, recycling, energy conservation measures, an environmentally preferable procurement policy, fuel-efficient vehicles, and vehicle anti-idling measures. The Department of Aviation is engaged in carrying out these efforts throughout its own facilities and operations. In 2012, the Airport was awarded the Dayton Regional Green 3 (DRG3) Green Business Certification by Montgomery County for promoting green practices and was re-certified in 2014.

The Green Business Certification program is a voluntary program designated to help businesses take basic green measures to reduce their ecological footprint, reduce their energy and resource use, and save money in the process. Earning Green Business Certification indicates that DAY is a part of an innovative leadership movement to green their business operations and help transition to a sustainable future.





2 Energy

Currently, the majority of energy at the Airport is consumed through the combustion of fossil fuels. As indicated in **Chapter 4**, this consumption is a significant contribution to GHG emissions and air pollution. Energy consumption is also a significant cost for the Department of Aviation and its tenants. Identifying ways to conserve energy will help DAY to both reduce environmental impacts and save money. Additionally, identifying opportunities to replace fossil-fuel based energy sources with cleaner alternative fuels will further diminish DAY's environmental impacts while increasing its resilience to power outages and fluctuating energy prices. All of these efforts will contribute to the airport's energy-related goals. In order to understand where the greatest opportunities for improvement are and to be able to track progress in achieving those goals, it was essential to assess baseline energy-related practices and performance.

2.1 Baseline Highlights

Performance Snapshot

Two sources were used for the energy data included in this baseline assessment. The City of Dayton conducted an Energy Analysis Review for the years 2006 through 2011 for all buildings and facilities controlled by the Airport. The results from this analysis are summarized in **Table 2-1** and **Figure 2-1**. Note that some of the changes in year-to-year data are due to structural or metering changes at the Airport and not necessarily due to increased or decreased energy efficiency.

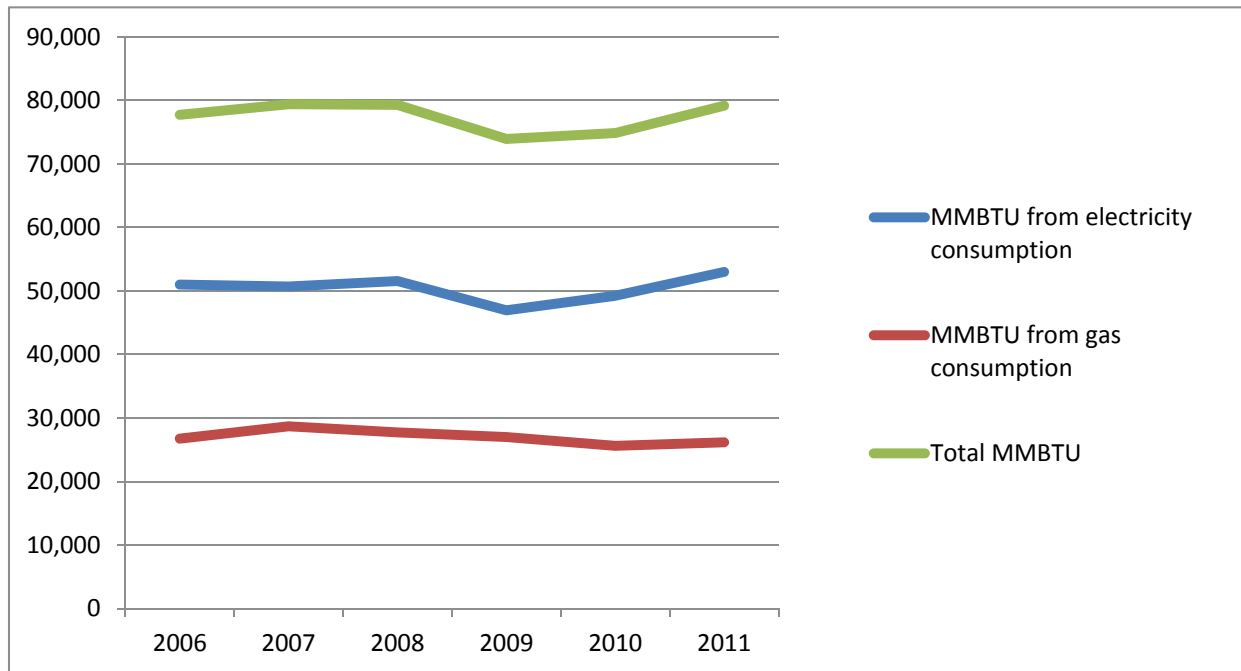
TABLE 2-1
Airport Energy Usage, Historical

	2006	2007	2008	2009	2010	2011
Electricity Usage (kWh)	14,947,550	14,862,597	15,114,741	13,761,218	14,434,637	15,530,988
Natural Gas usage (CCF)	261,246	280,219	270,840	263,612	250,170	255,626
Total Energy Usage (MMBTU)	77,753	79,406	79,306	73,947	74,868	79,168



FIGURE 2-1

Historical Energy Usage of Airport Facilities



As depicted in **Figure 2-1**, energy usage was largely consistent between 2006 and 2011. However, energy usage and electricity usage in particular, is responsible for significant contributions to greenhouse gas emissions as well as being a significant operational cost to the Airport. For these reasons, the Airport has already begun investigating opportunities for energy reduction and efficiency improvements.

The Airport recently conducted an energy audit for calendar year 2012 that included the passenger terminal, its three concourses (B, C and D; after the audit was completed, Concourse D was demolished and Concourse C has been renamed Concourse A), the airport traffic control tower (ATCT) and the parking garage. The audit was conducted with the goal of identifying and quantifying potential Energy Conservation Measures (ECMs) to be implemented at the Airport. Baseline energy usage as determined in the audit is summarized in **Table 2-2**.



TABLE 2-2

2012 Energy Usage, Selected Facilities

	KWH USED	ELECTRICITY MMBTU	ELECTRICITY COST	CCF NATURAL GAS USED	GAS MMBTU	NATURAL GAS COST	TOTAL MMBTU
Terminal, concourses, and ATCT	10,973,959	37,445	\$974,462	160,814	16,467	\$63,024	53,912
Parking garage	1,238,138	4,225	\$111,292	7,365	754	\$5,648	4,979
Total	12,212,097	41,670	\$1,085,754	168,179	17,221	\$68,672	58,891

Sources: *Energy Audit and Utility Assessment for Dayton International Airport*, Applied Resource Management, LLC (ARM), March 1, 2013; *Parking Garage Level III Utility Audit and Lighting Assessment for Dayton International Airport*, Applied Resource Management, LLC (ARM), March 1, 2013.

Existing Initiatives

The following table details the energy-efficiency related initiatives implemented at DAY. In addition to information about the initiatives, it also includes the sustainability benefits and EONS categories associated with each initiative. Many initiatives benefit more than one aspect of sustainability; the “EONS” categories refer to the four aspects that underlie airport sustainability: economic viability, operational efficiency, natural resource conservation, and social responsibility. Each initiative is denoted with a “symbol”- **EONS** - to demonstrate which aspects of airport sustainability each initiative influences.

TABLE 2-3

Existing Energy Initiatives

ENERGY INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY CATEGORIES (EONS ¹)
Airfield Lighting Airfield lighting has been upgraded to Light Emitting Diodes (LEDs).	Reduces the overall amount of purchased electricity used, which also reduces GHG emissions.	EON
Metered Pre-conditioned (PC) Air PC air units are individually metered so that energy can be billed directly to airlines.	Encourages energy reductions.	EN
Unified Electrical Metering The Airport was previously billed for its electricity at three different rates depending on the location of the meter at the Airport. The Airport negotiated a unified billing structure during recent negotiations with the utility.	Significant cost savings (approximately \$35,000 annually).	E

¹ Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility

2.2 Goal and Objectives

Goal: DAY will utilize design and operational techniques to maximize energy efficiency and the use of clean and renewable energy sources.

- Objective: Reduce consumption of fossil fuel-based energy throughout Airport buildings.
- Objective: Reduce consumption of fossil fuel-based energy throughout Airport vehicles and mobile equipment.
- Objective: Increase capacity for and use of renewable energy sources for Airport operations.



Strategies Identified to Achieve the Objectives

A number of opportunities for energy efficiency and reduction have been identified through the energy audit process. LWC, Inc. has reviewed these opportunities and evaluated them for their potential benefit, payback, as well as consistency with future terminal redevelopment. ECMs that have a relatively short payback and will still carry benefits through a terminal redevelopment have been given highest priority according to LWC's assessment. All cost and payback estimates are taken from the ARM, Inc. Energy Audit document.

High Priority Opportunities:

- Direct Digital Control Building Management System (DDC) and integrated Energy Management System (EMS): Implementation of a DDC / EMS would provide more efficient control and operation of the Airport's HVAC and other systems. No specific budget and / or future savings estimates have yet been calculated, but such systems typically provide increased efficiency of 10-15%. Installation of a DDC / EMS would also ensure the best possible efficiency of any upgrades to HVAC systems.
- Tankless Hot Water Heaters: It is recommended that the Airport replace its hot water tanks with tankless heaters to provide hot water more efficiently. This would save an estimated \$15,000 per year in gas usage costs and have an estimated payback of 2.5 years.
- Re-pipe Central Chilled Water Plant: As detailed in the ARM Energy Audit, the current piping layout of the Airport's chilled water plant is sub-optimal, impacting the plant's overall efficiency and capacity. Re-piping the plant will improve its efficiency and capacity and better allow for future expansion or relocation. While this recommendation is estimated to cost approximately \$500,000, it would save an estimated \$135,000 a year and would thus pay for itself in 3.7 years.

Additional Opportunities:

- Convert DX air handlers to chilled water: The efficiency ratio of the central chiller plant is roughly twice as efficient as the Airport's DX units. The DX units should be converted to chilled water units.

- Outdoor air economization: The existing air handlers have a range of outdoor air capabilities. Converting all units to 100% outdoor air capability would reduce loads and need for the existing cold water system.
- Hot water boiler replacement: Replacing the older boilers in the Airport with high efficiency condensing boilers would save an estimated \$38,000 annually and have a payback timeframe of 5.3 years.
- Parallel Pumping: Running two pumps in parallel as opposed to running one with the other as a backup would retain full flow while running at 66% of the power load.
- Convert hot water loop systems to demand systems. This would save roughly \$2,300 each year.
- Lighting upgrades: 1/3 of the DAY airfield has been converted to LED lights. Continuing the upgrade and upgrading the lighting in the parking garage, terminal and concourses would save approximately \$60,000 annually.

In addition to the specific upgrades outlined above, the Airport has an interest in developing sustainability guidelines and standards for construction, operations, and maintenance. A set of such guidelines has been developed for this Sustainability Master Plan that is consistent with the goals and objectives of the Plan and utilize best practices and standards from existing rating systems and other airport sustainability guidelines. The Sustainable Design and Construction Standards guidelines are included as Appendix F. A significant emphasis of these guidelines and standards is on minimizing energy consumption, improving efficiency, and utilizing alternative energy sources when possible.



3 People

DAY strives to provide a positive experience for its passengers and employees and act as a positive influence and example to the local communities it serves. These social and community benefits are integral to the social responsibility component of the EONS approach to airport sustainability and to DAY's goal of improving employee and community well-being as well as passenger experience.

3.1 Baseline Highlights

Existing Initiatives

The Airport currently has a number of initiatives to improve employee wellness. The following table highlights many of these initiatives implemented at DAY.

TABLE 3-1

Existing People Initiatives

PEOPLE INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY CATEGORIES (EONS ¹)
Passenger Experience and Satisfaction Passenger experience and satisfaction initiatives include: • Operation of the DAYRider courtesy shuttle. • The RTA resumed bus service (#43) to the Airport starting in August 2013. • Hydration stations allow passengers to refill water bottles at no cost. • The Airport currently holds a Passenger Appreciation Day quarterly, which includes free blood pressure checkups for passengers. • Wi-Fi internet access is available throughout the terminal and in the cell phone lot. • DAY is conducting an airport Passenger Satisfaction Study to better understand further opportunities to improve the passenger experience. • Airport is pursuing new concessions to the terminal, renovating the existing Max & Erma's restaurant, and Chick-Fill-a was added in 2013.	Improves passenger satisfaction.	O N S

PEOPLE INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY CATEGORIES (EONS ¹)
Employee Wellness Employee wellness initiatives include: - In conjunction with the City of Dayton, Airport employees are eligible to participate in the Premier Health EmployeeCARE program at Miami Valley Hospital. This program provides counseling, other mental health services and other assistance to employees and their families. - Airport employees also have access to the WellVibe employee engagement tool, which helps employees track and implement their personal health goals.	Improves employee health.	

¹ Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility

3.2 Goal and Objectives

Goal: DAY will implement actions to enhance the passenger experience and promote the well-being of Airport employees.

- Objective: Create and maintain a comfortable, pleasant environment throughout the Airport.
- Objective: Provide amenities throughout the airport to enhance passenger experience.
- Objective: Ensure that health and well-being of all Airport users, including passengers, Airport employees, and tenant employees is a priority.
- Objective: Engage employees and community stakeholders in sustainability activities of the Airport.

Strategies Identified to Achieve the Objectives

The Airport will have numerous opportunities to improve passenger experience and employee well-being, as well as further support and engage the local community through its terminal redevelopment efforts. Areas for improvement may include:

- Improved convenience features for passengers
- Use of healthy cleaning products and maintenance procedures
- Enhancements designed to make the terminal more connected and accessible
- Attracting local business and marketing the Airport for increased investment.





4 Environmental Stewardship

One of the core elements of the EONS framework is the conservation of natural resources and preserving the natural environment for both present and future generations. Management of on-airport natural resources is subject to numerous environmental regulations. These are related to local water quality, protection of local wetlands, management of Airport stormwater runoff, and impacts on local wildlife. Accordingly, DAY has established one of the goals of this Sustainability Master Plan to play a leadership role in the community by minimizing its impacts to the natural environment and consumption of natural resources.

4.1 Baseline Highlights

Performance Snapshot

4.1.1 Water Use and Quality

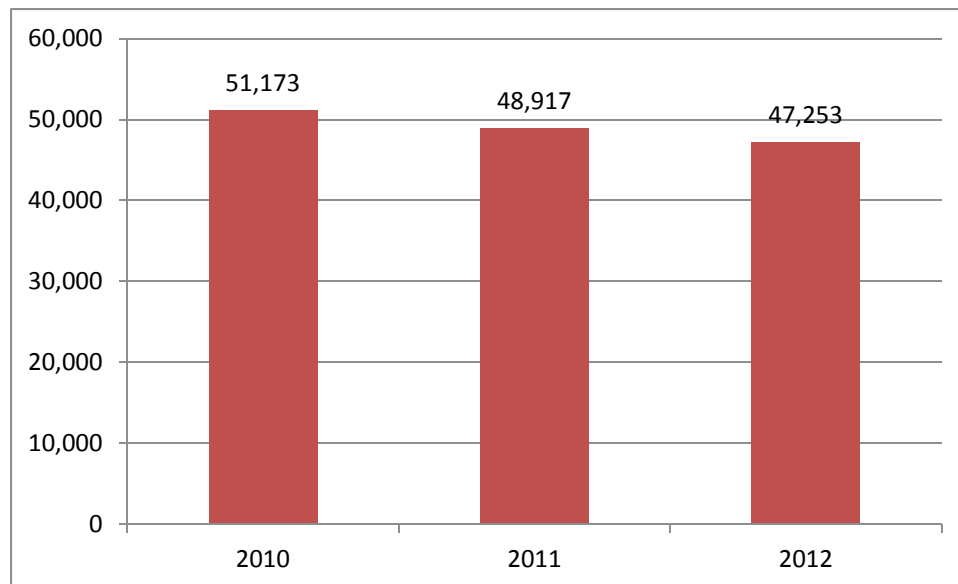
The Airport's facilities used a total of 47,253 hundred cubic feet (CCF) of water in 2012. DAY water use from the City of Dayton only and has slowly declined between 2010 and 2012 (**Figure 4-1**). During this same period, passenger enplanements increased at DAY, resulting in decreased water use per passenger. The Department of Aviation is in the process of finishing the renovation of its restroom facilities in Concourses A and B, including in the passenger terminal, and is installing low-flow fixtures, water closets, and urinals to reduce the amount of water used, which can be seen in the decreasing water use. The Department of Aviation does not currently employ specific strategies to reduce landscaping water use, nor does it have a landscape or vegetation management plan at DAY.

The Department of Aviation has developed a Storm Water Pollution Prevention Plan (SWP3) for the Airport that has been in place since 1994 and was last updated in August 2013 and published in November 2013. This plan provides procedures for managing stormwater runoff and ensuring that pollution from such runoff does not enter the watershed. The SWP3 incorporates comprehensive Best Management Practices, which are designed to prevent spills and other environmental incidents, stressing the importance of runoff management and employee awareness.

The Department of Aviation also has a Spill Prevention, Control, and Countermeasures Plan (SPCC) in place, which is currently being updated, and the Airport and all tenants comply with National Pollution Discharge Elimination System (NPDES) permit requirements. Regular maintenance and inspection of waterways, storm conduit outfalls, and oil/water separators is conducted.

FIGURE 4-1

DAY Water Use from the City of Dayton (Hundred Cubic Feet (CCF))



Source: City of Dayton, 2013.

Aircraft Deicing

Currently, the Airlines use chemical deicing methods and the Airport utilizes a Deicing Fluid Collection System (DFCS). The DFCS's primary purpose is to prevent deicing fluid from coming into contact with the Airport storm water run-off. During the deicing season, storm water from the four deicing apron areas is diverted from entering Mill Creek. The contaminated run-off is pumped into three storage lagoons, where it is discharged to the City of Dayton Waste Water Treatment Plant.

The DFCS was constructed to assist the Airport with meeting the requirements of the individual storm water permit issued by the Ohio Environmental Protection Agency (OEPA). This state-of-the-art system was the first in Ohio and one of only a few operating in North America, and is one of the industry's safest and most efficient aircraft deicing facilities.

The OEPA permit requires periodic sampling of select storm water outfalls of specific contaminants. Carbonaceous Biological Oxygen Demand (CBOD₅), is one of the many contaminants tested since level of CBOD₅ in storm water is proportional to the concentration of deicing fluid, and is an indicator of water quality. CBOD₅ levels from deicing fluids have been dramatically reduced since the system began operation.



Wetlands

Preservation of wetlands and natural resources is important to DAY. Management of wetland resources is an important aspect when achieving its natural resources goals and objectives. Wetlands at DAY include streams, lakes, and low-lying areas with standing water. The following wetlands are located on Airport property⁵:

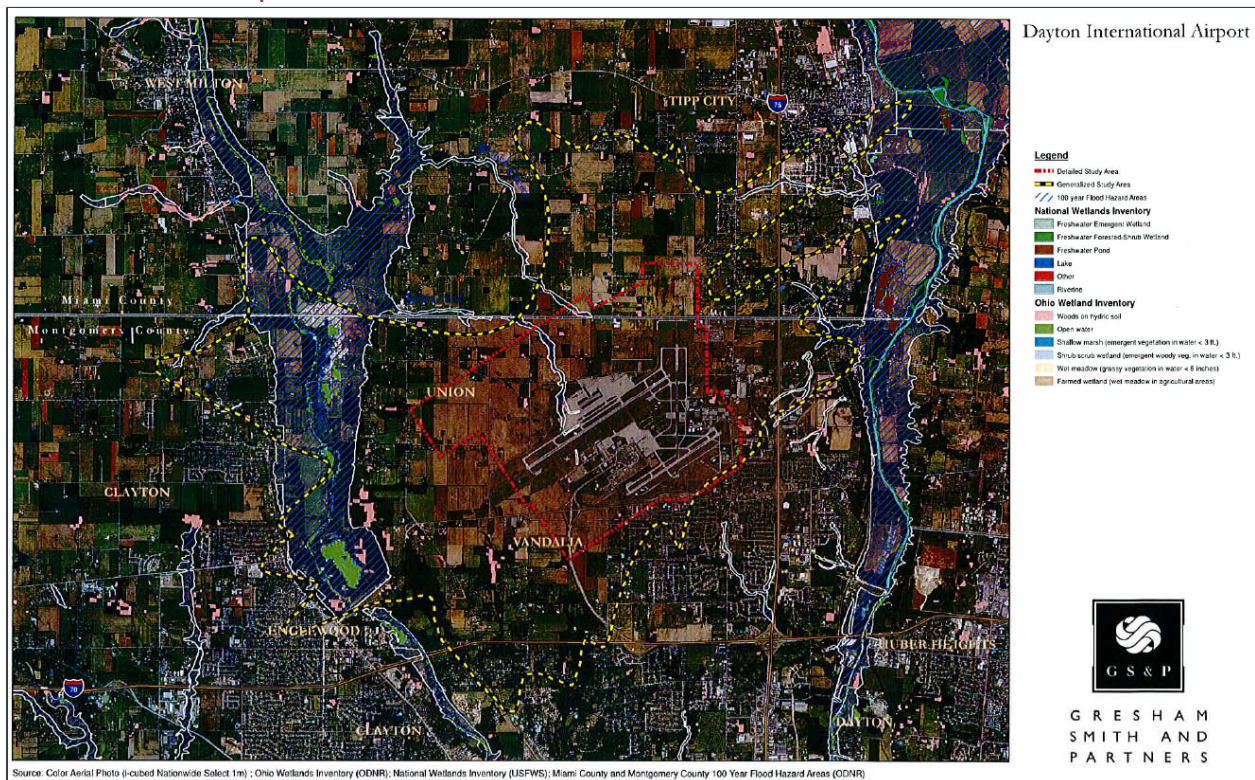
- A stream (flows through property 333)
- Lakes (Properties 165, 166)
- State Wetland may be present on the following properties, but these have not been verified: 13, 20, 22, 141, 302, 616, 9, 16, 10, 21, and 111.

For a map of wetlands and floodplains, see **Figure 4-2**.

DAY minimizes impacts to natural resources through proactive measures such as Stream Bank Mitigation Projects. The Airport entered into a mitigation project with Five Rivers Metro Parks to enhance a stream in the nearby Englewood MetroPark. This will permit the Airport to construct a storm line conduit (culvert) in an existing drainage ditch.

FIGURE 4-2

Wetlands and Floodplains

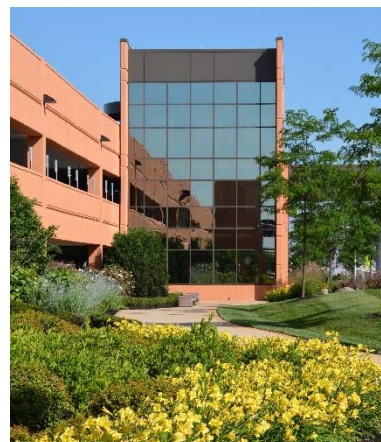


Source: Airport Land Use Development Options Plan, November 2008, Gresham Smith and Partners.

⁵ Airport Land Use Development Options Plan, November 2008, Gresham Smith and Partners.

4.1.2 Air Quality and Greenhouse Gas (GHG) Emissions

A critical component of a sustainability plan is assessment of the Airport's contributions to air pollution and climate change. A calendar year 2012 emissions inventory has been completed for DAY, including assessment of criteria air pollutants and GHG emissions. This inventory will assist the Department of Aviation by determining a baseline against which potential sustainability initiatives and emissions reduction measures can be identified and evaluated for the Airport.



Air Quality

The emissions inventory addresses the Environmental Protection Agency (EPA's) criteria air pollutants carbon monoxide (CO), ozone (O₃), respirable particulate matter measuring 10 micrometers or less in diameter (PM₁₀), respirable particulate matter measuring 2.5 micrometers or less in diameter (PM_{2.5}), and sulfur dioxide (SO₂).⁶ In addition, emissions of the greenhouse gasses, carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), expressed in terms of carbon dioxide equivalent emissions (CO₂e) are also included.⁷

The emissions inventories were prepared in accordance with FAA's Emissions and Dispersion Modeling System (EDMS version 5.1.3), the EPA's Motor Vehicle Emissions Simulator (MOVES version 2010b) and other relevant and contemporary data sources and tools. The GHG emissions inventory method is consistent with the industry standard Airport Cooperative Research Program (ACRP) Report 11: *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* from the Transportation Research Board (TRB).

Emissions at DAY arise primarily from the combustion of fossil fuels (i.e. jet fuel, aviation gasoline, diesel, motor gasoline, natural gas, etc.). In the case of GHG, offsite emissions associated with the production of electricity purchased for the facility are also included in the inventory. The following are the emissions sources included in the DAY emissions inventories:

- Aircraft
- Ground Service Equipment (GSE)/ Auxiliary Power Units (APU)
- Motor Vehicles
- Stationary Sources and Fuel Facilities
- Electrical Consumption

⁶ EPA's criteria pollutants refer to those pollutants for which EPA has established National Ambient Air Quality Standards (NAAQS) to safeguard human health and environmental welfare from the detrimental effects of air pollution. Notably, oxides of nitrogen (NO_x) and volatile organic compounds (VOC) are considered precursors to ground-level ozone formation and are evaluated as ozone surrogates in this inventory.

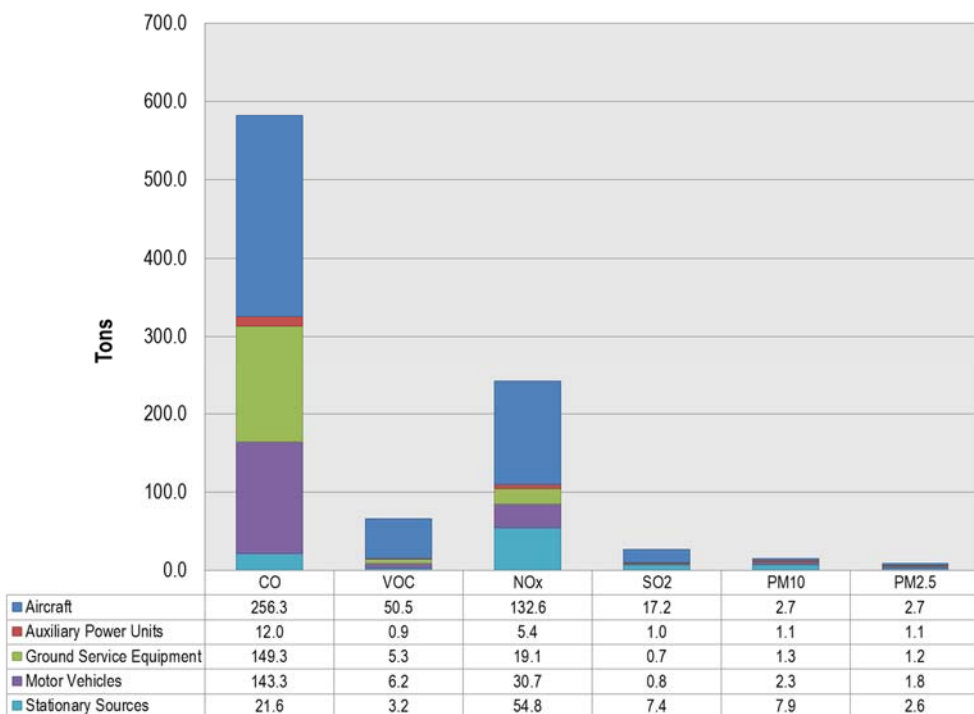
⁷ The expression CO₂e normalizes the warming effects of individual GHG to the global warming potential (GWP) of CO₂. Consistent with current Intergovernmental Panel on Climate Change (IPCC) guidelines, CH₄ and N₂O are considered 21 and 310 times as potent as CO₂, respectively, although they are emitted in much smaller quantities compared to overall CO₂ emissions.



Figure 4-3 presents the results of the DAY 2012 criteria pollutant emissions inventory. By and large, aircraft emissions are the largest contributor to the inventory for most pollutants. GSE and motor vehicles contribute significantly to total CO emissions; motor vehicles and stationary sources also comprise a large share of NO_x and PM emissions. A detailed report of the criteria pollutant emissions inventory is provided in **Appendix A**.

FIGURE 4-3

DAY Criteria Air Pollutant Emissions Inventory



Source: KB Environmental Sciences, Inc., 2013.

Greenhouse Gas (GHG) Emissions

GHG emissions are segregated in terms of emissions “ownership” (e.g., those emissions under the jurisdiction and control of the City of Dayton versus those produced by airport tenants). Further, consistent with the TRB ACRP guidelines,⁸ emissions reporting “boundaries” have been established according to the following categories:

- Scope 1 / Direct – GHG emissions from sources that are owned and controlled by the reporting entity (City of Dayton). These may include airport owned and controlled stationary sources (e.g., boilers, emergency generators, etc.) and vehicles using on-airport roadways and associated areas.
- Scope 2 / Indirect – GHG emissions associated with the generation of electricity consumed by the reporting entity (City of Dayton) and its tenants.
- Scope 3 / Indirect & Optional – GHG emissions that are attributed to activities at DAY, but are associated with sources that are neither owned nor controlled by the City of Dayton. These include aircraft-related emissions, emissions from motor vehicles on airport roadways, and emissions from other airport tenant activities.

⁸ ACRP Report 11 – Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (2009).



Table 4-1 presents the DAY 2012 GHG emissions inventory, in metric tons of CO₂e, by ownership and boundary category described above. As shown, GHG emissions under the direct control and ownership of the City of Dayton (i.e., Scope 1 emissions) comprise no more than 0.7 percent of the total emissions inventory.

It is difficult to compare GHG emissions inventories between airports as the sources included, the operational characteristics of the sources, and the inventory purpose can all vary substantially. However, DAY's Scope 1 emissions (as a percent) are comparable to other recently prepared GHG emissions inventories prepared for airport sustainability plans. Scope 1 contributions typically range from as little as less than one percent to roughly five percent of the total GHG emissions. A detailed report of the GHG emissions inventory is provided in **Appendix C**.

TABLE 4-1

GHG Emissions Inventory (Metric Tons)

SCOPE	OWNERSHIP	PARAMETER	CO ₂ E	PERCENT OF TOTAL
1	Airport	City of Dayton Employee Commutes	146	0.1%
		Diesel Usage	227	0.1%
		Gasoline Usage	275	0.1%
		Natural Gas Usage	880	0.4%
Scope 1 Total			1,528	0.7%
2	Airport	Electrical Usage	11,200	5.1%
	Tenant	Electrical Usage	1,355	0.6%
Scope 2 Total			12,555	5.7%
3	Public	Motor Vehicles - Parking	127	0.1%
		Motor Vehicles - Curbsides	587	0.3%
	Public/Tenant	Motor Vehicles - Roadways	7,571	3.4%
	Tenant	Aircraft – Above Ground Level (AGL)	21,747	9.8%
		Aircraft - APU	2,876	1.3%
		Aircraft - Cruise	154,584	69.9%
		Aircraft - Engine Startup	362	0.2%
		Aircraft - Taxi	17,124	7.7%
		GSE	2,052	0.9%
Scope 3 Total			207,030	93.6%
Grand Total			221,114	100%

Source: KB Environmental Sciences, 2013.

Note: CO₂E = Tons of CO₂ Equivalent

4.1.3 Sustainable Land Management

Under its environmental stewardship goal of minimizing Dayton International Airport's (DAY) impacts to the natural environment, the City of Dayton Department of Aviation has articulated an objective to evaluate alternative uses of non-aeronautical properties and alternative land covers of aeronautical properties. Early in the sustainability planning process, DAY expressed a particular interest in finding ways to best manage its properties to promote sustainability and reduce its carbon footprint.

Given DAY's ownership of a significant amount of agricultural lands, an analysis was completed to quantify the greenhouse gas (GHG) emissions associated with those properties, in addition to other benefits. Due to an expressed interest on the part of the Airport, an emphasis has been placed on evaluating the conversion of agricultural lands to native warm season grasses, or NWSG (often referred to as prairies). The analysis also includes an evaluation of conversion of regular turf grass in the aeronautical areas to slow-growth turf grass that would substantially reduce maintenance requirements. The analysis resulted in the development of a Microsoft Excel-based tool to calculate GHG emission changes and potential financial implications of converting uses and land covers of airport parcels. Further information regarding the sustainable land management evaluation and tool is included in Appendix A.



DAY also owns the Knoop Prairie, a NWSG area covering 113.5 acres and sequestering 195 million tons of CO₂ equivalent annually. The Knoop Prairie is managed by the Airport in cooperation with neighboring Aullwood Audubon Center and Farm (Aullwood). Aullwood also manages an expansive prairie on its own property a short distance west of the Airport. The existing relationship with Aullwood is an important component of this analysis as Aullwood has provided invaluable input on considerations for conversion to NWSG, resources on establishment and management practices, and will serve as a critical partner in any future pursuits of converting DAY property to such uses.

Aullwood and Dayton: Flying is in their nature

In 1957, Marie S. Aull donated 70 acres of land to the Audubon Society, which soon led to the opening of the Aullwood Audubon Center, the first nature center of the Midwest. Soon thereafter, Marie Aull purchased adjacent farmland which would later become the Aullwood Farm. In 1978 the center and farm would be combined into the Aullwood Audubon Nature Center and Farm. In 1995, the Center added an additional 150 acres through a long-term lease with Dayton International Airport, which was converted to restored tallgrass prairie. While the Airport maintains ownership of the Knoop Prairie, Aullwood was responsible for the establishment of this prairie, and this arrangement was the beginning of an ongoing relationship between Aullwood and the Airport. The Charity A. Krueger Farm Discovery Center was also opened in 2000 at the Aullwood Center in honor of Marie Aull on her 103rd birthday, just two years before her death at age 105.¹

Of course, the connection between the Aullwood Center and aviation began much earlier and remains a strong presence at the Center, which welcomes 80,000 visitors per year. Marie Aull and her husband, John Aull were close friends of the Wright Brothers, who were originally from Dayton, OH. John Aull helped the Wright Brothers pull their first plane and served on a committee for the International Air Races, the first air show in Dayton, in 1924. The Wright Brothers also learned a great deal about how to create an airplane and put humans into flight from watching birds, something that can now be studied at the Aullwood Center, especially as visitors walk down the “Birds, Flight, and Wrights Trail.”

As the Airport moves forward in identifying the most sustainable options for using and managing its lands, its relationship with the Aullwood Center is sure to continue to grow and benefit from the historic connection between nature and aviation.



Caption: (L) Birds, Flight, and Wrights Trail at Aullwood Nature Center; (R) Prairie at Aullwood Nature Sanctuary



4.1.4 Waste Management and Recycling

The 2012 *Community Solid Waste and Recycling Survey* revealed that approximately 156 tons of solid waste, 37 tons of cardboard, and 28 tons of commingled recyclables were collected. A total of 30% of the waste collected is recycled and removed from the waste stream; approximately 17% is recycled cardboard and approximately 13% commingled recycling.

In April 2012, the Montgomery County Solid Waste Policy Committee approved an incentive grant application to support the Airport's recycling program. Recycling containers in individual offices are emptied daily. The Airport currently recycles cardboard and comingled recyclables which includes glass bottles, plastic bottles, aluminum/metal cans and paper (including magazines and newspapers).

Trash (non-recyclable items) is only emptied daily from common areas/collection points. Employees are expected to place non-recyclable items in these common area garbage containers. Recycling containers have replaced regular trash cans in all Department of Aviation offices. Pallets, lighting, and scrap metal are recycled. The Airport has reused asphalt millings and crushed concrete. Currently grass clippings and leaves are mulched through the mowing process. There are no provisions within the contracts that require contractors to recycle; however, contractors are encouraged to recycle their construction waste per the drawings and specifications.

Tenant requirements

Tenants at DAY are encouraged to recycle by allowing the tenants to utilize the dumpsters provided for cardboard and commingled recycling in lieu of disposing of the waste. HMSHost is also encouraged to do the same in lieu of disposing of recyclables in their trash compactor.

Tenants are invited to participate in recycling their waste but Airport does not monitor *who* or *what* is recycled. There are no requirements to recycle through lease agreements at this present time. DAY is currently promoting recycling to the tenants as a way to help lower operating costs that would result in savings passed on to them.

Education/Promotion

In 2012, DAY developed a marketing campaign that includes the Airport's slogan; "It's a great DAY to recycle!" The campaign is designed to use the Airport's unique 3 letter designation – "DAY" – to connect the Airport with Recycling and get the public's attention as they pass through the terminal. A five foot tall display was created, and included a caricature of a tree with leaves to educate the public about recycling. Along with the displays, instructional signs were added to the recycling cans to get the public's attention and encourage them to join in the effort and recycle. In addition to promotional signage, DAY has included a link on their website to further educate the public about the Airport's recycling efforts.



DAY Recycling Program promotional signage



Portable Liquid Station at the Security Checkpoint



Recycling and Trash Cans Located Throughout the Airport.

Waste Audit –Summary and Results

A Waste Audit was conducted to collect and identify current and future waste collection practices that will streamline the collection process as well as identify potential revenue sources for DAY. The Waste Audit was performed to encompass a 24-hour period to identify components of Day's waste stream. The Waste Audit is documented in greater detail in **Appendix B**.

Rumpke Recycling, who assisted with the audit, did not pick-up the waste from the Airport Rescue and Fire-Fighting (ARFF) or Maintenance Buildings; therefore, the Waste Audit only includes the Terminal. The Waste Audit was recorded on the "Waste Audit Sort Form" (provided in **Appendix B**) and the results show that there is an opportunity to substantially improve recycling. Not as many recyclables are getting into the Commingled Recycling stream as possible and non-recyclables (trash) were present in the Commingled Recycling stream. Also, "Liquid Waste" is almost half of the total weight of the waste collected.

The Waste Audit found that:

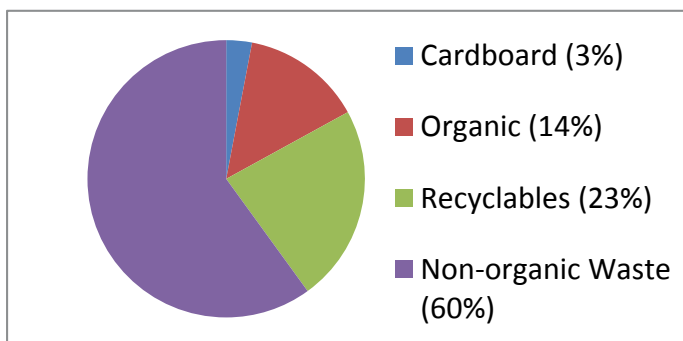
- The total weight of waste collected at the Terminal, including concessions, in the 24 hour period was 4,200 lbs. per the Rumpke recycling weight tickets. The breakdown is shown, by percent, in **Figure 4-4**.
- Approximately 48% of the total waste collected was liquid (2,032 lbs.). Note: this was the weight of the liquids that were poured out during the audit at the Rumpke facility after the trucks were weighed. The remaining waste was sorted and totaled 2,168 lbs.; the breakdown of the remaining waste is shown by percentage in **Figure 4-4**.
- More than half of total weight of waste collected was liquid since some waste was still wet from absorbing liquid, therefore weighing more (e.g., paper goods, cardboard, etc.).



- The remaining 52% of the total waste was 2,168 lbs. which was sorted into four categories: cardboard, organic, recycling, and non-organic.
- Percentages of total waste per category: 3% cardboard, 14% organic, 23% recycling, and 60% non-organic.
- 3% of cardboard was not sent to the balers for recycling.
- Out of the 23% of recyclables, only 18% made it into the Commingled Recycling stream.

This Waste Audit revealed that with the reduction of liquid waste and an increase in recycled waste, the Airport could reduce its waste by more than 50%. In 2012, non-recycled waste totaled more than 70% of all waste (**Table 4-2**).

FIGURE 4-4
Waste Audit (per 2,168 lbs. of Total Waste)



Source: Rumpke Recycling and Passero, 2013.

TABLE 4-2
2012 Waste

2012 WASTE	TOTAL
Percentage of Recycled Cardboard	15.04%
Percentage of Comingled Recycling	11.58%
Percentage of Regular Trash	63.58%
Percentage of Construction Trash	9.80%

Source: Rumpke Recycling, 2013.



Existing Initiatives

The Airport currently implements a variety of measures that improve the environmental stewardship at DAY. **Table 4-3** details the existing initiatives implemented at DAY.

TABLE 4-3

Existing Environmental Stewardship Initiatives

ENVIRONMENTAL STEWARDSHIP INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY CATEGORIES (EONS ¹)
Water Quality		
Maintenance DAY conducts routine maintenance of the existing waterways, storm conduit outfalls and oil/water separators.	Decreases likelihood of water quality impacts.	⓪ Ⓝ
Wetlands		
Wetland Mitigation Plans	Preserves natural resources and wetlands.	⓪ Ⓝ
Air Quality and Greenhouse Gas		
Fixed Gate Infrastructure All airport gates are equipped with 400 HZ power and preconditioned air to allow aircraft parked at the gate to be plugged in and operate their electrical and HVAC systems without running their engines.	This reduces criteria pollutants, GHG emissions, aircraft noise, and reduces fuel use.	Ⓝ
Cell Phone Waiting Lot DAY offers a parking lot with a flight notification board where patrons can wait for deplaning passengers to reduce driving and/or idling of vehicles.	This reduces GHG emissions, criteria pollutants, and terminal curbside congestion.	⓪ Ⓝ Ⓢ
Semi-consolidated Rental Car Operations Rental car tenants at DAY are housed on the bottom floor of the passenger parking garage.	This minimizes passenger trips to more remote locations for rental pick-up and drop-off, thus reducing fuel combustion, GHG emissions, and criteria air pollutants on airport roadways.	⓪ Ⓝ
Dayrider Shuttle Service A regular shuttle service operates between the terminal area and remote passenger access locations.	This service provides higher vehicle occupancy, thus reducing single-occupancy vehicle operation on airport roadways, reducing fuel use, GHG emissions, criteria air pollution in the airport vicinity.	⓪ Ⓝ
Bus Service The Greater Dayton Regional Transit Authority (RTA) resumed bus service (#43) to the Airport starting in August 2013. ²	This minimizes passenger trips to the Airport, thus reducing fuel combustion, GHG emissions, and criteria air pollutants.	Ⓝ Ⓢ

Waste Management and Recycling

Recycling DAY's Recycling Program began with a partnership between Rumpke Recycling and DAY, and was officially announced to the public on May 1, 2012. - Scrap metals, carpeting, fluorescent lamps / Ballasts, wood pallets, batteries, tires and motor oil are collected for recycling. - Cardboard is collected and placed in a separate compactor for recycling	Reduces waste disposed in landfills.	Ⓞ Ⓝ
Hydration Stations Hydration Stations have been installed to reduce the use of plastic bottles. Additionally, portable "Liquid Collection Stations" were placed at the TSA Security Checkpoints to reduce contamination and weight of the commingled recycling	Reduces waste disposed in landfills and improves passenger satisfaction because passengers can refill their bottles after the security checkpoint.	Ⓞ Ⓝ Ⓢ
Materials Reuse Reduced paper use through e-faxing and double-sided printing. Grind asphalt and re-use on site (non-FAA projects only)	Materials reuse and reduction decreases waste disposed in landfills. Reduces cost of construction projects through materials reuse.	Ⓔ Ⓞ Ⓝ

1 Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility

2 http://www.i-riderta.org/rta%e2%80%99s_new_route_takes_flight_with_service_to_airport.aspx



4.2 Goal and Objectives

Goal: DAY will play a leadership role in the community by minimizing the Airport's impacts to the natural environment and consumption of natural resources.

- Objective: Evaluate alternative uses of non-aeronautical Airport properties to determine best options for protecting natural resources.
- Objective: Reduce water consumption throughout Airport operations.
- Objective: Minimize negative impacts to local water quality.
- Objective: Reduce emission of criteria air pollutants and greenhouse gases.
- Objective: Reduce overall generation of waste and increase diversion of waste from landfills and incinerators.

Strategies Identified to Achieve the Objectives

Wetlands Recommended Initiatives

The Airport should consider the following activities to enhance the sustainability of DAY:

- Future proposed projects could be designed to avoid, minimize or mitigate any possible adverse impacts to wetlands
- Best Management Practices (BMPs) can be used during construction to minimize indirect impacts to wetland resources
- Maintain detailed wetland acreage and wetland mitigation data

Air Quality and Greenhouse Gas (GHG) Emissions Recommended Initiatives

As indicated above, the majority of GHG emissions associated with the airport are from aircraft. These emissions are beyond the control of the City's Department of Aviation. However, airlines around the globe are looking for ways to improve efficiency and reduce the environmental impact of their aircraft. The Airport's continued commitment to GHG reduction and sustainability may influence airlines and other tenants to further pursue these efforts. For example, the Required Navigational Performance (RNP) Pilot Study (further discussed in **Appendix A, Chapter 7**) for which DAY is a participating airport will have, not only noise benefits, but also energy saving and GHG reduction benefits as well.

With regard to emissions that are within the Airport's control, electricity usage clearly stands out as the largest source of emissions. The Airport will see GHG and air quality benefits from initiatives focused on reducing electricity use and improving energy efficiency throughout Airport buildings and operations. More details on these opportunities are provided in **Chapter 2**.



Waste Management and Recycling Recommended Initiatives

Potential waste and recycling opportunities at DAY include:

- Composting: Place all plant based scraps, fruits, vegetables, boiled eggshells, bread, coffee grounds and paper coffee filters, teabags, unbleached napkins and paper towels into compostable liner bags. After several months of processing, a nutrient-dense garden fertilizer will result that can be used for local farming.
- Have all food concessions switch from using plastic and styrofoam to biodegradable and compostable food service packaging and disposable products.
- Increase efforts to recycle aircraft/automobile oil filters, cooking oil, and printer/toner cartridges.
- Donate unused office furniture and equipment.
- Use trash compactors that allow for liquid extraction.
- Provide recycle bins in concession areas, kitchens, ticketing counters, and agents counters.

5 Sustainable Investment

DAY acts as an engine of economic growth for the southwest Ohio region. The Airport not only connects the region with the world, but provides other direct and indirect economic impacts through employment, trade and tourism.

5.1 Baseline Highlights

Performance Snapshot

DAY provides the 3rd highest economic impact for airports in the State according to the Ohio Department of Transportation (2006). The Airport's economic impact was equivalent to 17,556 jobs, \$387,666,500 in total payroll, and \$1,008,229,300 in total output⁹. DAY is also home to the Vectren Dayton Air Show Presented by Kroger, which was founded in 1975 and adds \$3.2 million to the region's economy every year according to the Dayton/Montgomery County Convention and Visitors Bureau.

Existing Initiatives

The Airport currently has a number of initiatives to provide benefits to the communities of the region.



⁹ *The Economic Impact of Airports in Ohio*, prepared for Ohio DOT, Office of Aviation by Wilbur Smith Associates, 2006, page v.



TABLE 5-1
Existing Sustainable Investment Initiatives

SUSTAINABLE INVESTMENT INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY
Community Outreach Community Outreach initiatives include: • The Airport holds an Air Camp each year, which introduces students to the aviation facilities and resources in the region. The Camp is hosted by Wright State University. Students are introduced to, and have opportunities to explore, the Air Force Research Laboratory, the National Museum of the U.S. Air Force, Dayton History, and the Boonshoft Museum of Discovery. • Founded in 1975, the annual Dayton Vectren Airshow is one of America's premier airshows. The airshow showcases world-class aerobatic champions, military jet demonstrations, and entertainment. Celebrating Dayton's Aviation heritage as home of the Wright Brothers, national museum of the US Air Force and Wright-Patterson AFB. This is a family-oriented festival at the Airport with aircraft exhibits, flyovers, and local music and food. Local children's art work is prominently displayed in the parking garage and terminal entryways. • Small Business Opportunity Forum	Provides positive exposure for the Airport in the community.	⑤
Volunteering and Charitable Donations The Airport has ongoing volunteer and donor relationships with the following charities: • Special Olympics • Aullwood Audubon Center and Farm • Honey Creek Watershed Association • Rotary Club of Dayton, OH • United Way • Children's Water Festival • Dayton Art Institute • Boys and Girls Club of Dayton • March of Dimes • Girl Scouts of America • Premier Health • St Christopher Council • Honor Flight • USO of Central Ohio	Provides positive exposure for the Airport in the community.	⑤

1 Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility

5.2 Goal and Objectives

Goal: DAY will engage in sustainable and responsible investment of its land, capital, and human resources to contribute to a thriving regional economy that attracts and retains business partners.

- Objective: Incorporate life cycle analysis into all Airport planning and operations.
- Objective: Support the local and regional economy.
- Objective: Support community outreach and engagement activities that promote social, economic, and environmental sustainability throughout Southwest Ohio.

Strategies Identified to Achieve the Objectives

The Airport will continue to provide connectivity and be an economic engine for the southwest Ohio region. Improving DAY's sustainable investment and enhancing the benefits to the community include:

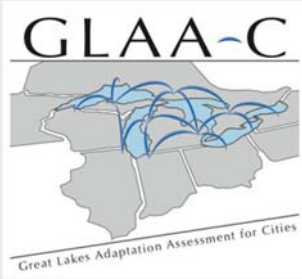
- Use of locally-sourced materials and supplies
- Conducting life cycle cost/benefit analyses
- Identifying material reuse opportunities



6 Resiliency

6.1 Baseline Highlights

Performance Snapshot



The goal of GLAA-C is to bring together researchers and practitioners to develop actionable climate adaptation programs for cities in the Great Lakes region. GLAA-C aims to create replicable programs to tackle the interconnected challenges which climate change presents.

Source:
<http://graham.umich.edu/glaac>

In addition to understanding the Airport's generation of emissions, it has become increasingly important to DAY to understand its vulnerabilities to potential climate change impacts as well as its ability to withstand (resiliency) and/or adapt to such impacts. The City of Dayton has been participating in the Great Lakes Adaptation Assessment for Cities (GLAA-C), a program led by the University Michigan and supported by the Kresge Foundation and the Graham Environmental Sustainability Institute. GLAA-C has conducted an Integrated Assessment of the climate change vulnerabilities and adaptive capacity of six cities in the Great Lakes region, including Ann Arbor and Flint, MI, Kingston and Thunder Bay, ON, and Toledo and Dayton, OH. On June 5, 2013, the City of Dayton hosted a Climate Change Adaptation and Resiliency Workshop with more than 65 City staff (including Department of Aviation staff), elected officials, and community stakeholders. The workshop reviewed historical and projected changes to the local climate and impacts associated with those changes, assessed the adaptive capacity of the city to those changes, and explored best practice adaptation strategies from other cities in the region and throughout the country. According to the GLAA-C efforts, Dayton is likely to experience the following climate change impacts:¹⁰

- Public Health
 - Increased heat wave intensity and frequency
 - Degraded air quality
 - Reduced water quality
 - Changing ecology, new pests, disease
- Infrastructure Damage
 - Stormwater management challenges due to increased extreme precipitation events and flooding
 - Potential changes to freeze-thaw cycles
 - Potential changes in the form of winter precipitation (more ice events)

¹⁰ GLAA-C, "Climate Change Adaptation in Dayton, OH." June 2013



The June 5 workshop revealed that decision-makers in the city see climate change as a serious threat to “increasing the economic and social vibrancy of the city” and making Dayton a ‘city of choice.’ The workshop identified that the greatest adaptive capacity the City currently possesses lies in its dedicated leadership.¹¹ Dayton’s historical spirit of innovation and invention will also be an asset to identifying the technology and strategies necessary to adapt to a changing climate.

Recommended actions that came out of this process included:

- Incorporating adaptation into key department operations, including the Department of Aviation
- Updating City infrastructure to be resilient to climate change impacts
- Promoting green infrastructure through code updates and City ordinances
- Making scientific information about climate change and impacts more accessible to the general public and to decision-makers

Actions specific to DAY included:

- Improving resilience to energy disruptions
- Investing in outdated infrastructure
- Implementing green infrastructure
- Engage in disaster response planning
- Participate in education efforts

As a gateway to Dayton and the world, the resiliency of the Airport is critical to the resiliency of the Southwest Ohio region. For this reason, DAY has identified adaptation and resiliency as a key focus area for this Sustainability Master Plan.

¹¹ Ibid

Energy Resiliency: Airport Microgrid Feasibility Study

The **Center for Transportation and the Environment (CTE)**, a 501(c)(3) non-profit, member-based organization, and the **Center for Electromechanics (CEM)** of the University of Texas at Austin has recently requested an FAA grant to fund research and test the feasibility of developing an airport microgrid at DAY. The Micro-Grid, which is an efficient energy-secure operation which would be independent from the local, traditional utility power grid. This would enable the Airport to continue service during a utility system failure due to maintenance, natural disasters, or national security issues such as cyber-attacks to the US power infrastructure. An airport microgrid allows for optimal generator load sharing and efficiency, thereby reducing energy consumption and emissions. It enhances energy security (a key component of the GLAA-C initiative) by allowing the local system to be islanded (separated) from the larger utility during times when the external utility fails. It also opens up the opportunity to incorporate renewable power generation and greater use of alternative fuels into the Airport's operations.

CTE and CEM will develop a plan to identify the best path forward for developing an airport microgrid at DAY. The project will model the current DAY power system and determine the outcomes for various "what-if" situations. An implementation plan will be developed with specific solutions for each outcome.

This approach will allow the project team to model renewable power generation and energy storage technologies alongside conventional back-up generation, and will provide the FAA a methodology for airport energy system assessment and improvement. The airport microgrid would support the FAA's emphasis on sustainability by reducing airport emissions by 2% each year if renewable power generation were incorporated into the system with greater use of alternative fuels.





Existing Initiatives

Table 6-1 details the resiliency initiatives implemented at DAY.

TABLE 6-1

Existing Resiliency Initiatives

CLIMATE IMPACTS INITIATIVES	SUSTAINABILITY BENEFIT(S)	APPLICABLE SUSTAINABILITY CATEGORIES (EONS ¹)
Microgrid Study The Center for Transportation and the Environment is pursuing funding for use of Microgrid Technology at DAY, an efficient and energy-secure operation which would be independent from the local, traditional utility power grid.	Increases energy efficiency and allows DAY to continue service during a utility system failure due to maintenance, natural disasters, or national security issues.	E O N
The City has partnered with Wright State University to pursue a grant through GLAA-C to support education and outreach efforts around climate change. DAY is providing assistance to these efforts by conducting some public surveys at the Airport.	Increases awareness of climate change, local impacts, and efforts to mitigate and adapt	E O N S

¹ Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility

6.2 Goal and Objectives

Goal: DAY will embrace regional efforts to implement actions to enhance the Airport's resilience to impacts associated with climate change.

- Objective: Update infrastructure to withstand extreme weather events.
- Objective: Incorporate green infrastructure standards into Airport design, construction, and maintenance guidelines.
- Objective: Develop plans to ensure the Airport has the right people and equipment for disaster response.

Strategies Identified to Achieve the Objectives

There are several opportunities that the Airport has for increasing its resilience to climate change impacts. Some key areas to enhance the Airport's resiliency include:

- Developing reliable energy sources on-site and upgrading outdated infrastructure
- Implementing green infrastructure projects and incorporating green infrastructure into design standards
- Coordinating with the City of Dayton and local/regional/state agencies in disaster response planning
- Using DAY's visibility for educational outreach on climate change and its impacts

7 Implementation and Monitoring

Overview

In an effort to implement and track the Sustainability initiatives and strategies developed for the Dayton International Airport (DAY), the Sustainability Advisory Committee (SAC) and the Airport's planning team developed a strategy of implementing a "Playbook", which could be used by the Airport's support staff to achieve its sustainability goals and monitor the progress over a period of time. The "Playbook" concept focuses on Airport owned and operated facilities only and not facilities/equipment occupied or operated by Tenants. It is the goal of the SAC that the methodologies and strategies employed by the Airport will also serve as a reference or guide for Airport Tenants as they implement their own improvement projects. The "Playbook" includes detailed information or Highlight Sheets for each of the priority short term initiatives for each sustainability goal category. This document can be used as a quick reference guidance document for members of the Airport's staff who volunteer to be part of the "DAY- Sustainability Green Team". A copy of the "Playbook" can be found in Appendix G of this report.

The primary components of the Playbook are as follows:

- Playbook Introduction
- DAY "Green" Team Members / Organizational Chart
- Sustainability Initiatives and Strategies Matrix
- Prioritization Charts (per goal category)
- Highlight (Playbook) Sheets (Top initiatives for each goal category)
- Sustainability Decision Flow Chart
- Purchasing Requisition Flow Process
- Capital Improvement Projects – Planning/ Design/ Construction Process
- Performance Monitoring

Before highlighting each component of the Playbook, the following sections of the report will first outline the framework of processes that were developed to this point.

RECOMMENDED SUSTAINABILITY STRATEGIES

Sustainability initiatives and strategies were developed based on many factors, including several site specific studies at the Dayton International Airport (such as Renewable Energy Alternatives, Waste Stream Audit, Evaluation of Terminal Mechanical/Electrical/HVAC systems, etc.). In addition, as part of this planning effort, multiple workshops and meetings with the SAC were conducted, feedback from an online survey of Airport tenants was collected, and a detailed review of successful sustainability strategies implemented at other airports with similar characteristics and operational size of the Dayton International Airport was conducted.



The results of these efforts were tabulated in an overall candidate Sustainability Initiatives & Strategies Matrix as shown in Appendix A within the Playbook itself. The Matrix outlines each of the candidate strategies developed during the planning effort. Follow up meetings and teleconferences were conducted with Airport Staff which included representatives from Airport Environmental, Airport Engineering, and key members of the Senior Administrative Staff. The proposed strategies were also reviewed in detail with the SAC during workshop meetings which included an opportunity to provide feedback for preferred strategies through electronic/anonymous voting. The intent of the meetings, workshops and teleconferences was to develop a detailed list of initiatives and strategies which appeared to be the most realistic and achievable for the Dayton International Airport, and would offer the most impact from an environmental perspective with the goal of advancing sustainability for the Airport and the surrounding communities.

SCORING AND PRIORITIZATION

After consolidating the initiatives and strategies in the matrix, the following primary considerations were used for prioritizing the list of initiatives and strategies:

- Overall ability of the Initiative to advance Sustainability.
- Financial implications of implementing the initiative including front-end capital cost, annual cost of maintenance, and level of Staff effort required to maintain the initiative. Cost ranges (Low, Medium, High) were used for scoring the capital cost and for maintenance costs.
- Estimated Return on Investment (in years)
- Consideration for future development plans

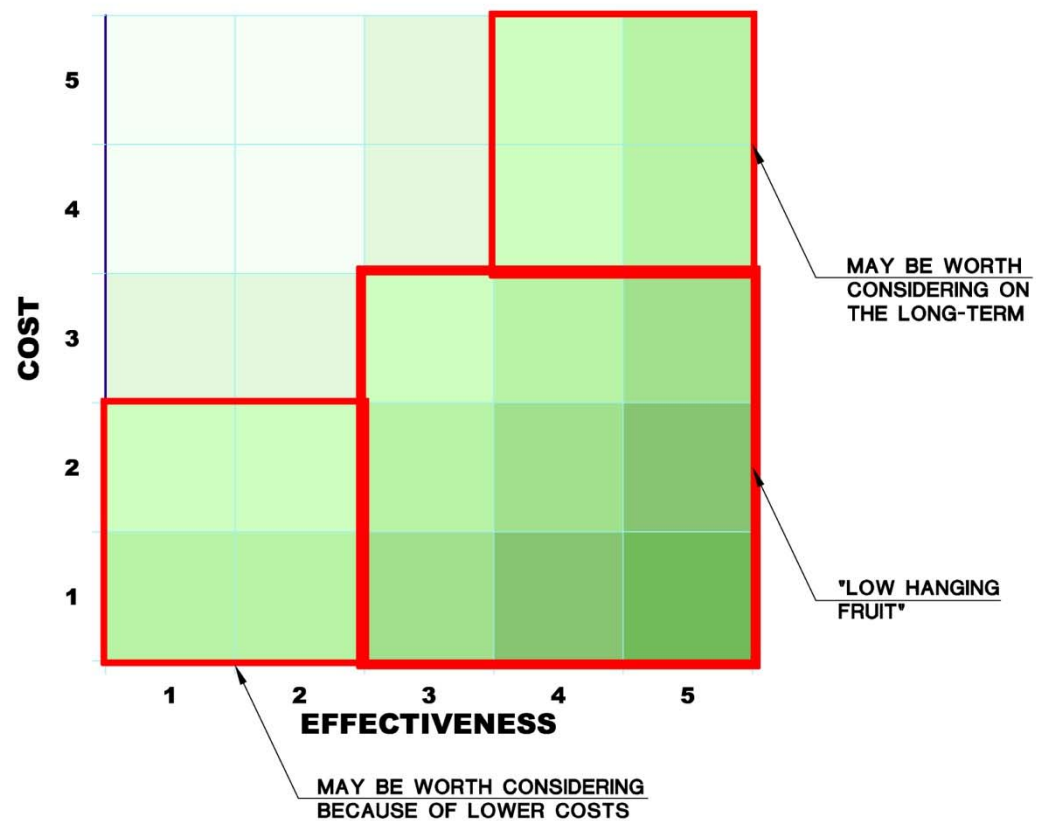
As noted in the Matrix and based on the factors outlined above, a two part score, using a scale of 1 to 5 (with 1 being low and 5 being a high score), was determined. The two part score focused on the following primary metrics:

1. Overall Relative Ability to Advance Sustainability
2. Overall Relative Cost/ Staff Level of Effort

The two part score was then plotted on a simple x-y axis graph and scoring from low to high (using the corresponding scale of 1 to 5). Plotting these onto a graph provided an opportunity to visually identify the lower cost/ higher effect initiatives (or the “low hanging fruit”), as well as other initiatives which may have a lower effect and still be worth consideration due to lower costs (ie. achievable). The graph also visually shows other initiatives which may be longer term candidates due to potentially higher cost implications.

For example, an initiative with a two part score of “4-1” would fall near the lower right hand corner of the graph due to its “higher effect to advance sustainability and its lower cost impact”. Conversely, a two part score of 1-5 would fall in the upper left hand corner of the graph due to its “lower effect to advance sustainability and its high cost impact”.

The figure on the next page outlines the basic framework of the x-y axis graph.



The Sustainability Initiatives & Strategies Matrix was then further evaluated and each of the initiatives ranked or prioritized. The top ranked three-four initiatives from each primary goal category and associated major objective were then highlighted and included in the Implementation Program (Playbook).



7.1 Implementation Program

As noted, for purposes of implementation only short-term initiatives and strategies were incorporated into the “Playbook”. For mid-term and long-term initiatives, additional evaluation and analysis may be warranted and opportunities sought for implementation within future capital development or stand alone projects. Each longer term initiative will need to be considered throughout the Airport’s capital planning, design, and construction processes.

Framework for Implementation Playbook

- Playbook Introduction
- DAY “Green” Team Members / Organizational Chart
- Sustainability Initiatives and Strategies Matrix
- Prioritization Charts (per goal category)
- Highlight (Playbook) Sheets (Top initiatives for each goal category)
- Sustainability Decision Flow Chart
- Purchasing Requisition Flow Process
- Capital Improvement Projects – Planning/ Design/ Construction Process
- Performance Monitoring

Playbook Introduction

This section of the Playbook outlines a brief summary of the goals and objectives of the Airport’s Sustainability Master Plan and the vision toward accomplishing these goals.

DAY – “Green” Team Members / Organizational Chart

This section of the Playbook outlines the Airport staff members who volunteer to participate as part of the Dayton Airport’s (DAY) – Green Team. In addition to information related to Staff member’s Division and everyday responsibilities, the function of the Team will be to operate with common goals in achieving the Sustainability initiatives.

An Organizational chart is provided within this second section of the Playbook. The Team captain will be responsible for updating the Organizational chart as members change in the future.

Sustainability Initiatives and Strategies Matrix

Included in spreadsheet format (both hard copy and editable electronic copy on flash drive), the Matrix will need to be updated on a regular basis to reflect initiatives which have been implemented, or as new initiatives are added.



Prioritization Charts (per Goal Category)

As noted, an X-Y axis graph and scoring from low to high (using a scale of 1 to 5) was used to further prioritize each initiative. For each primary Sustainability Goal Category, the results were then plotted on a graph. Results were then ranked or prioritized based on the highest effect for advancing Sustainability with the lowest cost or low hanging fruit. The initiatives which would have a lower effect for a higher cost were ranked lower. Initiatives which fell toward the center of the graph were also ranked in the same way, however additional factors such as Return on Investment, number of Goal Categories addressed, and level of staffing involvement were considered more in the ranking process.

Highlight (Playbook) Sheets (Top initiatives for each goal category).

Individual detailed highlight or Playbook sheets were developed for each of the priority initiatives for each goal category. These sheets contain detailed information with regard to number of goal categories the initiative covers, general cost information, references, etc.

Sustainability Decision Flow Chart

As a tool to help in the decision making process, a Sustainability Decision Flow Chart was created for use by the Green-Team in the planning, programming, design and ultimately construction phases of a project.

Purchasing Requisition Flow Process

Since the Airport is owned and operated by the City of Dayton, various City purchasing requirements are part of the requisitioning process. A schematic flow diagram outlining this process was provided for information.

Capital Improvement Projects – Planning/ Design/ Construction Process

With each new Capital Improvement Project that the Airport pursues, there is a potential opportunity to identify and/or incorporate Sustainability initiatives into the process and ultimately into the completed construction. As such, the process will need to include an opportunity to review various Sustainability Initiatives and integrate them when applicable while still conforming to required standards.

Performance Monitoring

Performance Monitoring Excel© based spreadsheets were developed for each of the primary goal categories. Each spreadsheet contains the progress to date of the top ranked initiatives, responsible party (or parties), and evaluation section for monitoring the progress on a daily/monthly basis.

Furthermore, a performance monitoring Sustainability Report Card or “SCOREBOARD” was developed also using an Excel© based spreadsheet as a way to report the Airport’s progress on an Annual Basis and as a tool to disseminate progress information to other Departments within the City and to the public. The SCOREBOARD is further discussed in Section 7.2 – Tracking Progress.



Funding Opportunities

As awareness of Sustainability increases, funding opportunities will also likely increase to assist with implementing the various initiatives and strategies as outlined within this report. There currently exists several funding opportunities ranging from Federal funding to State Funding, to local funding including third party (public/private partnerships) for specific types of projects.

Federal

On the Federal level, the Federal Aviation Administration (FAA) provides funding for eligible projects through the Airport Improvement Program (AIP) funds. AIP funding is provided primarily to Public Agencies for the planning and development of public-use Airports which are included on the National Plan of Integrated Airport Systems (or NPIAS). Projects typically include airfield or Terminal area infrastructure development.

Another funding source, as administered by the FAA, is the Passenger Facility Charge (or PFC) program. PFC's, as authorized by the Aviation Safety and Capacity Expansion Act of 1990, authorizes public agencies such as Airports the ability to collect PFC revenue (per passenger) for eligible airport projects. PFC funded projects are required to enhance or make significant improvements to safety, security, increased capacity, reduced noise, or increased air carrier competition. As such, these funds are generally focused on Terminal and facility improvements.

In addition, the FAA's Voluntary Airport Low Emissions (VALE) program offers grant funding for Airports for projects improving air quality in certain compromised air quality areas. For additional information regarding the VALE Program visit <http://www.faa.gov/airports/environmental/vale/>

Aside from funding programs provided through the FAA, other Federal Agencies including the U.S. EPA, the Department of Energy, and the U.S. Department of Agriculture also provide various grant and loan opportunities for Sustainability Projects.

The internet offers access to multiple sites containing information relative to grant opportunities throughout the U.S. A couple of the recommended sites include:

<http://www.fedcenter.gov/programs/sustainability/>

<http://www.grants.gov/search/subscribeAdvanced.do>

State

State funding through the Ohio Department of Transportation (ODOT), Office of Aviation has limited funding at this time, however the Ohio Environmental Protection Agency (OEPA) has some grant program opportunities for Sustainability projects including Recycling and Educational Awareness.

www.epa.ohio.gov/dmwm/home/grants.aspx

In addition ODOT does offer various multi-modal transportation and metropolitan cities grants/funding. Detailed information is included in the **ODOT – Program Resource Guide 2014**



Local Funding

The Airport (City of Dayton) is very pro-active in seeking available funding sources and looking for opportunities to provide sustainable solutions. Much progress has been made since the City's 2007 Sustainable Practices Policy was enacted. Increased recycling efforts and programs, more energy efficient fixtures and equipment in City owned buildings and facilities, and recent addition of (spent) liquid collection stations and freshwater bottle filling stations within the Airport Terminal to reduce bulk waste and improve recycling.

In January 2014, the City Commission passed a resolution to implement the Dayton Regional Green or DRG3 Initiative – a cooperative program with local Montgomery County to create a blueprint for a Sustainable Region.

Local funding sources, realized cost savings to the City, as well as grant funding provide local revenue for continued Sustainability efforts.

Third party sources also provide funding for Sustainability projects through various philanthropic organizations and foundations throughout the region and across the Country. A few examples include:

[Rockefeller Brothers Fund Sustainable Development](#)

"The Rockefeller Brothers Fund (RBF) sustainable development grant making endeavors to support environmental stewardship that is ecologically based, economically sound, socially just, culturally appropriate, and consistent with intergenerational equity. The Fund encourages government, business, and civil society to work collaboratively on environmental conservation and to make it an integral part of all development planning and activity. Recognizing the global nature of many environmental problems, the Fund also promotes international cooperation in addressing these challenges. Awards range from \$25,000 to \$300,000."

[The Joyce Foundation](#)

"The Joyce Foundation focuses its grant making on initiatives that promise to have an impact on the Great Lakes region, specifically the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin. The Foundation supports the development, testing, and implementation of policy-based, prevention-oriented, scientifically sound solutions to the environmental challenges facing the region, especially those that center around water."



7.2 Tracking Progress

Following is a description of the Annual Sustainability Report Card, or “Scoreboard”, for use by Dayton International Airport (DAY) to track and report its sustainability performance in the future. Sustainability performance tracking is an important focus to ensure that the plan and initiatives are implemented effectively and progress is reported. The Scoreboard is an Excel-based tool that can be updated with appropriate data over time by the Airport, and provides a snapshot of sustainability performance with metrics.

Metrics are monitored by the Airport for sustainability performance. These metrics will assist the airport in tracking progress made on implemented initiatives and correlate directly to the goals and objectives of the Sustainability Master Plan. Metrics were identified as the most appropriate measures to determine future sustainability performance by the Airport Sustainability Committee at a meeting on May 28, 2014, and discussed further on project coordination discussions with DAY in June 2014.

The following table, which is also provided in the Scoreboard Excel® file, lists the performance metrics, tracking frequency and primary data source. The Scoreboard page view is provided on the last page. This view shows the metrics in a reporting format for the Airport to use internally and/or externally in the future.

PERFORMANCE METRICS INCLUDED IN ANNUAL SUSTAINABILITY REPORT CARD (SCOREBOARD)

Performance Metrics	Tracking Frequency	Primary Data Source
Energy		
<i>Buildings</i>		
Energy Use Intensity (kWh/sqft) by Building	Annually	Debbie Tipton, Accounting Clerk
Energy Consumption (MMBtu) by Building	Annually	Debbie Tipton, Accounting Clerk
<i>Vehicles & Equipment</i>		
Total vehicles and equipment gas & diesel consumption	Annually	Field Maintenance
People		
Number of customer appreciation events and other airport events	Annually	Linda Hughes, Marketing Manager
Number of health and wellness clinics	Annually	Linda Hughes, Marketing Manager
Facebook reach and likes/comments/shares per post	Annually	Linda Hughes, Marketing Manager
Environmental Stewardship		
<i>Sustainable Land Management</i>		
Acreage of native warm season grasses	Annually	Mike Cross, Environmental Scientist
Acreage of slow growth grasses	Annually	Mike Cross, Environmental Scientist
Carbon emissions and fertilizer reductions resulting from sustainable land management practices	Annually	Calculated by Scoreboard from Acreage of native warm season grasses and Acreage of slow growth grasses
<i>Waste Management and Recycling</i>		
Percentage of Waste and Recycling (by weight)	Monthly + Annually (by weight)	Mike Cross, Environmental Scientist
Number of disposable water bottles diverted from waste stream (readings from 5 water refilling stations)	Quarterly + Annually	Mike Cross, Environmental Scientist
Liquid diverted from waste stream (through liquid collection stations)	Quarterly + Annually	Mike Cross, Environmental Scientist
<i>Water Use and Water Quality</i>		
Terminal water use per passenger	Monthly + Annually	City of Dayton Water

Performance Metrics	Tracking Frequency	Primary Data Source
Glycol recovery percentage	Annually (by winter season)	Mike Cross, Environmental Scientist
Sustainable Investment		
Purchasing - tracking of local and DBE contract values (City of Dayton Human Relations Council, HRC)	Annually	Juleda Hyde, City of Dayton HRC
Local and Regional economic development impact	Dependent on State Aviation System Planning updates	Ohio DOT Office of Aviation (Airports Focus Study)
Resiliency		
Number of NWS Storm-ready DAY staff	Annually	Mike Cross, Environmental Scientist
Number/costs of severe weather events	Annually	NOAA NWS



SCOREBOARD PAGE VIEW



Sustainability Performance Scoreboard

Energy



People



Sustainable Investment

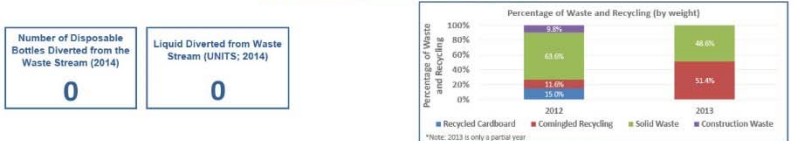


Environmental Stewardship

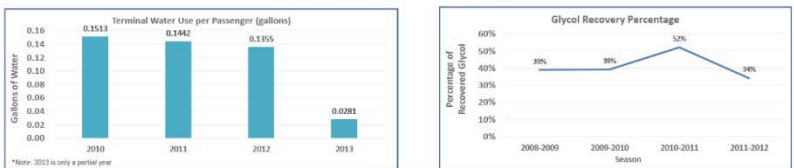
Sustainable Land Management



Waste Management and Recycling



Water Use and Water Quality



Resiliency





Appendix A

Sustainable Land Management Study



Sustainable Land Management Study

Existing Conditions

DAY comprises a total of 5,202.2 acres and approximately 1,450 acres is used for non-aeronautical uses. Currently, a majority of the non-aeronautical use (1,180 acres) is agriculture, specifically corn and soybean crops (0.01% of all of Ohio's cropland). As a starting point for this analysis, all non-aeronautical parcels were mapped, as seen in **Figure 1**. The Project Team then created a quantitative analysis tool that contains data on all of DAY's non-aeronautical parcels, full parcel size, farmable acreage, as well as current lease and tax information. The tool utilizes GHG emissions factors from recognized literature and GHG inventory protocols in order to estimate the annual GHG emissions from existing use. The tool also allows the user to select alternative uses in order to analyze the change in GHG emissions from the alternative use, any financial implications, and additional co-benefits of the alternative.

The tool uses a combined average GHG emissions factor for corn and soybean crops managed through conventional practices in Montgomery and Miami Counties, Ohio. These factors are available at the County level for various crop types and agriculture practices through the University of Michigan's "US Cropland Greenhouse Gas Calculator."¹² GHG emissions result from agricultural practices due to:

- Soil tillage
- Fertilizer application
- Pesticide application
- Crop residue burning
- Equipment fuel

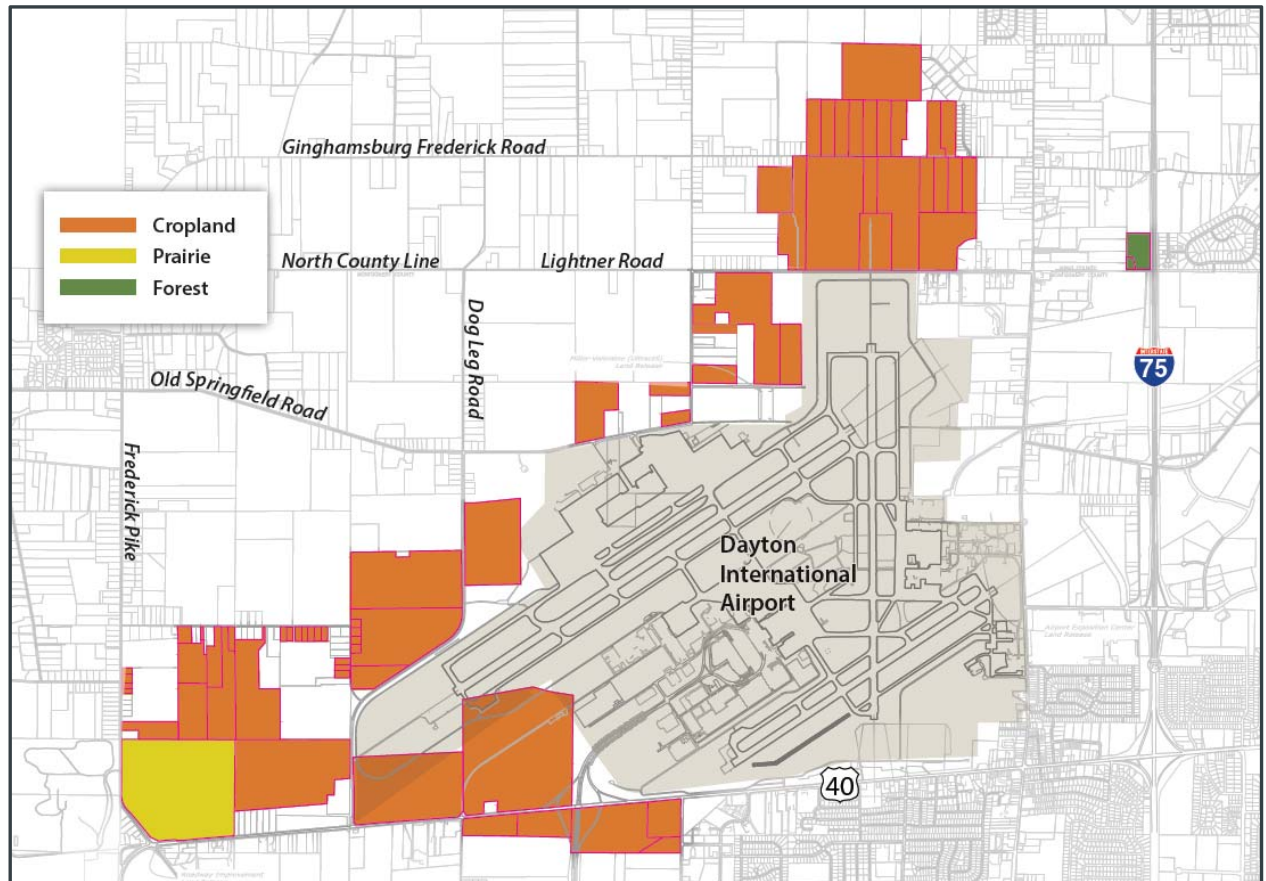
All of these sources of emissions are accounted for in the factors used in this tool. On the other hand, trees and soils have the ability to sequester, or absorb, carbon. While carbon sequestration rates vary greatly and depend on numerous variables, much research has been done to provide estimated ranges for these rates. Such emission and carbon sequestration rates for existing grassland and forest parcels were taken from Intergovernmental Panel on Climate Change (IPCC) guidance and U.S. Environmental Protection Agency publications regarding agriculture and forestry emissions and sequestration.¹³ Converting cropland to grassland is estimated to result in a GHG reduction benefit of 1.4 metric tons carbon dioxide equivalent (MTCDE) per acre. If converting all 1,180 farm acres to grassland, this could result in an annual GHG sequestration of 1,652 MTCDE. If combined with the avoided 625 MTCDE that would result annually from continued farming, it would result in an annual reduction of 2,277 MTCDE. Since it is unlikely that the Airport would convert all of this acreage, the tool allows the user to select one parcel at a time, and the portion of the parcel to be converted, in

¹² University of Michigan. US Cropland Greenhouse Gas Calculator. <http://surf.kbs.msu.edu/county/OH/Montgomery>

¹³ Specific factors and data sources are referenced in the tool.

order to evaluate the potential carbon reduction (or increase) and other impacts for a select area or areas.

Figure 1: Map of DAY Non-Aeronautical Parcels



In addition to farm properties, the Airport also has 15 acres of forest area on two non-congruent parcels, which is estimated to be responsible for an annual sequestration of 18.7 MTCDE. DAY also owns the Knoop Prairie, a NWSG area covering 113.5 acres and sequestering 195 MTCDE per year. The Knoop Prairie is managed by the Airport in cooperation with neighboring Aullwood Audubon Center and Farm (Aullwood). Aullwood also manages an expansive prairie on its own property a short distance west of the Airport.

The existing relationship with Aullwood is an important component of this analysis as Aullwood has provided invaluable input on considerations for conversion to NWSG, resources on establishment and management practices, and will serve as a critical partner in any future pursuits of converting DAY property to such uses.

In addition to conversion of agricultural land to NWSG, the tool evaluates the current land covers of other non-agricultural parcels, including turf. The majority of the non-paved aeronautical area of DAY is a turf cover that requires regular mowing during the growing season. Other forested areas are included in the aeronautical portion of the airport also. The entire airport property is shown in **Attachment 1**. Turf grass covers 2,609 acres of the total airport property. Based on an estimated amount of fuel used in mowing of this grass, this turf acreage is responsible for 9,184 MTCO₂e annually, or 3.52 MTCO₂e per acre.

Primary Considerations for Alternative Uses

In examining the potential alternative uses of DAY's non-aeronautical properties there were a number of considerations in addition to the carbon footprint. The Airport also needed to consider the following:

- Financial implications of conversion, including potential revenue losses, as well as ongoing maintenance and operational costs
- Potential conflicts with future development plans
- Impacts to the local agricultural community
- Consistency with other objectives of this Sustainability Master Plan

Also, given the consideration of establishment of NWSG, it was important to examine any risks associated with new wildlife. These considerations are addressed throughout the discussion that follows.

Conversion to Native Warm Season Grasses

The Native Warm Season Grasses discussed in this study refer to Ohio's tallgrass prairies, which are native to the state. The most common Ohio prairie grasses are bug bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*).¹⁴ In addition to such grasses, prairies typically consist of wildflowers, or forbs. The forbs are an important part of the prairie as they are a source of food for insects and wildlife.



Caption: Prairie at the Aullwood Nature Sanctuary

¹⁴ Ohio Prairie Association, "OPA FAQ". <http://www.ohioprairie.org/page26.html>



Because of the fertile soil of prairies, most of these lands were converted to farmland, and now less than one percent of Ohio's original prairie remains. It is considered the most endangered ecosystem of not only Ohio, but also all of North America.¹⁵

"Diverse prairies are more resilient systems than monocultures of annual row crops."¹⁶ There are a number of factors that are likely to impact agriculture in the near future, including climate change impacts, fuel price increases, pollution regulations, fertilizer and pesticide price variability. Prairie grasses are much more resilient to such changes. They manage stormwater well, but are also tolerant to periods of drought. They do not require fertilizers or pesticides, help manage pollution from stormwater runoff, and do not require the same level of maintenance for which equipment operation would be susceptible to increasing fuel prices. The diversity of plant species in prairie grass systems also makes it more resilient in the face of disease or pest invasion, whereas monoculture row crops would be more likely to be completely wiped out by such impacts.

Benefits

Carbon Sequestration

One of the primary benefits of establishing or conserving prairie grass is the carbon sequestration potential and, in fact, this potential is one of the key factors that interested the airport in considering it as an alternative use. The soil at DAY was once under prairie grass that has since been largely converted to agricultural uses. According to a study from Iowa State University,

"Soil that was produced under prairies but has been converted to row-crop agriculture may contain only 10% to 70% of the carbon stored belowground compared with soil that has continuously grown prairie. Reconstructing prairies onto these soils can result in significant carbon sequestration for decades."¹⁷

Soils typically achieve carbon storage equilibrium after about 20 years. Therefore, emission reduction benefits would be complete in that timeframe as well.¹⁸ This will be an important consideration for the Airport in determining land uses, as the full benefits of carbon sequestration in prairie grasses requires keeping it as prairie grass for a minimum of 10-15 years, possibly 20. Otherwise, once that carbon that has been stored is disturbed for some other use on the property, it would then be released into the atmosphere and counteract the sequestration benefits achieved.

¹⁵ Ohio Department of Natural Resources, Division of Wildlife. "Prairie Grassland Habitat Management." <http://www.dnr.state.oh.us/portals/9/pdf/pub387.pdf> Accessed April 6, 2014.

¹⁶ Iowa State University Extension and Outreach, "Incorporating Prairies into Multifunctional Landscapes." August 2011. P.14

¹⁷ *Ibid*, p.21

¹⁸ The Climate Trust. "Evaluation of Avoided Grassland Conversion and Cropland Conversion to Grassland as Potential Carbon Offset Project Types." <http://www.climateactionreserve.org/wp-content/uploads/2012/12/Grasslands-Issue-Paper.pdf> Accessed March 23, 2014.

As described earlier, the tool developed for this analysis assumed a carbon sequestration rate for converting cropland to prairie grasses of 1.4 metric tons carbon dioxide sequestered (removed from atmosphere) per acre annually.¹⁹ Taking an example parcel 141, a 27 acre parcel that is currently used for corn and soybean crops, its baseline greenhouse gas emissions total 14.4 metric tons of carbon dioxide equivalent (MTCO₂e) per year.²⁰ If converting that entire parcel area to prairie grassland, it would sequester 38.1 MTCO₂e. Taking the whole picture into account, this conversion would allow for the *avoided* emissions of 14.4 MTCO₂e and an additional sequestration of 38.1 MTCO₂e, for a combined overall reduction in emissions of 52.5 MTCO₂e per year.

In addition to carbon sequestration, prairies require less long-term maintenance than agricultural uses. Once established, prairies are almost entirely self-sustaining (other than a controlled burn after 5-7 years). This results in less use of mechanical equipment, requiring fuel use, to maintain the land, an additional cost savings to the Airport as well as an additional reduction in greenhouse gas emissions.

Stormwater and Pollution Management

Prairies also have extensive root systems (sometimes as much as 8 feet deep²¹). These root systems improve the land's ability to infiltrate water and reduce stormwater runoff. The Minnesota Department of Natural Resources emphasizes some of the following additional benefits of prairies:

- Prairies can absorb 9 inches of rainfall before runoff occurs
- One acre of prairie can "intercept as much as 53 tons of water during a one-inch hour rain event"
- Prairies anchor soil to reduce erosion²²

It has also been demonstrated that prairies reduce nutrient pollution. Lower phosphorous and nitrate concentrations have been documented in water bodies located near prairies. They also increase groundwater recharge. All of these benefits of prairies are an important consideration given the Airport's goals of increasing resiliency to climate change impacts and improving environmental quality in and around the airport.

¹⁹ US EPA, "Greenhouse Gas Mitigation Options in U.S. Forestry and Agriculture."

²⁰ This rate reflects a combined average emissions factor for corn and soybean in both Miami and Montgomery counties, assuming conventional till practices. Emissions factors taken from U.S. Cropland Greenhouse Gas Calculator, Michigan State University, <http://surf.kbs.msu.edu/>

²¹ Iowa State University Extension and Outreach, "Incorporating Prairies into Multifunctional Landscapes." August 2011

²² Minnesota Department of Natural Resources. "Put Down Some Roots...Plant Prairie" http://files.dnr.state.mn.us/assistance/nrplanning/community/roadsidesforwildlife/putdownroots_poster.pdf

Wildlife habitat

Native warm season grasses can provide important habitat for a variety of bird species. The Aullwood Audubon Center has indicated that they are working toward being designated as an Important Bird Area (IBA), a program of the Audubon Society that aims to identify and conserve “areas that are vital to birds and other biodiversity.”²³ In conversations with Aullwood staff, they indicated that it requires about 150 acres of continuous prairie to realize full bird species habitat benefits, but that smaller parcels can still be beneficial for other smaller bird species and still contribute to overall biodiversity support.

The development of bird and other wildlife habitat is a major consideration for airports given that a number of species can become a hazard risk to aviation. These considerations are further addressed later in this study.

Prairie grasses are also great habitat for bees, which serve as pollinators for the local ecosystem, including local farms. While corn crops are not dependent on insects for pollination, soybean crops do rely on honeybees for 50 percent of pollination and providing bee habitat has become increasingly important given the rise of Colony Collapse Disorder.²⁴ Aullwood’s Farm and Nature Center have become an excellent habitat for honeybees and they have used this as an educational opportunity and a source of additional revenue through the sale of local honey.



Caption: “Honeybee Crossing” at Aullwood Nature Center

²³ National Audubon Society. <http://web4.audubon.org/bird/iba/> Accessed April 24, 2014.

²⁴ http://www.nbcnews.com/id/18442426/ns/health-diet_and_nutrition/t/declining-honeybees-threat-food-supply/

The Buzz at Seattle-Tacoma International Airport

The Seattle-Tacoma International Airport has partnered with a non-profit organization, The Common Acre, to use some of its vacant property to host 500,000 honeybees in the hopes of reviving declining bee populations. Dusseldorf Airport in Germany has also started using bees to monitor local air quality and presence of toxins.



Source: <http://q13fox.com/2013/06/05/half-a-million-bees-sharing-the-airspace-above-sea-tac-airport/#axzz305u8GpQP> (Courtesy Port of Seattle)

Hosting bees on Airport properties could be an interesting option for DAY, especially within the context of having cropland and/or areas of prairie grasses. It would be consistent with the Airports sustainability goals, it has proven successful at neighboring Aullwood, and there are examples of similar efforts at other airports. DAY could promote this activity, educate passenger and the public on its benefits, and potentially offer local honey for sale in its own shops.

*Establishing and Maintaining a Prairie*²⁵

There are a number of resources available that provide guidance on how to establish and maintain a prairie. One of the best resources that the Airport would have if choosing to pursue this option is the staff at Aullwood, who are experienced and knowledgeable in establishing and maintaining prairies. Generally, the Airport can expect the following processes with regard to converting to prairie grass.

Prairies typically take about three years to become fully established. Controlled burns are recommended during the second and third years. If burning is not an option, the area should be mowed once every three years in the early spring, but not more than 25 percent of the area should be mowed in a given year. Controlled burning allows for the vegetation to grow back very quickly. It functions similar to providing a fertilizer, promoting close to double-growth after a burn.

²⁵ Ohio Department of Natural Resources, Division of Wildlife. "Prairie Grassland Habitat Management." <http://www.dnr.state.oh.us/portals/9/pdf/pub387.pdf> Accessed April 6, 2014.



This process begs a question, however, of whether burning might release the sequestered carbon back into the atmosphere. The answer is that yes, burning does result in some CO₂ emissions, but there is less released than has been sequestered in the prairie's soils. In addition, the fires promote more vegetative growth which results in even more sequestration.^{26 27}

With regard to cropland conversion to prairie, soybean cropland provides the easiest conversion, but corn cropland has proven to be an easy conversion as well. It is possible to cut seeds from existing prairies or to buy seeds in bulk. Cutting seeds from the Knoop Prairie may be the best option for DAY and also reduce overall establishment costs.

Financial Implications

The potential financial implications of converting existing agricultural uses to prairie, or warm season native grasses, have been categorized in this study into initial costs and annual costs. Initial costs are one-time costs associated with converting the parcel(s), and the annual costs are recurring costs after the initial costs are realized. The different types of initial and annual costs considered in the sustainable land management evaluation (and the Sustainable Land Management Tool) include:

Initial Costs

- Current Agricultural Use Value (CAUV) recoupment costs
- Land cover establishment costs

Annual Costs

- Property tax
- Lost lease revenue
- Conservation Reserve Program

Initial Costs

Current Agricultural Use Value (CAUV) Recoupment Costs

Current Agricultural Use Value (CAUV) is a differential real estate tax assessment program which affords owners of farmland the opportunity to have their parcels taxed according to their value in agriculture, rather than fully assessed value. Current agricultural use values for taxing farmland are determined by calculating the farm's projected gross income from agricultural production, subtracting projected non-land production costs to get the farm's net income, then dividing this by an adjusted capitalization rate to arrive at the farmland's agricultural worth.²⁸ A total of 842.25 acres owned by DAY are currently enrolled in the CAUV program, including property leased by Waterwheel Farm, Inc. and Elmer Prikkel.

²⁶ <http://prairieecologist.com/2011/03/21/why-prescribed-fires-in-grasslands-dont-contribute-to-global-warming/>

²⁷ <http://www.k-state.edu/media/webzine/konza/soil.html>

²⁸ Ohio State University Fact Sheet, <http://ohioline.osu.edu/cd-fact/1267.html>



Converting CAUV Properties to non-Agriculture Use

Property no longer used for agriculture would:

1. Lose any tax breaks and possibly incur an increase in property tax; and
2. Would owe the prior three years of reductions, or “recoupments”, applied to the property.²⁹

Parcels in which less than 25 percent is converted to non-agricultural use would not be subject to recoupment costs. In addition, conversion of parcels to public use (i.e., parks, airport facilities) would not be subject to recoupment costs.

Due to the lack of full tax records information prior to 2013 from Miami County’s online system, CAUV participation was determined based on the taxes paid in each year. Fully assessed values for each parcel in Miami County prior to 2013 were determined based on the ratio of CAUV value to full assessed value in 2013.

Land Cover Establishment Costs

The initial cost of establishing a warm season grass pasture is accounted for by using the following per acre estimates³⁰:

- Seed costs: \$400/acre³¹
- Site prep (tillage): \$8-20/acre (average = \$14/acre)
- Site prep (herbicide): \$3-13/acre (average = \$8/acre)
- Seeding costs \$10-50/acre (average = \$30/acre)
- Weed management \$8-27/acre (average = \$18/acre)
- **TOTAL COSTS** **\$470/acre**

Although the seed costs can range greatly, DAY has developed an estimated cost based on local seed costs for the desired type of warm season grass pasture. As other installation estimates are developed and further refined, DAY can edit the Tool assumptions to more accurately calculate establishment costs.

²⁹ An application for “Deferred Recoupment” may be submitted to the respective County tax assessor to delay payment of the three-year recoupment (Montgomery County: <http://www.mcrealestate.org/forms/HtmlFrame.aspx?mode=CAUV.htm>; Miami County: <http://www.miamicountyauditor.org>).

³⁰ Iowa State University Extension and Outreach, “Incorporating Prairies into Multifunctional Landscapes.” August 2011.

³¹ Estimated price of \$400/acres for seed provided by Mike Cross, Environmental Scientist, Department of Aviation based on his investigation of prices.



Annual Costs

Property Taxes

An annual cost associated with converting property from agricultural use would be an increase in property taxes – if the property is currently enrolled in the CAUV program. This annual cost is not associated with the initial cost of “recoupment” (based on the past three years), but rather the estimated cost in future tax years that amounts to the difference in taxes at the fully assessed value and the CAUV value. The estimate uses the year 2013 difference in taxes. There would be no difference in annual property taxes for exempt parcels or parcels that are not currently in the CAUV program.

Lost Lease Revenue

The annual lost lease revenue per parcel is estimated based on previous lease agreements at \$139.90 per acre.

Conservation Reserve Program

The Conservation Reserve Program (CRP) is a land conservation program administered by the Farm Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production, and plant species that will improve environmental health and quality. Contracts for land enrolled in CRP are 10-15 years in length.³² Those enrolled in CRP receive an annual rental payment for their enrolled acres. The Tool assumes that CRP payments would be \$14.84/acre based on prevailing rates in the state of Ohio.³³ FSA also provides cost-sharing and other incentives to help offset the costs associated with putting these practices in place.

To be eligible for CRP enrollment, a farmer must have owned or operated the land for at least 12 months prior the previous CRP sign-up period. Participants can enroll in CRP in two ways. The first is through a competitive process known as CRP General Sign-up. CRP General sign-ups are announced on a periodic basis by the Secretary of Agriculture; they do not occur according to any fixed schedule. The second way to enroll is through CRP Continuous Sign-up which offers on a continuous basis. All enrollment offers are processed through the local³⁴ FSA office.

³² USDA FSA, <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp>

³³ *Evaluation of Avoided Grassland Conversion and Cropland Conversion to Grassland as Potential Carbon Offset Project Types*, The Climate Trust, Diaz, et al., Table 25.

³⁴ <http://offices.sc.egov.usda.gov/locator/app?service=page/ServiceCenterSummary&stateCode=39&cnty=113>



Continuous CRP Sign-up

Continuous CRP is focused on environmentally sensitive land and offers are not ranked against each other. Environmentally sensitive land may include, but is not limited to, agricultural land prone to erosion, pasture or agricultural land that borders river or stream banks, or field margins. Continuous CRP sign-up land eligibility requirements also take into consideration the type of conservation practice the owner wishes to install. Accepted conservation practices include:

- Buffers for wildlife habitat
- Wetlands buffer
- Riparian buffer
- Wetland restoration
- Filter strips
- Grass waterways
- Shelter belts
- Living snow fences
- Contour Grass Strips
- Salt tolerant vegetation
- Shallow water areas for wildlife

General CRP Sign-up

General CRP sign-up only occurs when the Secretary of Agriculture announces USDA will accept bids for enrollment. General CRP sign-up is competitive and offers are ranked against each other on a national level. Offers made during General CRP sign-up are ranked primarily on the environmental benefits that will result from the proposed conservation practices to be put in place. FSA assigns each offer an Environmental Benefits Index (EBI) depending on the environmental sensitivity of the land and the type(s) of conservation practices proposed for it.

Eligibility

Based on conversations with USDA and FSA, DAY may be eligible for assistance through the CRP program.³⁵ Previously, since the City of Dayton owns the land, DAY would not have been eligible for the CRP program; however, eligibility criteria may change with the recent passage of the Agricultural Act of 2014 (also known as the Farm Bill). Criteria for eligibility in 2014-2018 have not been established yet, but city/state entities may be eligible to participate in the CRP program. DAY will likely have to coordinate with two separate FSA offices, and submit separate CRP applications; one for farmland leased in Montgomery County and another for farmland in Miami County, as applicable.

As discussed above, DAY may face eligibility challenges because it is a government entity. Additionally, there were adjusted gross income limitations under the previous Farm Bill eligibility criteria. Some of the eligibility criteria, which may change with the new Farm Bill, include:

³⁵ USDA – Jeff Barnes, (937) 854-7646 x102; FSA [Montgomery County] – Marian Rowell, (937) 456-4211 x2; FSA [Miami County] – Debbie Reed, (937) 335-1918 x134.



- Was the land was used for row crops at some point during 2002-2007?
 - Were the crops reported to FSA (Note, 99% of farmers report to the FSA)?
- Is the land out of production?
- Did the owner (DAY/City of Dayton) make less than \$1 million over the past three years?

Carbon Offset Market Potential

Conversion of Airport land to native warm season grasses could potentially offer a revenue generating opportunity in future years. Projects that reduce, avoid, or sequester carbon emissions are often eligible for selling credits on the carbon offset market. While forest sequestration projects have become quite common on such markets, soil sequestration has not yet entered the market. The Climate Trust has recently completed a paper for the Climate Action Reserve, one of the most trusted carbon offset registries, that evaluates the potential for both “avoided grassland conversion” and “cropland conversion to grassland” as offset project types. The latter would be consistent with what DAY is currently considering. While the Climate Trust begins to answer some important questions about what it would take for such projects to be eligible on the carbon offset market, there is not yet a standard method in place for verifying the value of such project.

Two key issues for such projects that will have to be addressed include additionality and leakage. Additionality refers to the concept that the price paid for a carbon offset has been documented to be a necessary financial resource to make that project happen. This will be an especially important consideration if the Airport proceeds with conversion using its own funding sources and later attempts to sell offset credits for that conversion. Leakage refers to the idea that the sequestration benefits could potentially be offset by a cropland simply being developed elsewhere. Permanence would also be required for such an offset project, i.e. the prairie would need to remain in place for that 15 to 20 year timeframe previously discussed in order not to reverse any of the sequestration benefits. Carbon offset prices on the voluntary market currently range anywhere from \$1 to \$40 depending on the project and provider. It is difficult to anticipate at this time what price per ton such a conversion project at DAY may be able to earn.

Additional Considerations

Wildlife Hazards

Significant research is underway that is comparing wildlife hazards at or near airports between turf grasses and tallgrass. This research is being conducted by the USDA-APHIS National Wildlife Research Center in collaboration with Mississippi State University and partners at the Department of Defense. This is a continuation of some research already done by this group. In their paper, “Do Native Warm-season Grasslands Near Airports Increase Bird Strike Hazards?” the team investigated whether NWSG areas located on or near airports could increase hazards posed to aviation by certain bird species. Three grassland areas were studied in Ohio, including the Paul Knoop Prairie at DAY, mentioned earlier, along with three adjacent turf grass areas to determine if the NWSG areas attracted more hazardous birds.

This research is extremely important to airports and should be an important consideration for DAY in making its land use decisions. Wildlife strikes have historically cost the aviation industry millions of



dollars annually and close to 300 human lives were lost over the last century due to bird strikes. The findings of the research team indicated that “raptor abundance did not differ between the two land cover types,” and that “overall, the distribution of birds within hazard levels was relatively consistent between the two land cover types. Birds in the ‘low’ and ‘very low’ hazard levels (combined) accounted for 93.9% of birds using the airfield grasslands and 97.8% of birds using the NWSG areas.” Their research does suggest, however, that use of grasslands as habitat by birds is influenced not only by the type of grassland, but also the contiguous size and management activities. The study concludes that NWSG could be a viable land use near airfields, but the Airport should continue to pay attention to similar research being conducted elsewhere and should also work closely with Aullwood to understand the impacts that various prairie management decisions might have on bird habitat.³⁶

Future Land Development

The ability for the Airport to develop the land in the future is another consideration for converting cropland to NWSG. While converting back to cropland is easy and the soil is still good or in some cases even better, the full benefits of prairie restoration and carbon sequestration are not realized until the 10 to 20 year range. Any development on the land could reverse carbon benefits and, in addition, the CRP programs require land be conserved for a minimum of 10-15 years. Also, according to a paper from Iowa State University, “Although it is easy to get rid of a prairie, almost all of the cost in having a prairie is incurred during the establishment years. Many of the government programs that provide cost sharing for prairie establishment require the landowner to commit to leaving the land as prairie for a specific number of years (ranging from 10 years to a permanent easement). If the prairie is removed before that time, the landowner must repay all or part of the cost-sharing allotment.”³⁷

Other Options

Maintaining Agricultural Uses

The Airport may wish to keep some or all of its current agricultural parcels as such. This option allows the Airport to continue to collect revenue through leasing of the property and supports Ohio agriculture. However, if choosing to do so, the Airport could still enhance the sustainability of the agricultural lands by requiring its agricultural tenants to use more sustainable farming techniques. This could be done by adding requirements around efficiency of farm equipment, reduced till practices (which lowers the greenhouse gas emissions rate per acre), and/or requirements around pesticide and fertilizer use.

An additional option if maintaining agricultural areas would be to establish prairie buffer areas near the farm properties. “Prairies can be useful additions to the landscape from scales of less than an acre to hundreds of acres.”³⁸ They can be extremely beneficial to area farms for many of the reasons discussed earlier in this study. Prairie areas can reduce soil erosion throughout larger the landscape, which is especially helpful to farms if prairie strips are placed between farms. “Placing strips of prairie

³⁶ Schmidt, Jason A., Washburn, Brian E., Devault, Travis L., Seamans, Thomas W., Schmidt, Paige M. “Do Native Warm-season Grasslands Near Airports Increase Bird Strike Hazards?” *The American Midland Naturalist*, 170(1):144-157.2013. University of Notre Dame, <http://www.bioone.org/doi/full/10.1674/0003-0031-170.1.144>

³⁷ Iowa State University Extension and Outreach, “Incorporating Prairies into Multifunctional Landscapes.” August 2011. P.13

³⁸ Iowa State University Extension and Outreach, “Incorporating Prairies into Multifunctional Landscapes.” August 2011. P.7



on only 10% of the area of a watershed has been found to reduce sediment loss by 90-95% when compared to watersheds with 100% annual row crops.”³⁹

Turf or Slow-Growth Grass

The Airport has recently been considering replacing some of its conventional turf grass areas with slow-growth, low-maintenance turf grass, such as the FlightTurf® product. FlightTurf claims the following benefits over traditional turf grass:

- Reduced emissions from less frequent mowing
- Cost savings from less frequent mowing
- Decreased stormwater runoff
- Drought tolerance (reduced watering)
- Wildlife protection
- Non-invasive species

The sustainable land use evaluation tool developed for this project has incorporated this option and the potential benefits. The amount of each airport parcel that is currently turf grass has been determined so that the Airport can determine the costs (including implementation costs and maintenance savings) as well as greenhouse gas reductions (associated with decreased maintenance requirements).

The following factors were used to determine costs associated with conversion of turf to slow-growth turf (based on FlightTurf website information):

- \$1,981 per acre for establishment costs –average of new establishment and conversion of turf
- \$800 per acre in maintenance savings—based on need for one mowing per year vs. estimate of 22 mowings per year for regular turf

Conclusion and Next Steps

As this study has explicated, there are numerous opportunities and benefits associated with potential land use conversions on DAY properties. However, there are clearly a number of significant considerations for the Airport to account for as well, such as financial implications, safety, and ability to develop land in the future. Combined with this study, the sustainable land use evaluation tool provides a quantitative decision-making tool that the Airport can use to assist in making informed decisions about the use of its properties that make financial sense, are compatible with other airport uses, and consistent with the Airport’s sustainability mission.

Specific considerations when using tool should include:

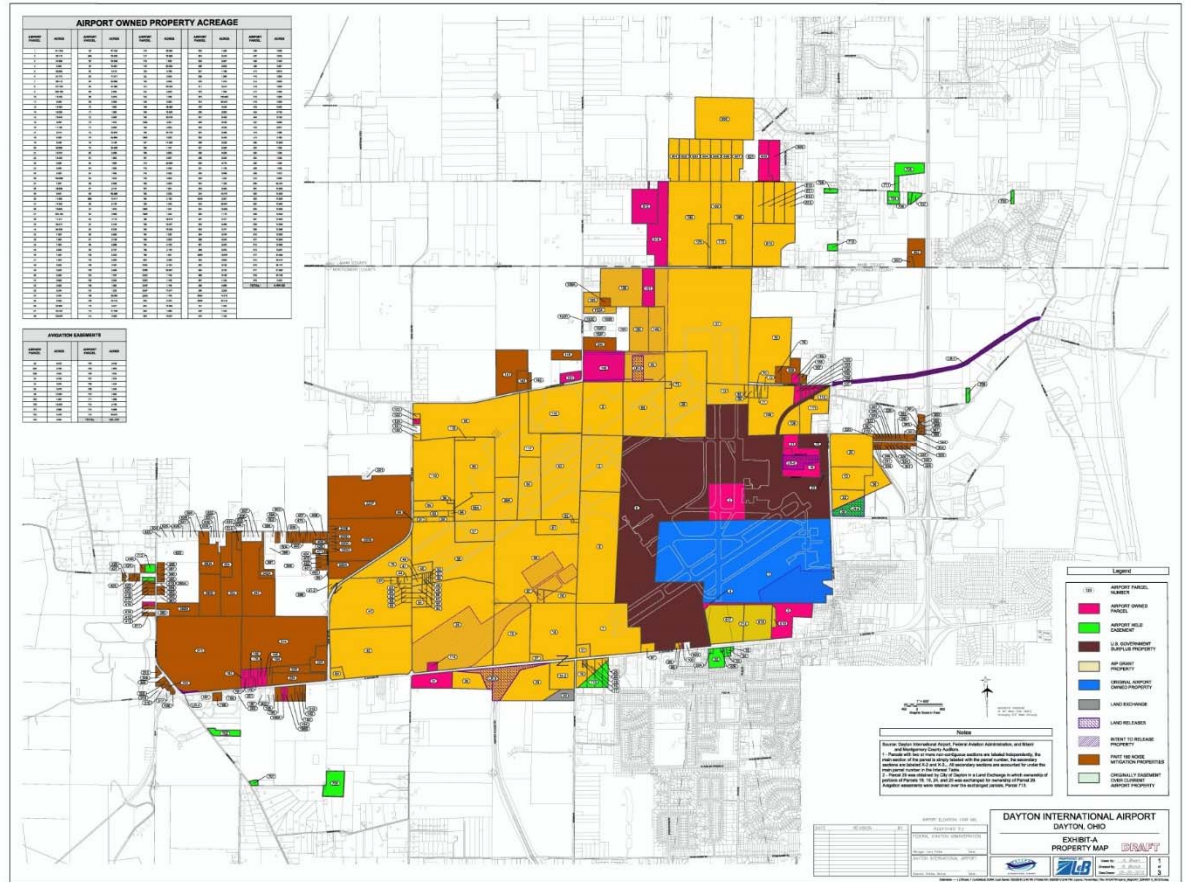
- Is the parcel in the CAUV program? Parcels in the CAUV program could result in substantial “recoupment” costs going back up to three years.
- Is the parcel currently being leased? Converting a parcel that is currently leased would result in lease cancellation penalties. All leased agricultural lands run through February 28, 2015.

³⁹ Iowa State University Extension and Outreach, “Incorporating Prairies into Multifunctional Landscapes.” August 2011. P.4

- How much of the parcel would be disturbed with development projects? Conversion of turf to slow-growth turf would be more financially feasible if land would already be disturbed from development projects.



ATTACHMENT 1: **Dayton International Airport – Exhibit A: Property Map**





Appendix B

Solid Waste Audit

Solid Waste Audit

Current Performance / Baseline Info

❖ *Collection Processes and Recycling Rates*

In May 2012 the Dayton International Airport (DAY) did a formal press release announcing they are "Going Green". Prior to the announcement the Airport teamed with Rumpke Recycling and developed a recycling campaign slogan "It's a great DAY to recycle" including their unique 3 letter designation "DAY". In addition to wrapping trash cans with a customized "Airport Recycling" motif for the commingled recycling and providing them throughout the Terminal and Concourses, portable liquid stations were placed at the TSA Security Checkpoint. Since then DAY has incorporated additional materials to be collected for recycling including; cardboard, scrap metals, fluorescent lamps / Ballasts, wood pallets, batteries, tires and motor oil. (Refer to "Sustainability Waste Audit Plan" for collection locations and types.)



Portable Liquid Station @ TSA Security Checkpoint / Typ. Recycle & Trash Cans throughout the Airport



Waste Management Inventory



Waste Component	LOCATION									
	Concourse A+B	Terminal (Ticketing/ Rental Car Counters)	Administration Areas	Security Screening Checkpoint Area	Various Concessions	Airlines and Airfield Ramp Areas	Airport Maintenance Facilities	Parking Facilities	ARFF Facility	Construction Project Areas (see note below)
Corrugated Cardboard (see note below)		x	x		x	x	x		x	x
Office (White) Paper	x	x	x	x	x	x	x		x	
Mixed Paper	x	x	x	x	x	x	x	x	x	x
Used Printer/Toner Cartridges		x	x		x	x	x		x	
Plastic Containers	x	x	x	x	x	x	x	x	x	x
Glass Containers	x	x	x	x	x	x	x	x	x	x
Aluminum Containers	x	x	x	x	x	x	x	x	x	x
Fluorescent Lamps/Ballasts*							x			
Miscellaneous Batteries*							x			
Hard Plastics (pails, etc.)					x		x			
Used Asphalt										x
Used Concrete										x
Scrap Metal*							x			x
Yard Waste (i.e. wood, mulch, etc.)							x			
Food Waste	x	x	x	x	x	x	x	x	x	x
Used Cooking Oil					x				x	
Used Tires*							x			
Pallets*							x			x
Aircraft/Automobile Used Oil*						x	x			

Note: Construction debris generally handled by Contractor shall not be included in the Waste Audit sort since it is not part of the typical everyday operations of the Airport waste stream.

Corrugated Cardboard shall not be included in the Waste Audit sort since it is currently being collected separately baled and hauled for recycling.

Waste components with a asterisk (*) are currently being stored separately for recycling or part of agreement with outside vendors to pick-up and recycle, when delivering supplies.



Per the "2012 Community Solid Waste and Recycling Survey" approximately; 156 tons of solid waste, 37 tons of cardboard and 28 tons of commingled recyclables were collected and disposed of by Rumpke. Therefore, the average percentage of recycled cardboard is approximately 17% and the average percentage of commingled recycling is approximately 13% which is a total of 30% of the waste collected that is being removed from the waste stream for recycling.

❖ *Tenant Requirements*

Tenants at DAY are encouraged to recycle by allowing the tenants to utilize the dumpsters provided for cardboard and commingled recycling in lieu of just disposing of the waste. HMSHost is also encouraged to do the same in lieu of disposing of recyclables in their trash compactor. There is currently no provisions in place for tenants to recycle other than voluntarily. As a side note it is the same for contractors who are encouraged to recycle their construction waste.



Recycle Dumpster clearly marked with what is allowable recycle waste.

❖ *Education / Promotion*

In 2012 DAY teamed with an agency to help develop a marketing campaign that would include the Airport's slogan to get the public's attention as they pass thru the Airport. They developed a five foot tall display with a caricature of a tree with leaves to educate the public about recycling. Along with the displays, instructional signs were added to the recycling cans to get the public's attention and encourage them to join in the effort and recycle. In addition to promotional signage DAY has included a link on their web site to further educate the public about their recycling efforts.



Five foot tall Promotional Signage display with recycling and waste cans.



DAY Recycling Program on the Airport's website.

❖ *Waste Audit - Process Summary and Results*

As part of the Sustainability Master Plan Study for Dayton International Airport (DAY) a Waste Plan is required. A Waste Audit must be conducted to collect and identify current and future waste collection practices that will streamline the collection process as well as identify potential revenue sources for DAY. The Waste Audit was performed to encompass a 24-hour period to identify components of Day's waste stream. In order to process the Waste Audit we developed "Waste Sort Instructions" and a "Waste Sort Flow Chart" to help coordination with Rumpke and to inform our volunteers of the process.

Leading up to the Waste Audit day we had to make adjustments to our plan do to some limitations and operational issues at Rumpke. Rumpke did not provide a separate pick-up for the HMSHost Waste. So we did our best to try to assess the volume of the waste in the HMSHost dumpster by placing cardboard on top before pick-up to help mark the waste. Also Rumpke did not pick-up the waste from the ARFF or Maintenance Buildings, therefore the Waste Audit Sort is "Terminal Only". The Waste Audit was recorded on the "Waste Audit Sort Form" and the results show that currently not much of the recycling is getting into the Commingled Recycling stream and a lot of non-recyclables are going into the Commingled Recycling stream. Also when comparing the weights with Rumpke's Weight Slips it appears that "Liquid Waste" is almost half of the total weight of the waste collected.



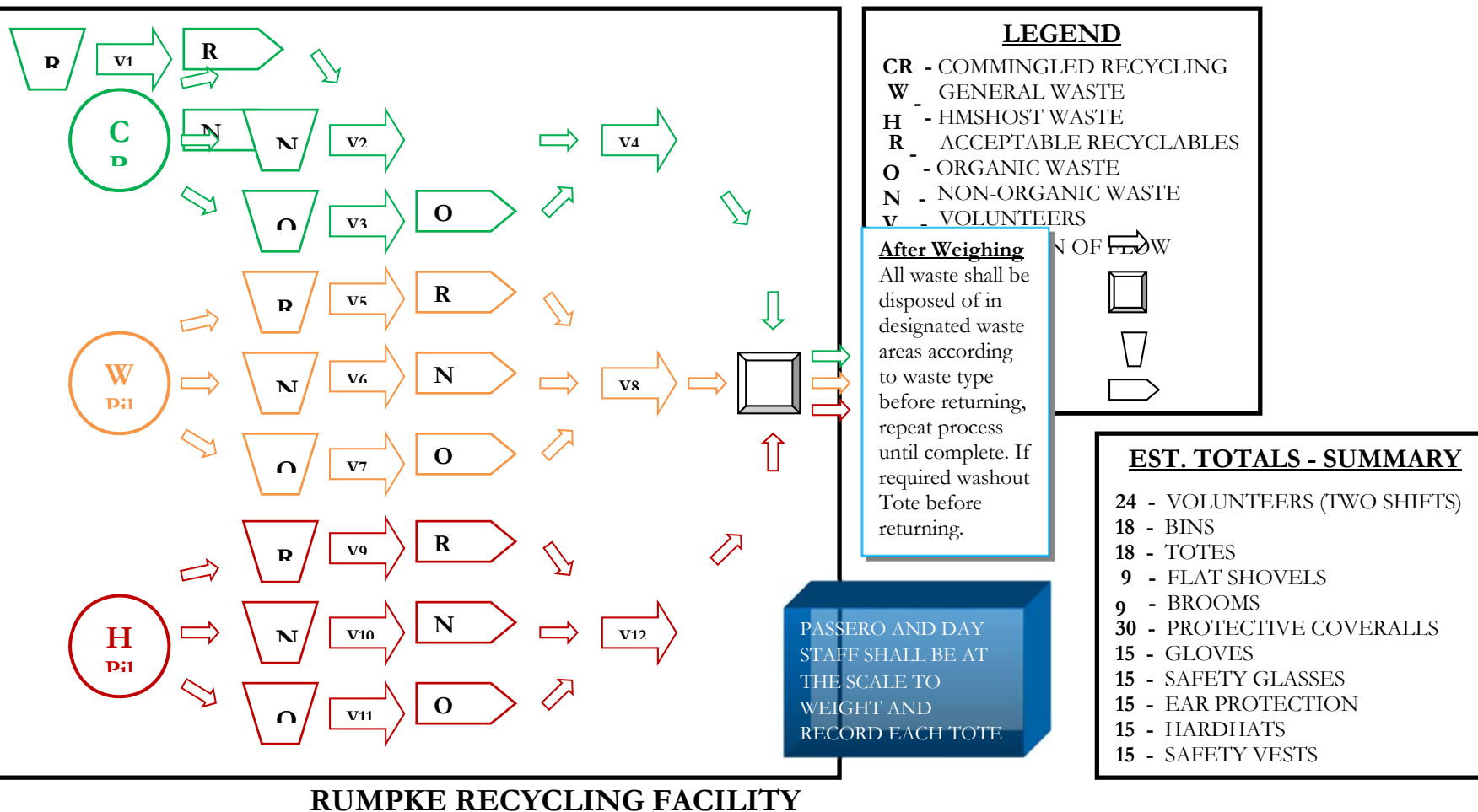
Waste Sort Instructions



1. Rumpke Recycling staff: Shall collect all waste from all the dumpsters throughout the Airport 24 hours prior to the Waste Sample pick-up.
2. Airport Maintenance/Operations staff: Shall collect the Waste Sample to be sorted for the next 24 hours thus an otherwise representative sample of waste from their facility.
3. Airport Maintenance/Operations staff: Shall direct and provide their concession vendor HMSHost with a temporary dumpster to use during the 24 hour Waste Sample collection period.
4. HMSHost staff: Shall use dumpster provide by Airport for designated time period in lieu of their own trash compactor which shall be locked.
5. Rumpke Recycling staff: Shall collect three separate types of Waste Samples and keep them separated, the three types are Commingled Recycling (baled cardboard not included), HMSHost (temporary dumpster) and all of the remaining Waste throughout the Airport's facilities.
6. Rumpke Recycling staff: Shall haul all three Waste Samples to their facility on East Monument Avenue in Dayton prior to Volunteers arriving.
7. Volunteers: Shall arrive 15 minutes early per their scheduled time slot with comfortable clothing and "heavy-duty" footwear. If any volunteers arrive with improper footwear they shall not be allowed in the facility and unfortunately be turned away, not be able to assist in this effort.
8. Volunteers: Shall be provided with protective coveralls, gloves, safety glasses, ear protection, hardhat and safety vest.
9. Volunteers: Shall be put in three separate groups, one group for each Waste Sample type. Each group shall Sort their Waste Sample pile by three major components (e.g. organics, non-organics, and recyclable).
10. Volunteers: Shall use the empty bins to place the sorted wastes into and then dump that waste into separate empty totes. Each volunteer should fill their bins according to their lifting ability.
11. Passero Associates staff: Shall weight a portion of the totes to determine an average base weight to be subtract from each recorded weight. Any excessive material waste that sticks to tote shall be washed off prior to the tote being used again.
12. Volunteers: Shall cart the full totes to the designated weighting area.
13. Passero Associates staff: Shall identify weight and record each tote.
14. Rumpke Recycling staff: Shall provide designated dumpsters for the weighted wastes.
15. Volunteers: Shall then cart the weighted full totes to the designated dumpsters.
16. Volunteers: Shall then return to their designated group with the empty tote to repeat the process. If the tote has any excessive material waste the volunteer shall go the washing area to clean the tote before returning to their group.



Waste Sort Flow Chart





WASTE AUDIT SORT FORM / WEIGHED WASTE IN POUNDS

	COMMINGLED RECYCLING				GENERAL WASTE				HMSHOST WASTE			
	RECYCLE	CARD-BOARD	NON-ORGANIC	ORGANIC	RECYCLE	CARD-BOARD	NON-ORGANIC	ORGANIC	RECYCLE	CARD-BOARD	NON-ORGANIC	ORGANIC
1	89	6	103	8	29	25	66	200	57	12	85	14
2					38	11	66				33	90
3					46		59				61	
4					38		129					
5					67		79					
6					32		93					
7					35		66					
8					24		65					
9					46		145					
10							10					
11							80					
12							161					
13												
14												
15												
16												
17												
18												
19												
20												
T	89	6	103	8	355	36	1019	200	57	12	179	104

TOTAL RECYCLE = 501
 TOTAL CARDBOARD = 54
 TOTAL NON-ORGANIC = 1301
 TOTAL ORGANIC = 312
 TOTAL FOR 24 HOURS = 2168

TOTAL COMMINGLED RECYCLING = 206 - 940 (RUMPKE LOAD) = 734 LIQUID WEIGHT

TOTAL WASTE COMBINED = 1962 - 3260 (RUMPKE LOAD) = 1298 LIQUID WEIGHT

TOTAL WASTE COLLECTED = 2168

TOTAL LIQUID WEIGHT COLLECTED = 2032

Additional Waste Audit Results:

- Total weight of waste collected at the Terminal including concessions in a 24 hour period was 4,200 lbs. of Total Waste in trucks.
- 48% of the total waste collected was Liquid weight of 2,032 lbs. (liquids that spilled out when dumping, not weighted)
- 52% of the total waste weighted was 2,168 lbs. which was divided into 4 categories; cardboard, organic, recycle & non-organic.
- Percentages of total waste weighted per category; 3% cardboard., 14% organic., 23% recycle and 60% non-organic.
- More than half of total weight of waste collected was liquids since some waste was still wet i.e. paper goods, cardboard etc.
- 3% of cardboard in not making it to the balers for recycling.
- Out of the 23% recycle waste only 18% of it is making it into the Commingled Recycling stream.
- With the reduction of liquid waste and the increase in recycled waste the airport could reduce its waste impact by over 50%.



Waste Audit at the Rumpke Facility in progress.

Current Initiatives:

- ✓ Recycling Program begun with the partnership between Rumpke Recycling and DAY and was officially announced to the public in a press release that DAY is "Going Green" on May 1, 2012
- ✓ Portable "Liquid Stations" were placed at the TSA Security Checkpoints to reduce contamination and weight of the commingled recycling
- ✓ By the end of 2012 DAY expanded its Recycling Program to include their administrative offices
- ✓ Printer's defaults are set to double-sided and e-faxing is used to reduce paper usage
- ✓ Recycling requirements are being incorporated into the construction specifications
- ✓ Scrape metals, carpeting, fluorescent lamps / Ballasts, wood pallets, batteries, tires and motor oil is being collected for recycling
- ✓ Cardboard is collected and placed in a baler for recycling
- ✓ Asphalt is milled and stored for re-use. (non FAA funded projects only)
- ✓ Hydration Stations have been installed to reduce the use of plastic bottles



Cardboard baled and stored until enough has been collected for delivery or pick-up.

Potential Opportunities:

- ✓ Composting: Place all plant based scraps, fruits, vegetables, boiled eggshells, bread, coffee grounds and paper coffee filters, teabags, unbleached napkins and paper towels into compostable liner bags. {Neither meat, dairy nor grease type products can be composted.} After several months of processing, a nutrient-dense garden fertilizer will result that can be used for local farming
- ✓ Have all food concessions switch from using plastic and Styrofoam to environmentally friendly green packaging products that are biodegradable and compostable food service packaging and disposable products for compost-ability
- ✓ In addition to what are currently recycled increase efforts to also recycle Aircraft/Automobile oil filters, cooking oil and printer/toner cartridges
- ✓ Donate unused office furniture and equipment
- ✓ Use trash compactors that allow for liquid extraction
- ✓ Provide recycle bins in concession areas, kitchens, ticketing counters and agents counters



Appendix C

Air Quality and GHG Emissions Inventory



Air Quality and GHG Emissions Inventory

A calendar year (CY) 2012 emissions inventory of operations at the James M. Cox Dayton International Airport (DAY) has been prepared to assist the City of Dayton in developing a baseline against which potential sustainability initiatives and emissions reduction measures can be identified and evaluated. The emissions inventory addresses the Environmental Protection Agency (EPA's) criteria air pollutants carbon monoxide (CO), ozone (O₃), respirable particulate matter measuring 10 micrometers or less in diameter (PM₁₀), respirable particulate matter measuring 2.5 micrometers or less in diameter (PM_{2.5}), and sulfur dioxide (SO₂).⁴⁰ In addition, emissions of the greenhouse gases (GHGs) carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), expressed in terms of carbon dioxide equivalent emissions (CO₂e) are also included.⁴¹

This technical appendix outlines the calculation methodologies and input data used to compute the criteria pollutant and GHG emissions inventories for each emissions source in operation at DAY (e.g., aircraft).

1.1. Aircraft and Auxiliary Power Units

Criteria pollutant emissions from aircraft and auxiliary power units (APU) were computed using the Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS version 5.1.3). EDMS computes aircraft emissions in the following modes of operation: startup, taxi/idle, take-off, climb-out, approach, and landing roll. For criteria pollutants, emissions aloft are computed up to the altitude of the local atmospheric mixing height, representing the vertical extent in the atmosphere over which emitted pollutants do not mix downward to ground level.

To determine the local mixing height, EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) was queried to obtain twice-daily measurements at the nearest upper air station, Dayton Wright Patterson Air Force Base (Station #13840). Based on these measurements, the local mixing height for the Dayton area is 2,732 feet on average. In terms of GHG inventory, the mixing height was held at the EDMS default value of 3,000 feet to make the "cruise" component of the GHG inventory more consistent between airports.

Primary inputs to EDMS comprise an aircraft fleet mix (i.e., aircraft types operating at the airport and their equipped engines), annual landing/take-off cycles (LTO) conducted by the aircraft fleet, and aircraft taxi times.⁴² EDMS automatically assigns an APU to eligible aircraft based on market and APU manufacturer data but calls for the specification of APU operating times during gate service. Each of these input parameters are discussed below:

Aircraft Fleet Mix and Operations

Annual aircraft operations were based on statistics provided by the City of Dayton. These reported operations agreed well with tower counts provided by the Air Traffic Control Tower at DAY, the FAA's Air Traffic Activity Data System (ATADS) and the FAA's Terminal Area Forecast (TAF). The commercial aircraft, cargo and air taxi fleet mix using DAY

⁴⁰ EPA's criteria pollutants refer to those pollutants for which EPA has established National Ambient Air Quality Standards (NAAQS) to safeguard human health and environmental welfare from the detrimental effects of air pollution. Notably, oxides of nitrogen (NO_x) and volatile organic compounds (VOC) are considered precursors to ground-level ozone formation and are evaluated as ozone surrogates in this inventory.

⁴¹ The expression CO₂e normalizes the warming effects of individual GHG to the global warming potential (GWP) of CO₂. Consistent with current Intergovernmental Panel on Climate Change (IPCC) guidelines, CH₄ and N₂O are considered 21 and 310 times as potent as CO₂, respectively, although they are emitted in much smaller quantities compared to overall CO₂ emissions.

⁴² An LTO cycle equals one arrival and one departure operation for a given aircraft.



in 2012 (e.g., AirTran's Boeing 717-200 with the BR700-715C1-30 series engine) was derived based on information from the Bureau of Transportation Statistics (BTS) along with the *JP Airline Fleets International 2011-2012* aircraft market share report published by FlightGlobal. To ascertain the general aviation and military aircraft using the airport, the FAA's Traffic Flow Management System Counts (TFMSC) database was consulted.

Aircraft Taxi Times

To estimate aircraft taxi emissions, taxi times were obtained from the BTS *Airline On-time Statistics* database and applied to the DAY aircraft fleet based on carrier, airframe and engine where appropriate. The BTS database reports taxi information for 16 U.S. air carriers that have at least one percent of total domestic scheduled-service passenger revenue, as well as two other carriers that report their schedule information voluntarily. For carriers at DAY not reporting this information to BTS, as well as for other operational categories (i.e., cargo, military and general aviation), an airfield average taxi time was computed based on available BTS data and applied in EDMS to estimate taxi emissions.

Auxiliary Power Unit Utilization

For aircraft equipped with APU according to EDMS, operating times were derived to account for the usage of emissions-reducing infrastructure such as 400 Hertz (Hz) gate power and pre-conditioned air (PCA) units at DAY passenger gates.

To estimate APU operating times related to passenger air carrier and air taxi operations, gate occupancy times were observed during an operational survey conducted in June of 2013. For military and general aviation aircraft for which EDMS indicates an APU is used, an average turnaround time of 26.4 minutes per LTO was assumed based on survey observations.

Operating times were further weighted to reflect the extent of 400 Hz/PCA infrastructure availability and the proportion of hours that the temperature is between 35 degrees and 55 degrees Fahrenheit (as the aircraft would receive comfort air by opening cabin doors during these time periods rather than running the APU). Equation 1 below outlines how the running time calculation was applied.

Equation 1:

$$\text{APU Running Time (minutes)} = (\% \text{ PCA} \times \text{APU}_{\text{time}}) + (1 - \% \text{ PCA}) \times \text{Gate Occupancy} \times (1 - \text{Temp})$$

Where:

$\% \text{ PCA}$ = Proportion of gates equipped with PCA in given year

APU_{time} = Observed APU operating time during turnaround when using PCA/400 Hz (in minutes)

Gate Occupancy = Turnaround time for each aircraft (in minutes)

Temp = Proportion of hours that temperature is between 35 degrees and 55 degrees Fahrenheit



Based on CY 2012 temperature data for the area surrounding DAY, temperatures were between 35 and 55 degrees Fahrenheit for 30.4 percent (%) of the year. Notably, although 100% of DAY aircraft gates have 400 Hz/PCA parking utilities, only 29% of the observed aircraft operations actually used them during the June 2013 survey. So, the “% PCA” term of the equation above was adjusted to account for this observation.

Table AQ-1 summarizes the EDMS aircraft fleet, LTO, taxi times and APU utilization applied in the baseline emissions inventory.



Table AQ-1: EDMS Aircraft and APU Parameters

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
Air Taxi	ASA (Atlantic Southeast)	Embraer ERJ145-LR	AE3007A1P Type 3 (reduced emissions)	2	6.31	12.89	15.98	15.98
	ASH (Mesa)	Bombardier CRJ-700-ER	CF34-8C1	113	4.08	14.80	11.75	11.75
	ASQ (ExpressJet)	Bombardier CRJ-200-ER	CF34-3B	741	5.01	13.05	11.75	11.75
		Embraer ERJ135-LR	AE3007A3 Type 3 (reduced emissions)	10	4.75	13.27	20.09	20.09
		Embraer ERJ145-LR	AE3007A1 Type 2	255	6.69	12.14	20.09	20.09
			AE3007A1P Type 3 (reduced emissions)	1,005	6.31	12.89	20.09	20.09
		Embraer ERJ145-XR	AE3007A1E Type 3	319	6.07	12.93	20.09	20.09
	AWI (Air Wisconsin)	Bombardier CRJ-200-ER	CF34-3B	11	5.28	13.20	11.75	11.75
		Bombardier CRJ-200-LR	CF34-3B	139	5.28	13.20	11.75	11.75
	CHQ (Chautauqua)	Embraer ERJ135-LR	AE3007A3 Type 2	12	5.28	13.20	13.19	13.19
		Embraer ERJ140-LR	AE3007A1/3 Type 3 (reduced emissions)	29	5.28	13.20	13.19	13.19

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Embraer ERJ145-EP	AE3007A1 Type 2	2	5.28	13.20	13.19	13.19
		Embraer ERJ145-LR	AE3007A1 Type 2	108	5.28	13.20	13.19	13.19
	COM (ComAir)	Bombardier CRJ-100	CF34-3A1 LEC II	230	6.34	16.92	11.75	11.75
		Bombardier CRJ-100-LR	CF34-3A1 LEC II	183	6.34	16.92	11.75	11.75
		Bombardier CRJ-700-ER	CF34-8C1	119	6.34	16.92	11.75	11.75
		Bombardier CRJ-900	CF34-8C5 LEC	103	6.34	16.92	11.75	11.75
	EGF (American Eagle)	Bombardier CRJ-700-ER	CF34-8C1	2	3.00	11.00	11.75	11.75
		Embraer ERJ135-LR	AE3007A3 Type 3 (reduced emissions)	1	4.00	18.00	18.04	18.04
		Embraer ERJ140-LR	AE3007A1/3 Type 3 (reduced emissions)	91	5.05	15.71	18.04	18.04
		Embraer ERJ145-LR	AE3007A1 Type 3 (reduced emissions)	1,102	4.92	13.72	18.04	18.04
		Saab 340-B	CT7-9B	24	4.39	14.00	0.00	0.00
	FLG (Pinnacle)	Bombardier CRJ-200-LR	CF34-3B	374	6.34	16.92	15.53	15.53
		Bombardier CRJ-400-LR	CF34-3B	513	6.34	16.92	15.53	15.53
		Bombardier CRJ-900	CF34-8C5 LEC	117	6.34	16.92	15.53	15.53
	GJS	Bombardier CRJ-700-LR	CF34-8C5B1 LEC	1,358	5.28	13.20	11.75	11.75

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
	(GoJet)							
	JIA	Bombardier CRJ-200-LR	CF34-3B	3,260	5.28	13.20	7.97	7.97
	(PSA Airlines)	Bombardier CRJ-700-ER	CF34-8C1	1,304	5.28	13.20	13.70	13.70
	LOF	Embraer ERJ145-EP	AE3007A1/1 Type 2	344	5.28	13.20	10.96	10.96
	(Trans States)	Embraer ERJ145-LR	AE3007A1 Type 2	497	5.28	13.20	10.96	10.96
			AE3007A1/1 Type 3 (reduced emissions)	115	5.28	13.20	10.96	10.96
	SKW (SkyWest)	Bombardier CRJ-100-LR	CF34-3A1 LEC II	44	5.14	14.39	11.75	11.75
		Bombardier CRJ-200-ER	CF34-3B	281	5.43	13.82	11.75	11.75
		Bombardier CRJ-200-LR	CF34-3B	627	5.35	14.27	11.75	11.75
		Bombardier CRJ-700-ER	CF34-8C1	54	4.90	13.65	11.75	11.75
			CF34-8C1 Block 1 LEC	21	4.57	14.39	11.75	11.75
	UCA (CommutAir)	Bombardier de Havilland Dash 8 Q200	PW123D	21	5.28	13.20	0.00	0.00
		Bombardier de Havilland Dash 8 Q300	PW123B	7	5.28	13.20	0.00	0.00
Cargo Air Carrier	FDX	Airbus A300F4-600 Series	CF6-80C2A5F 1862M39	84	5.28	13.20	13.19	13.19
		Boeing 757-200 Series	RB211-535E4	100	5.28	13.20	13.19	13.19



Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
	(FedEx Corporation)	Boeing MD-10-1	CF6-6D	117	5.28	13.20	13.19	13.19
		Boeing MD-11	CF6-80C2D1F	80	5.28	13.20	13.19	13.19
General Aviation	--	Aerostar PA-60	TIO-540-J2B2	9	5.28	13.20	0.00	0.00
		Air Tractor 802	PT6A-67AF	4	5.28	13.20	0.00	0.00
		BAE Jetstream 31	TPE331-10UG	9	5.28	13.20	0.00	0.00
		BAE Jetstream 41	TPE331-14	2	5.28	13.20	0.00	0.00
		Boeing DC-10-10 Series	CF6-6D	1	5.28	13.20	13.19	13.19
		Boeing DC-3	R-1820	1	5.28	13.20	0.00	0.00
		Boeing DC-9-10 Series	JT8D-7 series Reduced emissions	2	5.28	13.20	13.19	13.19
		Boeing DC-9-30 Series	JT8D-7 series Reduced emissions	18	5.28	13.20	13.19	13.19
		Boeing MD-83	JT8D-219 Environmental Kit (E_Kit)	12	5.28	13.20	13.19	13.19
		Bombardier Challenger 300	AE3007A1 Type 2	73	5.28	13.20	0.00	0.00
		Bombardier Challenger 600	ALF 502L-2	72	5.28	13.20	13.19	13.19
		Bombardier Global Express	BR700-710A2-20	7	5.28	13.20	13.19	13.19
		Bombardier Global Express 5000	BR700-710A2-20	5	5.28	13.20	0.00	0.00
		Bombardier Learjet 25	CJ610-6	2	5.28	13.20	0.00	0.00

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Bombardier Learjet 31	TFE731-2-2B	42	5.28	13.20	0.00	0.00
		Bombardier Learjet 35	TFE731-2-2B	21	5.28	13.20	0.00	0.00
		Bombardier Learjet 40	TFE731-2-2B	33	5.28	13.20	0.00	0.00
		Bombardier Learjet 45	TFE731-2-2B	113	5.28	13.20	0.00	0.00
		Bombardier Learjet 60	TFE731-2/2A	39	5.28	13.20	0.00	0.00
		Cessna 150 Series	O-200	7	5.28	13.20	0.00	0.00
		Cessna 172 Skyhawk	O-320	228	5.28	13.20	0.00	0.00
		Cessna 182	IO-360-B	87	5.28	13.20	0.00	0.00
		Cessna 206	IO-360-B	47	5.28	13.20	0.00	0.00
		Cessna 208 Caravan	PT6A-114A	15	5.28	13.20	0.00	0.00
		Cessna 210 Centurion	TIO-540-J2B2	114	5.28	13.20	0.00	0.00
		Cessna 310	TIO-540-J2B2	252	5.28	13.20	0.00	0.00
		Cessna 337 Skymaster	IO-360-B	12	5.28	13.20	0.00	0.00
		Cessna 340	TIO-540-J2B2	14	5.28	13.20	0.00	0.00
		Cessna 402	TIO-540-J2B2	40	5.28	13.20	0.00	0.00
		Cessna 404 Titan II	TIO-540-J2B2	159	5.28	13.20	0.00	0.00

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Cessna 414	TIO-540-J2B2	35	5.28	13.20	0.00	0.00
		Cessna 421 Golden Eagle	TIO-540-J2B2	185	5.28	13.20	0.00	0.00
		Cessna 425 Conquest I	PT6A-60	5	5.28	13.20	0.00	0.00
		Cessna 441 Conquest II	TPE331-8	41	5.28	13.20	0.00	0.00
		Cessna 500 Citation I	JT15D-1 series	7	5.28	13.20	0.00	0.00
		Cessna 501 Citation ISP	JT15D-1 series	19	5.28	13.20	0.00	0.00
		Cessna 525 CitationJet	JT15D-1 series	143	5.28	13.20	0.00	0.00
		Cessna 550 Citation II	JT15D-4 series	255	5.28	13.20	0.00	0.00
		Cessna 560 Citation V	JT15D-5, -5A, -5B	281	5.28	13.20	0.00	0.00
		Cessna 560 Citation XLS	JT15D-5, -5A, -5B	462	5.28	13.20	0.00	0.00
		Cessna 650 Citation III	TFE731-3	33	5.28	13.20	0.00	0.00
		Cessna 680 Citation Sovereign	PW306B Annular	14	5.28	13.20	0.00	0.00
		Cessna 750 Citation X	AE3007C Type 2	18	5.28	13.20	0.00	0.00
		Cirrus SR20	IO-360-B	93	5.28	13.20	0.00	0.00
		Cirrus SR22	TIO-540-J2B2	177	5.28	13.20	0.00	0.00
		Convair CV-440	R-1820	7	5.28	13.20	0.00	0.00

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Convair CV-580	501D22A	101	5.28	13.20	0.00	0.00
		Dassault Falcon 10	TAY Mk620-15	2	5.28	13.20	0.00	0.00
		Dassault Falcon 2000	PW308C Annular	71	5.28	13.20	13.19	13.19
		Dassault Falcon 50	TFE731-3	53	5.28	13.20	13.19	13.19
		Dassault Falcon 900	TFE731-3	52	5.28	13.20	13.19	13.19
		De Havilland DHC-6-300 Twin Otter	PT6A-27	2	5.28	13.20	0.00	0.00
		Dornier 328-100 Series	PW119B	2	5.28	13.20	13.19	13.19
		EADS Socata TB-20 Trinidad	TIO-540-J2B2	18	5.28	13.20	0.00	0.00
		EADS Socata TBM-700	PT6A-64	20	5.28	13.20	0.00	0.00
		EADS Socata TBM-850	PT6A-66	18	5.28	13.20	0.00	0.00
		Embraer EMB120 Brasilia	PW118B	35	5.28	13.20	13.19	13.19
		Fairchild SA-226-T Merlin III	TPE331-3U	97	5.28	13.20	0.00	0.00
		Fairchild SA-226-TC Metro II	TPE331-3U	8	5.28	13.20	0.00	0.00
		Falcon 7X	CFM56-5C2/P SAC	5	5.28	13.20	0.00	0.00
		Gulfstream G150	TFE731-3	21	5.28	13.20	13.19	13.19
		Gulfstream G200	PW306A Annular	24	5.28	13.20	13.19	13.19

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Gulfstream G300	TAY Mk611-8	7	5.28	13.20	13.19	13.19
		Gulfstream G400	TAY Mk611-8	92	5.28	13.20	13.19	13.19
		Gulfstream G500	BR700-710A1-10	73	5.28	13.20	13.19	13.19
		Hawker HS-125 Series 1	TFE731-3	13	5.28	13.20	0.00	0.00
		Israel IAI-1124 Westwind I	TFE731-3	18	5.28	13.20	0.00	0.00
		Israel IAI-1125 Astra	TFE731-3	19	5.28	13.20	0.00	0.00
		Lancair 360	IO-360-B	1	5.28	13.20	0.00	0.00
		Lockheed F-117 Nighthawk	F404-GE-F1D2	1	5.28	13.20	0.00	0.00
		Mitsubishi MU-2	TPE331-1	5	5.28	13.20	0.00	0.00
		Mitsubishi MU-300 Diamond	JT15D-4 series	1	5.28	13.20	0.00	0.00
		Mooney M20-K	TSIO-360C	161	5.28	13.20	0.00	0.00
		Piaggio P.180 Avanti	PT6A-66	2	5.28	13.20	0.00	0.00
		Pilatus PC-12	PT6A-67B	48	5.28	13.20	0.00	0.00
		Piper PA-23 Apache/Aztec	TIO-540-J2B2	4	5.28	13.20	0.00	0.00
		Piper PA-24 Comanche	TIO-540-J2B2	14	5.28	13.20	0.00	0.00
		Piper PA-27 Aztec	TIO-540-J2B2	53	5.28	13.20	0.00	0.00

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Piper PA-28 Cherokee Series	O-320	160	5.28	13.20	0.00	0.00
		Piper PA-30 Twin Comanche	IO-320-D1AD	27	5.28	13.20	0.00	0.00
		Piper PA-31 Navajo	TIO-540-J2B2	57	5.28	13.20	0.00	0.00
		Piper PA-32 Cherokee Six	TIO-540-J2B2	110	5.28	13.20	0.00	0.00
		Piper PA-34 Seneca	TSIO-360C	60	5.28	13.20	0.00	0.00
		Piper PA-42 Cheyenne Series	PT6A-41	6	5.28	13.20	0.00	0.00
		Piper PA46-TP Meridian	PT6A-42	78	5.28	13.20	0.00	0.00
		Raytheon Beech 1900-C	PT6A-65B	226	5.28	13.20	0.00	0.00
		Raytheon Beech 55 Baron	TIO-540-J2B2	25	5.28	13.20	0.00	0.00
		Raytheon Beech 60 Duke	TIO-540-J2B2	5	5.28	13.20	0.00	0.00
		Raytheon Beech 99	PT6A-36	1	5.28	13.20	0.00	0.00
		Raytheon Beech Baron 58	TIO-540-J2B2	50	5.28	13.20	0.00	0.00
		Raytheon Beech Bonanza 36	TIO-540-J2B2	215	5.28	13.20	0.00	0.00
		Raytheon Beechjet 400	JT15D-5, -5A, -5B	247	5.28	13.20	0.00	0.00
		Raytheon Hawker 1000	TFE731-2/2A	2	5.28	13.20	0.00	0.00
		Raytheon Hawker 4000 Horizon	PW308A Annular	2	5.28	13.20	13.19	13.19

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Raytheon Hawker 800	TFE731-3	1,738	5.28	13.20	13.19	13.19
		Raytheon King Air 100	TPE331-6	14	5.28	13.20	0.00	0.00
		Raytheon King Air 90	PT6A-28	196	5.28	13.20	0.00	0.00
		Raytheon Premier I	JT15D-1 series	170	5.28	13.20	0.00	0.00
		Raytheon Starship 2000	PT6A-67A	9	5.28	13.20	0.00	0.00
		Raytheon Super King Air 200	PT6A-42	186	5.28	13.20	0.00	0.00
		Raytheon Super King Air 300	PT6A-60A	161	5.28	13.20	0.00	0.00
		Robinson R44 Raven	TIO-540-J2B2	1	5.28	13.20	0.00	0.00
		Rockwell Sabreliner 60	CF700-2D	31	5.28	13.20	0.00	0.00
		Sikorsky S-76 Spirit	T700-GE-700	4	5.28	13.20	0.00	0.00
Military	--	Bell 206 JetRanger	250B17B	2	5.28	13.20	0.00	0.00
		Bell UH-1 Iroquois	T400-CP-400	1	5.28	13.20	0.00	0.00
		Boeing 737-700 Series	CFM56-7B22	5	5.28	13.20	13.19	13.19
		Boeing 747-200 Series	CF6-50E2 Low emissions fuel nozzle	2	5.28	13.20	13.19	13.19
		Boeing 757-200 Series	PW2037	2	5.28	13.20	13.19	13.19
		Boeing C-17A	PW2040	1	5.28	13.20	0.00	0.00

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Boeing DC-10-10 Series	CF6-6D	1	5.28	13.20	13.19	13.19
		Boeing DC-9-30 Series	JT8D-7 series Reduced emissions	5	5.28	13.20	13.19	13.19
		Boeing F/A-18 Hornet	F404-GE-400	32	5.28	13.20	0.00	0.00
		Boeing F-15 Eagle	F100-PW-100	5	5.28	13.20	0.00	0.00
		Boeing KC-135 Stratotanker	JT3D-7 series Smoke fix 14-70KC	14	5.28	13.20	0.00	0.00
		Bombardier Challenger 600	ALF 502L-2	2	5.28	13.20	13.19	13.19
		Bombardier Learjet 25	CJ610-6	1	5.28	13.20	0.00	0.00
		Bombardier Learjet 35A/36A (C-21A)	TFE731-2-2B	23	5.28	13.20	0.00	0.00
		Bombardier Learjet 45	TFE731-2-2B	1	5.28	13.20	0.00	0.00
		CASA CN-235-300	CT7-9B	3	5.28	13.20	0.00	0.00
		Cessna 150 Series	O-200	1	5.28	13.20	0.00	0.00
		Cessna 172 Skyhawk	O-320	3	5.28	13.20	0.00	0.00
		Cessna 182	IO-360-B	5	5.28	13.20	0.00	0.00
		Cessna 310	TIO-540-J2B2	3	5.28	13.20	0.00	0.00
		Cessna 560 Citation V	JT15D-5, -5A, -5B	8	5.28	13.20	0.00	0.00
		Dassault Falcon 20-G	CF700-2D	2	5.28	13.20	13.19	13.19

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		De Havilland DHC-8-100	PW120A	5	5.28	13.20	0.00	0.00
		De Havilland DHC-8-200	PW123C	1	5.28	13.20	0.00	0.00
		Embraer ERJ190	CF34-10E	1	5.28	13.20	13.19	13.19
		Fairchild SA-226-TC Metro II	TPE331-3U	7	5.28	13.20	0.00	0.00
		Gulfstream G500	BR700-710A1-10	10	5.28	13.20	13.19	13.19
		Israel IAI-1125 Astra	TFE731-3	5	5.28	13.20	0.00	0.00
		Lockheed C-130 Hercules	T56-A-15	5	5.28	13.20	0.00	0.00
		Lockheed Martin F-16 Fighting Falcon	F100-PW-100	10	5.28	13.20	0.00	0.00
		LTV A-7 Corsair II	TF41-A-2	1	5.28	13.20	0.00	0.00
		McDonnell Douglas A-4 Skyhawk	J65-W-20	2	5.28	13.20	0.00	0.00
		McDonnell Douglas F-4 Phantom II	J79-GE-10	5	5.28	13.20	0.00	0.00
		Pilatus PC-12	PT6A-67B	3	5.28	13.20	0.00	0.00
		Piper PA-28 Cherokee Series	O-320	1	5.28	13.20	0.00	0.00
		Raytheon Beech Bonanza 36	TIO-540-J2B2	3	5.28	13.20	0.00	0.00
		Raytheon Beechjet 400	JT15D-5, -5A, -5B	74	5.28	13.20	0.00	0.00
		Raytheon Hawker 800	TFE731-3	2	5.28	13.20	13.19	13.19

Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Raytheon King Air 90	PT6A-28	5	5.28	13.20	0.00	0.00
		Raytheon Super King Air 200	PT6A-42	11	5.28	13.20	0.00	0.00
		Raytheon Super King Air 300	PT6A-60A	5	5.28	13.20	0.00	0.00
		Sikorsky S-76 Spirit	T700-GE-700	1	5.28	13.20	0.00	0.00
		Sikorsky SH-60 Sea Hawk	T700-GE-401 -401C	8	5.28	13.20	0.00	0.00
		Sikorsky UH-60 Black Hawk	T700-GE-700	2	5.28	13.20	0.00	0.00
		T-38 Talon	J85-GE-5H (w/AB)	18	5.28	13.20	0.00	0.00
Passenger Air Carrier	AAL (American Airlines)	Boeing MD-82	JT8D-217A Environmental Kit (E_Kit)	51	5.35	13.72	13.19	13.19
			JT8D-217C Environmental Kit (E_Kit)	1,102	5.96	14.28	13.19	13.19
		Boeing MD-83	JT8D-217 series	26	7.11	15.56	13.19	13.19
			JT8D-219 Environmental Kit (E_Kit)	115	5.13	15.68	13.19	13.19
		Cessna 550 Citation II	JT15D-4 series	14	5.20	32.40	0.00	0.00
		Piper PA-31 Navajo	TIO-540-J2B2	23	4.38	14.13	0.00	0.00
	DAL (Delta Air Lines)	Airbus A319-100 Series	CFM56-5A5	3	7.00	19.00	13.19	13.19
		Boeing 737-700 Series	CFM56-7B26/3 Tech Insertion	3	3.00	30.50	13.19	13.19
		Boeing 737-800 Series	CFM56-7B26	3	4.50	13.00	13.19	13.19



Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
		Boeing 757-200 Series	PW2037	90	6.55	20.84	13.19	13.19
		Boeing DC-9-50 Series	JT8D-17 Reduced emissions	439	6.02	17.77	13.19	13.19
		Boeing MD-88	JT8D-219	2,282	6.40	16.59	13.19	13.19
		Boeing MD-90	V2525-D5	20	6.42	16.25	13.19	13.19
			V2528-D5	16	6.50	15.80	13.19	13.19
	FFT (Frontier)	Airbus A318-100 Series	CFM56-5B8/P SAC	29	4.82	12.94	13.19	13.19
		Airbus A319-100 Series	CFM56-5B5/P	725	5.56	10.91	13.19	13.19
			CFM56-5B6/3 Tech Insertion	45	5.19	11.89	13.19	13.19
			CFM56-5B6/P	70	5.00	9.83	13.19	13.19
		Airbus A320-200 Series	CFM56-5B4/3 Tech Insertion	213	5.27	10.57	13.19	13.19
			CFM56-5B4/P	44	5.27	11.31	13.19	13.19
	SWA (Southwest)	Boeing 737-300 Series	CFM56-3-B1	19	4.08	10.25	8.12	8.12
			CFM56-3B-2	2	3.00	8.00	8.12	8.12
		Boeing 737-700 Series	CFM56-7B22	93	4.37	8.44	8.12	8.12
			CFM56-7B24	58	4.50	8.25	8.12	8.12
			CFM56-7B24/3 Tech Insertion	55	4.36	8.64	8.12	8.12



Segment	Carrier	EDMS			Taxi Time (minutes)		APU Time (minutes)	
		Aircraft	Engine	LTO	In	Out	Depart	Arrive
	TRS (AirTran)	Boeing 717-200 Series	BR700-715A1-30 Improved fuel injector	988	5.25	12.25	8.12	8.12
BR700-715C1-30 Improved fuel injector			2,184	5.32	11.47	8.12	8.12	
Boeing 737-700 Series		CFM56-7B22	112	5.49	17.54	8.12	8.12	
		CFM56-7B22/2	15	4.58	14.83	8.12	8.12	
Subtotal – Air Taxi			13,538					
Subtotal – Cargo Air Carrier			381					
Subtotal – General Aviation			8,037					
Subtotal – Military			307					
Subtotal – Passenger Air Carrier			8,839					
Grand Total			31,102					

Sources: City of Dayton, 2013; Federal Aviation Administration, 2013; Bureau of Transportation Statistics, 2013; and KB Environmental Sciences, Inc., 2013.



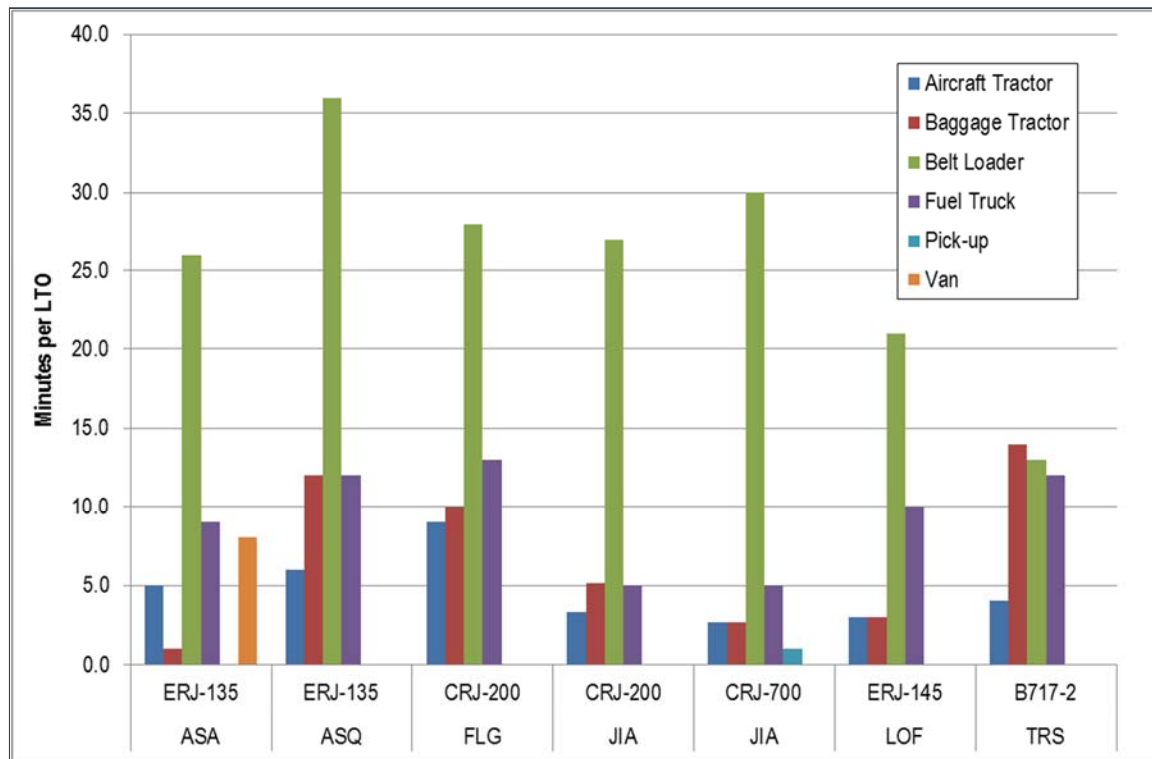
1.2. Ground Support Equipment

Ground support equipment (GSE) emissions were modeled using EDMS in two ways: (1) the gate-based method, and (2) the population-based method. The former captures GSE activity during apron service while an aircraft is being turned around; the latter approach is reserved for GSE activities that occur outside of the apron area or for cases where the utilization during a turnaround event is not known.

Within the gate-based method, GSE emissions are primarily a function of horsepower, fuel type, equipment age, load factor (i.e., the percentage of full throttle during operation) and operating time per LTO. Much of this fleet information was provided by tenant respondents to distributed sustainability data collection surveys, comprising Piedmont, PSA, Aviation Sales, Wright Bros. Aero, and FedEx Express. Where these parameters were not included in the survey response, EDMS default information was applied. The listing of available makes and models of equipment in EDMS is not comprehensive so for instances where there was not an exact match in EDMS for the listed GSE, the best available surrogate was selected where possible.

During a field survey conducted in June of 2013, GSE operating times per LTO were observed for some of the most frequently flown aircraft at DAY and applied to applicable EDMS aircraft operations. These data are summarized on Figure AQ-1. Where appropriate, these data were also used to construct averages for application to other aircraft operations that were not directly observed during the field survey (e.g., a set of average operating times for an ERJ aircraft based on the ERJ observations of ASA, ASQ and LOF activities). Similarly, where carriers operate under the same flagship, limited assumptions were made to relate observed activity from one carrier to another member of the flagship (e.g., AirTran GSE observations were assumed representative of GSE servicing Southwest narrow-body aircraft).

Figure AQ-2: Gate-based GSE Operating Times



Source: KB Environmental Sciences, Inc., 2013.

With the exception of operating time, EDMS requires the same input parameters for the population-based emissions method as it does for the gate-based method. Rather than applying operating times per LTO, the population-based method calls for the specification of annual hours of operation. As with the gate-based method, input values were taken directly from respondents to the sustainability data collection survey and supplemented with EDMS default information where necessary and available. Where hours of operation were not specified for airport deicing vehicles, usage was inferred based on reported glycol usage and known vehicle utilization from select carriers. Table AQ-2 details the GSE fleet and operations applied in EDMS for the population-based emissions estimate.

Table AQ-2: Population-based GSE Parameters

Carrier	Type	Fuel	Hours per Year	Horsepower	Load	Model Year
AirTran	Deicer	Gas	944	165	0.70	2006
American	Deicer	Gas	324	165	0.70	2006
American Eagle	Deicer	Gas	330	165	0.70	2006
Continental/ExpressJet	Deicer	Gas	505	165	0.70	2006
Delta	Deicer	Gas	995	165	0.70	2006



FedEx Express	Air Start	Diesel	260	425	0.90	1980
		Diesel	260	850	0.90	2000
	Aircraft Tractor	Diesel	600	0	0.80	2012
		Diesel	300	0	0.80	1980
	Belt Loader	Diesel	600	71	0.50	2011
		Diesel	200	71	0.50	1994
		Gas	200	71	0.50	1994
	Cargo Loader	Diesel	620	133	0.50	1996
		Diesel	400	80	0.50	1998
	Cargo Tractor	Gas	200	88	0.54	1997
		Diesel	350	88	0.54	2005
		Diesel	350	88	0.54	2006
	Deicer	Gas	350	165	0.70	2009
	Fork Lift	Diesel	300	55	0.30	1998
		LPG	300	55	0.30	2000
		LPG	375	55	0.30	2005
	Ground Power Unit	Diesel	400	0	0.75	1998
	Other (HVU, Light Unit)	Gas	250	140	0.50	2000
		Diesel	260	140	0.50	2000
		Diesel	320	140	0.50	2006
	Service Truck	Gas	300	235	0.20	2002
Frontier	Deicer	Gas	296	165	0.70	2009
Piedmont/PSA/USAir	Deicer	Gas	1600	165	0.70	2009
United	Deicer	Gas	826	165	0.70	2009
Wright Bros	Deicer	Gas	43	165	0.70	2009

Sources: Tenant Sustainability Surveys, 2013; and KB Environmental Sciences, Inc., 2013.



1.3. Stationary Sources

Stationary sources of air emissions at DAY include: aboveground storage tanks (AST); underground storage tanks (UST); combustion devices such as boilers and generators; cooling towers; and deicing application. Brief summaries of inventory methods and input data for each of these categories are provided below.

Storage Tanks

EDMS can estimate volatile organic compound (VOC) emissions from fuel vapors escaping an aboveground fuel tank both passively and during refueling. The rate and magnitude of VOC emissions depends on the type of fuel stored in the tank, ambient temperature and pressure, tank dimensions and capacity. The EPA also provides a similar methodology by which VOC emissions associated with loading losses from UST can be computed. Table AQ-3 summarizes the tank parameters used to compute AST/UST emissions based on either EDMS or the EPA method⁴³. Of note, because vapor emissions from fuel tanks are typically nominal, only the largest, most frequently used tanks were included in the emissions inventory.

⁴³ The EPA method is based on the emission estimation procedures detailed in Chapter 7.1 (November 2006) of EPA's *Compilation of Air Pollution Emissions Factors*, Fifth Edition, (i.e., AP-42).



Table AQ-3: Aboveground and Underground Storage Tank Emissions Parameters

Tank Type	Facility (no. Tanks)	Product	Diameter (meters)	Height (meters)	Max liquid Height	Average Liquid Height	Reid/True Vapor Pressure (PSI)	Throughput (kiloliters)	Capacity (1,000 gallon)
AST - Horizontal	Stevens Aviation (1)	Jet A	2.44	9.75	--	--	--	1,180.0	12
	Wright Bros. Aero (2)	Aviation Gasoline	2.44	8.15	--	--	7.00	494.0	10
		Jet A	2.44	8.15	--	--	--	983.3	10
AST - Vertical	Wright Bros. Aero (3)	Jet A	5.47	4.33	4.33	3.25	--	42,381.5	431
			4.81	2.01	2.01	1.51	--	15,241.6	155
			4.81	2.01	2.01	1.51	--	15,241.6	155
UST	Aviation Sales (2)	Aviation Gasoline	--	--	--	--	7.40	--	10
			--	--	--	--	7.40	--	10
		Jet A	--	--	--	--	0.02	--	10
			--	--	--	--	0.02	--	10
	Avis Rent A Car (1)	Motor Gasoline	--	--	--	--	7.40	--	12
	Budget Rent-a-Car (1)	Motor Gasoline	--	--	--	--	7.40	--	12
	City of Dayton (2)	Diesel	--	--	--	--	0.01	--	12

Tank Type	Facility (no. Tanks)	Product	Diameter (meters)	Height (meters)	Max liquid Height	Average Liquid Height	Reid/True Vapor Pressure (PSI)	Throughput (kiloliters)	Capacity (1,000 gallon)
		Motor Gasoline	--	--	--	--	7.40	--	12
	Corporate Flight Alternatives (2)	Jet A	--	--	--	--	0.02	--	20
			--	--	--	--	0.02	--	20
	Enterprise Rent a Car (1)	Motor Gasoline	--	--	--	--	7.40	--	10
	Federal Express (2)	Diesel	--	--	--	--	0.01	--	2
		Motor Gasoline	--	--	--	--	7.40	--	10
	National Car Rental (1)	Motor Gasoline	--	--	--	--	7.40	--	10
			--	--	--	--	7.40	--	10
	NCR Aviation Dept. (1)	Jet A	--	--	--	--	0.02	--	20
	SOIN (2)	Jet A	--	--	--	--	0.02	--	15
			--	--	--	--	0.02	--	15
	Stevens Aviation (5)	Aviation Gasoline	--	--	--	--	7.40	--	20
		Jet A	--	--	--	--	0.02	--	20



Tank Type	Facility (no. Tanks)	Product	Diameter (meters)	Height (meters)	Max liquid Height	Average Liquid Height	Reid/True Vapor Pressure (PSI)	Throughput (kiloliters)	Capacity (1,000 gallon)
			--	--	--	--	0.02	--	20
			--	--	--	--	0.02	--	20
			--	--	--	--	0.02	--	20
	UPS (3)	Diesel	--	--	--	--	0.01	--	30
		Jet A	--	--	--	--	0.02	--	10
		Motor Gasoline	--	--	--	--	7.40	--	10
	Win Wholesale (1)	Jet A	--	--	--	--	0.02	--	15
	Wright Bros. Aero (2)	Aviation Gasoline	--	--	--	--	7.40	--	10
		Motor Gasoline	--	--	--	--	7.40	--	10

Source: City of Dayton Storage Tank Inventory, 2013.

Note: Values listed as "--" signify parameters that are not required input for emissions calculation.



Combustion Devices

To meet Ohio EPA air permitting requirements, the City of Dayton maintains a periodic emissions inventory of its stationary combustion devices, including boilers, generators, and water heaters. The emissions calculations are based on a “potential to emit” (PTE), meaning the inventory is based upon a worst-case operating schedule and/or fuel usage for each of the included combustion devices. Smaller devices that meet permit exemption requirements are not included in the inventory. Because specific operating schedules and/or fuel usage by device are not readily available, the CY 2012 criteria pollutant PTE calculations for non-exempt devices were adopted directly into the sustainability baseline assessment. Per the City of Dayton, the on-site trash incinerator and one diesel emergency generator previously included in the annual inventories were discounted because these devices have since been retired or decommissioned. Table AQ-4 lists combustion devices included in the sustainability baseline assessment.

Table AQ-4: Stationary Combustion Devices

Device	Description/Location	Fuel	Capacity/Rated Input
Boiler	Main Terminal	Natural Gas	6,330,000 BTU/Hr
Generator	B concourse unit #1	Diesel	500 kW, 36 GPH
	B concourse unit #2	Diesel	500 kW, 36 GPH
	Building #44 (Electric shop)	Diesel	50 kW, 4.66 GPH
	Building #51 (Field Mtce.) + sewage lift	Diesel	200 kW, 16.33 GPH
	Building #7 (ARFF)	Diesel	100 kW, 9.33 GPH
	C concourse unit #1	Diesel	600 kW, 44 GPH
	C concourse unit #2	Diesel	600 kW, 44 GPH
	Cargo Rd. sewage--East	Diesel	75 kW, 4.66 GPH
	Cargo Rd. sewage--West	Diesel	75 kW, 4.66 GPH
	Electrical Vault	Natural Gas	450 kW, 5800 CFH
	Main Terminal	Natural Gas	18,900,000 BTU/Hr
	Main terminal-208V	Diesel	750 kW, 54 GPH
	Main terminal-480V	Diesel	1250 kW, 93 GPH
	NE sewage (Emery) + glycol #3	Diesel	100 kW, 9.33 GPH
	Parking Garage	Diesel	565 kW, 36.8 GPH
	Trailer mounted	Diesel	150 kW, 12.83 GPH
Water Heater	Field Maintenance	Natural Gas	7,452,900 BTU/Hr
	Main Terminal	Natural Gas	3,750,000 BTU/Hr
	North / Concourse "C"	Natural Gas	3,600,000 BTU/Hr

Source: City of Dayton, 2013.

Notes: BTU/Hr = British thermal units per hour, kW = kilowatt, CFH = cubic feet per hour, and GPH = gallons per hour.

Cooling Towers

Two cooling towers operate at DAY for the purposes of supporting the heating, ventilation and air conditioning (HVAC) needs of the airport terminal. According to the EPA, unless controlled, cooling towers emit PM₁₀ during operation, sourced from the dissolved solids contained within the water that is circulated through them (called “drift”). PM₁₀ drift



emissions from the DAY cooling towers were computed based on methodology contained within Chapter 13.4 (January 1995) of EPA's *Compilation of Air Pollutant Emissions Factors, Fifth Edition* (i.e., "AP-42"). Table AQ-5 presents the cooling tower operational parameters and calculation steps used to estimate PM₁₀ drift emissions.

Table AQ-5: Cooling Tower Parameters

Parameters	Tower #1 and #2
Type	Cooling Tower, Open cell, Induced draft
Circulating Water Flow Rate (CWFR)	1,625 gallons per minute
Hours of operation	8,760 hours per year
Drift Rate (DR) ^a	0.02%
Density of Water	8.34 pounds per gallon
Total Dissolved Solids (TDS) Concentration ^b	3,700 parts per million
Solution Drift (SD) ^c	162.6 pounds per hour
PM ₁₀ Drift ^d	0.60 pounds per hour

Source: EPA, 1995, KB Environmental Sciences, Inc., 2013.

Notes: ^a Drift rate is the percent of circulating water. Assumed 0.02 per EPA's AP-42 Table 13.4-1.

^b The TDS values are based on lower range for counter flow per EPA's AP-42 Table 13.4-2.

^c Includes water and based on circulating water flow rate and drift rate

(CWFR gal/min x DR % x 8.34 lb/gal x 60 min/hr).

^d PM calculated based on total dissolved solids and solution drift (TDS x SD).

Deicing Activities

Evaporative VOC emissions occur as de-icing and anti-icing fluids are applied to aircraft and airfield surfaces. The extent of VOC emissions computed by EDMS depends on the type(s) of fluid used, the amount(s) applied, the fluid density and the VOC solution content by mass. Deicing fluid usage reported by DAY tenants was provided by the City of Dayton. Because current de-icing season usage was not available, the CY 2011-2012 de-icing season usage was used as a surrogate and corresponds to 197.17 kiloliters. It was assumed that all fluid was propylene glycol, that the fluid density is 1,036 grams per liter, and that the fluid has a 50% VOC concentration by mass. Unless directed otherwise, EDMS utilizes a VOC emissions rate of 0.110 grams of VOC per kilogram of glycol used, and this rate was retained for the emissions calculation.

1.4. Motor Vehicles

The motor vehicle emissions inventory prepared for the DAY sustainability baseline includes motor vehicle activity (1) on airport roadways, (2) within on-site parking facilities, and (3) at the terminal area curbsides. Running emissions were included for all three of these categories, whereas idling emissions were additionally included for parking and curbside activities. Presented now are discussions of emissions calculation methodology and activity parameters for each of these three categories.



Roadways

Emissions from travel on airport roadways are primarily a function of annual vehicle miles of travel (AVMT) on each roadway segment, which is a product of average annual daily traffic volume (AADT) and travel distance for each type of vehicle. AVMT is then factored against a series of pollutant emissions rates, in grams per AVMT, to compute emissions. This approach is also employed for the component of parking and curbside activities involving vehicle travel (as opposed to vehicle idling). Emissions calculation for motor vehicle travel follows Equation 2 below:

Equation 2:

Running Emissions (tons) = $AADT_{seg} \times 365 \text{ days/year} \times D_{seg} \times EF_{xy} \div 2000 \text{ pounds per ton} \div 453.59 \text{ grams per pound}$

Where:

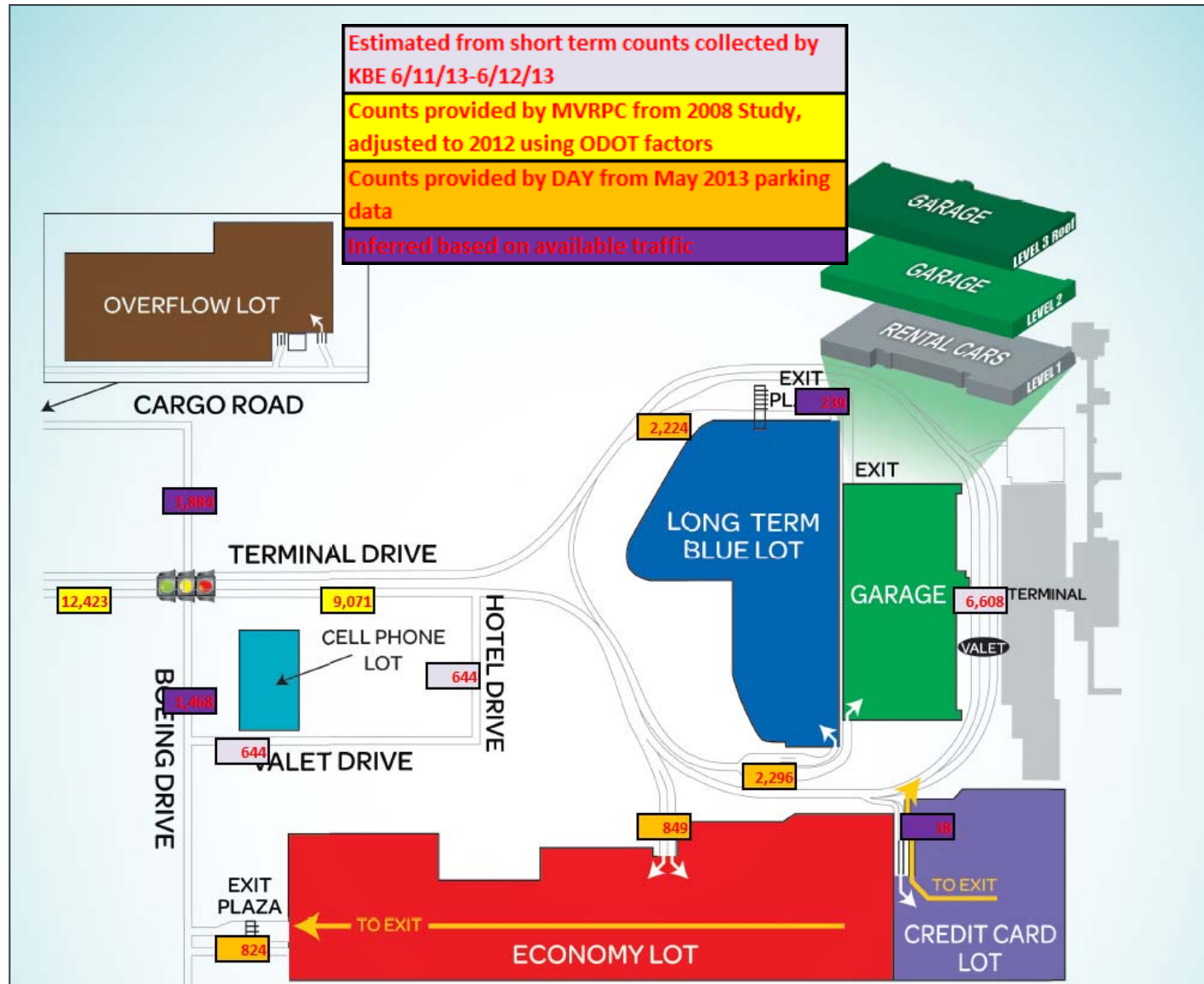
$AADT_{seg}$ = Average Annual Daily Traffic on Roadway Segment

D_{seg} = Roadway Segment Travel Distance (in miles)

EF_{xy} = Emissions Rate for Pollutant "x" at Average Speed "y" (in grams per mile)

To assist in the development of AVMT and vehicle mixes for airport roadways, short-term traffic observations were conducted in June of 2013 and blended with available information from both the Miami Valley Regional Planning Commission (MVRPC) as well as the City of Dayton. These short term traffic counts were adjusted to AADT using Ohio Department of Transportation (ODOT) adjustment factors and temporal patterns of aircraft operations at DAY during 2012, and are depicted on Figure AQ-2.

Figure AQ-3: Annual Average Daily Traffic (AADT) for DAY Roadways





Emissions rates were developed using EPA's Motor Vehicle Emissions Simulator (MOVES version 2010b) and are dependent on the vehicle mix (i.e., the percentage of cars, trucks, shuttles, buses, etc.), fuel mix (i.e., gasoline, diesel), and average travelling speed (e.g., 25 miles per hour). For the DAY inventory, MOVES was invoked using information specific to Montgomery County as reported in the most recent Ozone and Particulate Matter air quality plans prepared by the Ohio EPA and the MVRPC. Summaries of MOVES emissions rates applied to the roadway emissions calculations, the travel-based component of the parking emissions calculations, and the travel-based component of the curbside emissions calculations, are summarized on Table AQ-6.

Table AQ-6: MOVES Running Emission Rates

Average Speed (mph)	Vehicle Category	Emissions Rate (grams per mile)						
		CO	NO _x	SO ₂	VOC	PM ₁₀	PM _{2.5}	CO ₂ e ¹
10	Passenger Cars, Taxis, Limos	12.24	1.81	0.05	0.49	0.09	0.05	762.50
	Passenger Trucks	14.20	2.36	0.07	0.57	0.12	0.05	1,014.08
	Shuttles	9.60	16.49	0.27	1.69	1.68	1.57	1,248.55
15	Passenger Cars, Taxis, Limos	10.43	1.46	0.04	0.38	0.07	0.04	594.99
	Passenger Trucks	12.30	1.92	0.05	0.45	0.09	0.04	795.09
	Shuttles	7.10	10.94	0.22	1.20	1.26	1.18	1,010.41
25	Passenger Cars, Taxis, Limos	8.03	1.04	0.03	0.27	0.06	0.03	448.74
	Passenger Trucks	9.52	1.39	0.04	0.34	0.07	0.03	609.05
	Shuttles	4.94	5.96	0.18	0.80	0.85	0.79	800.36
55	Passenger Cars, Taxis, Limos	5.97	0.75	0.02	0.16	0.03	0.02	331.70
	Passenger Trucks	7.97	1.15	0.03	0.20	0.03	0.02	466.94

Sources: KB Environmental Sciences, Inc., 2013.

Note: ¹ CO₂e emissions represent composite emissions of the individual greenhouse gases (GHGs) carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), normalized to the GHG potency of CO₂ by applying Global Warming Potentials (GWP) of 1 for CO₂, 21 for CH₄, and 310 for N₂O.

Parking Facilities

As mentioned, the travel-based component of the parking emissions inventory involved the derivation of AVMT based on parking volumes provided by the City of Dayton, short-term traffic counts in the cell phone lot, and inferred travel distances (See Equation 2). The 10 mile per hour emissions rates summarized on Table AQ-6 were applied to the derived AVMT to compute the travel emissions.

Vehicle idling while in the parking facilities was also estimated for inclusion in the parking emissions inventory. It was assumed that a measureable amount of idling would only occur in the most frequently used facilities (i.e., the short term, long term and economy facilities), and that vehicles would idle on average for 1.5 minutes as they collect the entrance ticket, circulate for an available space, and wait to pay in the exit queue (or to drop off/pick up passengers in the case of shuttles, taxis, and limos). In the case of the short term parking garage, it was assumed that approximately 60% of the entering traffic would park on the first level and the remaining 40% would continue on to the second level.



Equation 3 below outlines idling emissions quantification steps. Table AQ-7 identifies the AADT, travel distances and idling times used per Equations 2 and 3 to estimate running and idling emissions, respectively, per parking facility.

Equation 3:

Idling Emissions (tons) = $AADT_{\text{park}} \times 365 \text{ days/year} \times H_{\text{veh}} \times EF_x \div 2000 \text{ pounds per ton} \div 453.59 \text{ grams per pound}$

Where:

$AADT_{\text{park}}$ = Average Annual Daily Traffic within Parking Facility

H_{veh} = Idling Time (in hours per vehicle)

EF_x = Emissions Rate for Pollutant “x” (in grams per hour spent at idle)

Table AQ-7: Parking Activity Data

Parking Facility	AADT (per level)			Distance (per level)			Idle Time (hours per vehicle)
	2	3	Total	2	3	Total	
Short Term	706	470	1,176	0.20	0.39	0.39	0.025
Long Term	--	--	1,120	--	--	0.30	0.025
Economy	--	--	849	--	--	0.55	0.025
Credit Card	--	--	38	--	--	0.22	0
Employee	--	--	1,798	--	--	0.15	0
Cell Phone	--	--	644	--	--	0.09	0

Source: KB Environmental Sciences, Inc., 2013; City of Dayton, 2013.

The MOVES model was used to estimate idling emissions rates for application to the idling portion of the parking emissions inventory. These rates are summarized in grams per vehicle on Table AQ-8.

Table AQ-8: MOVES Parking Idle Emissions Rates

Vehicle Category	Idle Emissions Rate (grams per vehicle)						
	CO	NO _x	SO ₂	VOC	PM ₁₀	PM _{2.5}	CO ₂ e ¹
Passenger Car	1.01	0.18	0.01	0.08	0.003	0.003	101.60
Passenger Truck	1.28	0.20	0.01	0.07	0.002	0.002	136.11
Shuttle	1.28	5.27	0.03	0.29	0.252	0.245	156.11

Sources: KB Environmental Sciences, Inc., 2013.

Note: ¹ CO₂e emissions represent composite emissions of the individual greenhouse gases (GHGs) carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), normalized to the greenhouse gas (GHG) potency of carbon dioxide (CO₂) by applying Global Warming Potentials (GWP) of 1 for CO₂, 21 for CH₄, and 310 for N₂O.

Terminal Curbsides

As mentioned, the travel-based component of the curbside emissions inventory utilized a derivation of AVMT based on short-term traffic counts conducted in June of 2013. Because the arrivals, departures and ground transportation curbs have different vehicle utilizations, classification counts and idling times were also recorded during the sampling. It is important to note that although all categories of vehicles were observed to access each curbside area, not every vehicle category was observed to dwell or idle at a given area. Idling calculation methodology for the curbside inventory is consistent with that specified for the parking emissions inventory (see Equation 3). The idling times and MOVES emissions rates used in the inventory are summarized on Table AQ-9. Observed vehicle classifications are depicted on Figure AQ-3.

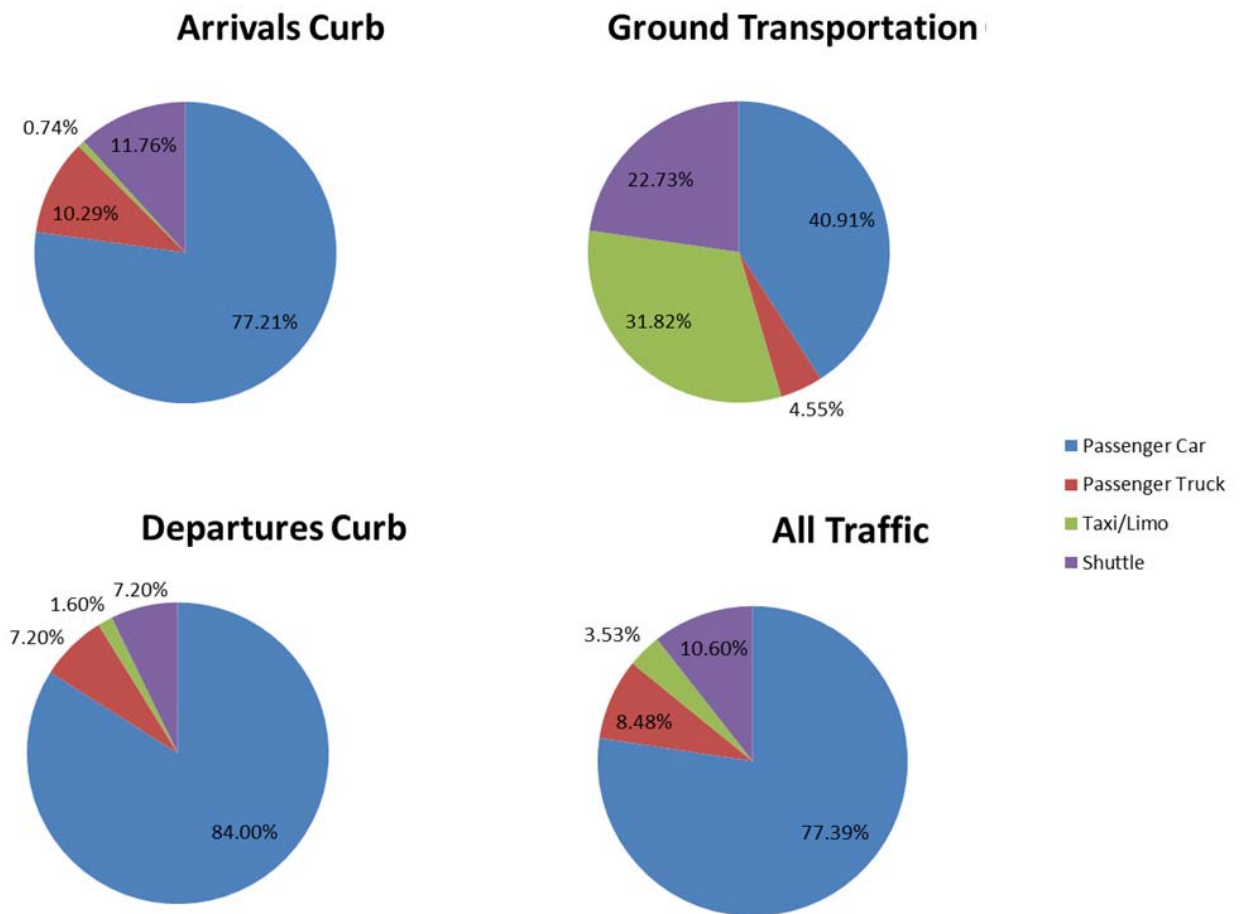
Table AQ-9: MOVES Curbside Idle Emissions Rates/Times

Curbside Area	Vehicle Category	Idling Time (hours per vehicle)	Idle Emissions Rate (grams per vehicle)						
			CO	NO _x	SO ₂	VOC	PM ₁₀	PM _{2.5}	CO _{2e} ¹
Arrivals	Passenger Car	0.09	3.63	0.65	0.03	0.30	0.01	0.01	365.76
	Shuttle	0.02	1.07	4.39	0.03	0.24	0.21	0.20	130.09
Departures	Passenger Car	0.05	1.93	0.34	0.01	0.16	0.01	0.01	194.48
	Passenger Truck	0.02	0.86	0.13	0.01	0.05	0.00	0.00	90.74
	Shuttle	0.02	1.14	4.69	0.03	0.26	0.22	0.22	138.76
	Taxi/Limo	<0.01	0.17	0.03	<0.01	0.01	<0.01	<0.01	16.93
Ground Transportation	Passenger Car	0.02	0.67	0.12	0.01	0.06	<0.01	<0.01	67.73
	Shuttle	0.03	1.71	7.03	0.05	0.39	0.34	0.33	208.14
	Taxi/Limo	0.07	2.94	0.53	0.02	0.24	0.01	0.01	296.33

Sources: KB Environmental Sciences, Inc., 2013.

Note: ¹ CO_{2e} emissions represent composite emissions of the individual greenhouse gases (GHGs) carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), normalized to the greenhouse gas (GHG) potency of CO₂ by applying Global Warming Potentials (GWP) of 1 for CO₂, 21 for CH₄, and 310 for N₂O.

Figure AQ-4: Vehicle Classifications





1.5. Greenhouse Gas Emissions

The methodology with which motor vehicle GHG were computed is outlined within Section 1.4. Otherwise, the GHG inventory prepared for the DAY baseline assessment was energy-based in that it factored fuel (or electricity) usage against a GHG emissions factor in pounds per gallon of fuel (or unit of electricity). Actual fuel usage was utilized wherever possible. In instances where actual fuel usage was not provided, fuel usage was simulated using federally-approved models and tools based on activity levels specified in Sections 1.1 through 1.3. The GHG emissions inventory method is consistent with the industry standard *ACRP Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*.

As mentioned, the GHG inventory considers the individual GHG CO₂, CH₄ and N₂O and normalizes these emissions as CO₂e using global warming potentials (GWP) of 1 for CO₂, 21 for CH₄, and 310 for N₂O.⁴⁴ Table AQ-10 details the energy usage, data sources and GHG emissions rates used in the baseline GHG inventory.

⁴⁴ The expression CO₂e normalizes the warming effects of individual GHG to the global warming potential (GWP) of CO₂. Consistent with current Intergovernmental Panel on Climate Change (IPCC) guidelines, CH₄ and N₂O are considered 21 and 310 times as potent as CO₂, respectively, although they are emitted in much smaller quantities compared to overall CO₂ emissions.



Table AQ-10: GHG Emissions Inventory Input and Calculation Parameters

Entity	Parameter	Fuel	Gallons	MMCF	MWh	Source	CO ₂ Rate	CH ₄ Rate	N ₂ O Rate
Airport	Diesel Usage	Motor Gas	30,927.00	--	--	Fuel Invoice Balance for 2012 City of Dayton, Aviation, Field Maint. Final edition.xls	19.6 lb/gal ¹	0.00055 lb/gal ²	0.00020 lb/gal ²
	Gasoline Usage	Diesel	22,279.10	--	--	Fuel Invoice Balance for 2012 City of Dayton, Aviation, Field Maint. Final edition.xls	22.4 lb/gal ¹	0.00053 lb/gal ²	0.00019 lb/gal ²
	Natural Gas Usage	CNG	--	16.08	--	Energy Audit and Utility Assessment For Dayton International Airport (ARM 2013)	120.6 lb/1000 ft ^{3 2}	0.00020 lb/1000 ft ^{3 2}	0.00020 lb/1000 ft ^{3 2}
	Electrical Usage	--	--	--	10,973.96	Energy Audit and Utility Assessment For Dayton International Airport (ARM 2013)	2,241.6 lb/MWh ³	0.04944 lb/MWh ³	0.02380 lb/MWh ³
Tenant	Electrical Usage	--	--	--	1,327.74	PSA Airlines Tenant Survey; Stevens Aviation Tenant Survey;	2,241.6 lb/MWh ³	0.04944 lb/MWh ³	0.02380 lb/MWh ³
	Aircraft – Above Ground Level	Jet A	2,236,283.83	--	--	Simulated using EDMS 5.1.3	21.1 lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
		Aviation Gas	14,280.47	--	--	Simulated using EDMS 5.1.3	18.4 lb/gal ¹	0.01554 lb/gal ¹	0.00024 lb/gal ¹
	Aircraft - APU	Jet A	29,849,688.39	--	--	Simulated using EDMS 5.1.3	21.1 lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
	Aircraft - Cruise	Jet A	120,273.30	--	--	Aircraft Flight less AGL, Startup, Taxi	21.1 lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
		Aviation Gas	--	--	--	Aircraft Flight less AGL, Taxi	18.4 lb/gal ¹	0.01554 lb/gal ¹	0.00024 lb/gal ¹
	Aircraft - Engine Startup	Jet A	37,482.47	--	--	Simulated using EDMS 5.1.3	21.1lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
	Aircraft - Flight	Jet A	19,920,304.00	--	--	ASI Tenant Survey; 2013 Ohio Airports Focus Study Airport Inventory & Data Survey (ODOT 2013)	21.1lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
		Aviation Gas	139,013.50	--	--	ASI Tenant Survey; 2013 Ohio Airports Focus Study Airport Inventory & Data Survey (ODOT 2013)	18.4 lb/gal ¹	0.01554 lb/gal ¹	0.00024 lb/gal ¹
	Aircraft - Taxi	Jet A	1,766,869.31	--	--	Simulated using EDMS 5.1.3	21.1lb/gal ¹	0.00060 lb/gal ¹	0.00068 lb/gal ¹
		Aviation Gas	4,459.72	--	--	Simulated using EDMS 5.1.3	18.4 lb/gal ¹	0.01554 lb/gal ¹	0.00024 lb/gal ¹
	GSE	Motor Gas	81,086.25	--	--	Simulated using EDMS 5.1.3	19.6 lb/gal ¹	0.00055 lb/gal ²	0.00020 lb/gal ²
		Diesel	136,526.98	--	--	Simulated using EDMS 5.1.3	22.4 lb/gal ¹	0.00053 lb/gal ²	0.00019 lb/gal ²
		LPG	1,658.95	--	--	Simulated using EDMS 5.1.3	12.8 lb/gal ¹	0.00025 lb/gal ⁴	0.00002 lb/gal ⁴

Sources: Input data sources as listed. GHG emissions rates are sourced to the following:

¹ ACRP Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories, Transportation Research Board (2009).

² Voluntary Reporting of Greenhouse Gases Program Fuel Emission Coefficients, Energy Information Administration (2011).

³ EGRID2012 v1.0 for Dayton Power and Light, Montgomery County, OH, Environmental Protection Agency (2012).

⁴ Source Inventory of Bay Area GHG Emissions, Bay Area Air Quality Management District (2006).

Notes: MMCF = million cubic feet; MWh = Megawatt Hour; CNG = compressed natural gas; LPG = liquefied petroleum gas; lb/gal = pounds per gallon; and lb/1000ft³ = pounds per 1,000 cubic feet



Appendix D

Tenant Survey Result



Tenant Survey Results

Introduction

As part of the Sustainability Master Plan's baseline assessment, the project team solicited general sustainability-related information from Airport tenants through an online survey. The attached survey (**Attachment 1**) specifically addresses Airport tenants; which included airlines, FBOs, in-terminal concessionaires, and corporate/cargo facilities.

Airport staff sent the survey link to designated recipients. The survey included questions relating to:

1. Existing sustainability policy
2. Existing and/or planned sustainability initiatives
3. Suggestions for enhancement of sustainability initiatives at DAY

Airport tenants were given approximately one month to complete the survey. A summary of responses and highlights are provided below.

The general sustainability-related survey should not be confused with the Sustainability Tenant Survey regarding equipment inventory and fuel usage that was used to determine air quality and GHG emissions inventories.

Airline, FBO and Other Tenant Profile

Based on a tenant list provided by DAY, there are six airlines, three fixed-base operators (FBOs), 31 tenants, and 41 concessionaires at DAY. The airlines include AirTran/Southwest, American Airlines (including American Eagle), Delta Airlines (including Delta Connection), US Airways (including PSA Airlines / US Airways Express), and United Airlines. The FBOs include Aviation Sales, Stevens Aviation, and Wright Brothers Aero.

Response Rate

The tenant survey was distributed to 39 individuals representing 22 tenants on May 29th. Reminder emails were sent on June 14th and July 1st to increase participation. The survey response rate was 15 individuals representing 12 tenants (54.5 percent of tenants that received the survey responded); however, not all participants responded to all questions. Survey respondents included:

- American Eagle
- Aviation Sales
- Corporate Flight Alternatives (2 respondents)
- Dallas Airmotive, Inc.
- Delta Air Lines (3 respondents)
- Department of Homeland Security / Transportation Security Administration (DHS/TSA)
- FedEx Express
- HMS Host
- PSA Airlines, Inc. (US Airways Express)
- Southwest Airlines
- Standard Parking
- US Airways

Survey Responses

As depicted in **Figure 1**, 10 survey participants responded in the affirmative that their company had a formalized sustainability policy (66.7 percent); three indicated that their organization has no such policy (20.0 percent) and only two respondents were unsure (13.3 percent).

Thirteen tenants (86.7 percent) indicated that their organization implements initiatives to contribute to the sustainability of the company or the Airport (see **Figure 2**). Two respondents indicated that their organization does not implement any initiatives (13.3 percent).

Those that responded in the affirmative provided the following list of example initiatives:

- Noise reduction
- Recycling
- Auxiliary Power Unit (APU) conservation
- Fuel burn efficiency
- Energy efficiency
- Community outreach activities (e.g., park cleaning and planting)
- Green vehicles
- Solar power at facilities

Of the nine respondents that listed initiatives in their response, six of the respondents indicated that they recycle materials at DAY, which included:

- Dallas Airmotive – Recycling of paper, plastic, and aluminum
- Delta Airlines – Recycling of all paper and plastic onboard flights
- DHS/TSA – General recycling (no further recycling information provided)
- FedEx – General recycling (no further recycling information provided)
- HMS Host – Coffee ground recycling
- Southwest Airlines – Onboard recycling (no further recycling information provided)

When asked whether their organization is investigating any other potential sustainability-related initiatives; six respondents (40.0percent) indicated they were and nine respondents (60.0 percent) indicated they were not. It should be noted that one tenant had two different respondents which provided differing responses. This may support an initiative to increase communication with tenants. The tenants exploring additional initiatives included:

- Dallas Airmotive headquarters' is exploring further ways to go paperless

Figure 1: Organizations with a formalized sustainability program/ policy/goals?

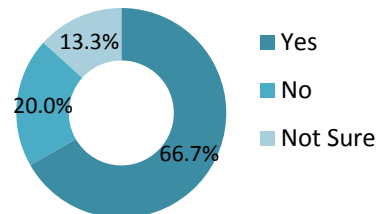
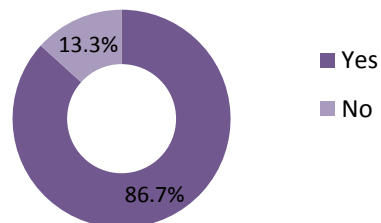


Figure 2: Organizations implementing sustainability initiatives





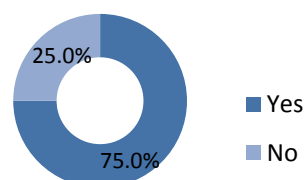
- Delta Airlines (no further information provided)
- DHS/TSA is seeing to use less paper and printing
- HMS Host (no further information provided)
- Southwest Airlines is always investigating potential initiatives, but the respondent was unsure of what the initiatives might be
- US Airways (no further information provided)

Four respondents indicated that DAY could aid their organization in accomplishing their sustainability goals (30.8 percent); nine respondents indicated that DAY would not be able to assist (69.2 percent). HMS Host expressed they would like DAY to help them find an outlet for coffee grounds and food waste.

As shown in **Figure 3**, nine respondents (75.0 percent) would like to be notified of upcoming opportunities for participation in DAY's sustainability planning effort. Three respondents indicated they would not like to be notified of participation opportunities (25.0 percent) and three respondents skipped this question. The tenants that would like to be notified of upcoming opportunities for participation include:

- American Eagle – Rodney Warner, Rodney.Warner@aa.com, 937-890-6668
- Corporate Flight Alternatives – Todd Funderburg, tfunderburg1@woh.rr.com, 937-264-5408
- Dallas Airmotive – Jeff Strachan, jstrachan@dallasairmotive.com, 937-890-8276
- Delta Airlines – Monica Lee, monica.lee@delta.com, 937-454-2888
- Delta Airlines – Ryan Norman, ryan.norman@delta.com, 859-443-9450
- HMS Host – Erik Sprungman, erik.springman@hmshost.com, 937-313-7501
- PSA Airlines – Gene Adams, gene.adams@usairways.com, 937-454-5831
- Southwest Airlines – James Bopp, james.bopp@wnco.com, 563-940-7481
- Standard Parking – Dennis Lloyd, dlloyd@spplus.com, 937-898-1555

Figure 3: Organizations Requesting Notification of Sustainability Planning Participation Opportunities





ATTACHMENT 1 – AIRPORT TENANT TRANSMITTAL EMAIL AND ONLINE SURVEY QUESTIONS

SURVEY TRANSMITTAL EMAIL

Dear Airport Airlines, FBO's, and Tenants,

The Dayton International Airport (DAY) is very fortunate to have been accepted into the FAA's Sustainable Master Planning Pilot Program. As such, we are conducting informational surveys to assist us in gathering the information to develop our DAY Sustainability Master Plan. The purpose of the DAY Sustainability Master Plan is to develop a framework for the Airport to incorporate sustainability – focusing on economic, environmental and community aspects – into its operations and decision-making processes.

We are asking that each entity complete the two surveys:

- The Sustainability Questionnaire which may be found at <https://www.surveymonkey.com/s/9SWQFX6>
- Sustainability Tenant Survey regarding equipment inventory and fuel usage. (Attached)

These surveys are an important component of the DAY Sustainability Master Plan. Please assist the Airport with this effort by completing the survey by Friday, June 7th. Your input is important and valuable. Thank you in advance for your participation. For questions or concerns, please feel free to give me a call at the numbers below.

Sincerely,

Mike

Michael Cross
Environmental Scientist
City of Dayton, Department of Aviation
3600 Terminal Drive, Suite 300
Vandalia, OH 45377
Office: (937) 454-8226
Cell: (937) 623-8343
Fax: (937) 264-3592
Mcross@flydayton.com





SURVEY (on surveymonkey.com)

**DAY Sustainability Master Plan - Tenant Survey**

Purpose of this Survey:

1. To collect information on any sustainability activities your company is planning or has initiated.
2. To better understand if there are opportunities for the Airport's sustainability initiatives to support your company's efforts

Dayton International Airport (DAY) Sustainability Master Plan: Background

Due to rising concerns regarding resource conservation, environmental protection, and fiscal responsibility, airports worldwide are part of a growing debate regarding airport growth and the environmental consequences of aviation. To address these issues, the Federal Aviation Administration (FAA) has launched a Sustainable Master Plan Pilot Program to encourage sustainable airport development. Sustainable airport development is defined by the Airport Council International-North America as "...a holistic approach to managing an airport so as to ensure the integrity of the Economic viability, Operational efficiency, Natural resource conservation and Social responsibility (EONS) of the airport."

DAY is conducting a Sustainability Master Plan as part of the FAA's Sustainable Master Plan Pilot Program. The DAY Sustainability Master Plan is comprised of the following components:

- Sustainability Baseline Assessment
- Goals & Objectives
- Potential sustainability strategies to implement at DAY
- Implementation Strategy

The following survey is an important component of the DAY Sustainability Master Plan, and should take approximately 10 minutes to complete. You can assist the Airport with this effort by completing the survey by Friday, June 7th.

Thank you in advance for your participation.
For questions or concerns, please contact mcross@flydayton.com.

[Next](#)

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**DAY Sustainability Master Plan - Tenant Survey**

***2. Does your organization have a formalized sustainability program/ policy/ goals?**

☐ Yes

☐ No

☐ Not Sure

Additional Comments

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DAY Sustainability Master Plan - Tenant Survey

*** 3. Is your organization implementing any initiatives to contribute to the sustainability of your company or of the airport?**

(Examples of sustainability initiatives include promoting use of public transportation, recycling, purchase of "green" products (e.g., recycled content paper, green cleaning products), energy efficiency initiatives, air or water quality improvements, noise reduction, community outreach, airfield efficiency, etc)

☐ Yes (If yes, please describe below and/or provide relevant documents to mcross@flydayton.com)

☐ No

Additional Comments

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DAY Sustainability Master Plan - Tenant Survey

*** 4. Is your organization investigating any other potential sustainability-related activities?**

☐ Yes (please describe below)

☐ No

Additional Comments

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DAY Sustainability Master Plan - Tenant Survey

***5. Are there any ways that DAY could aid your organization in accomplishing its sustainability goals?**

☐ Yes (please describe)

☐ No

Additional Comments

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DAY Sustainability Master Plan - Tenant Survey

***6. Would you like to be notified of upcoming opportunities for participation in this planning effort?**

(This may include invitations to stakeholder visioning meetings or notification of when study documents are available for review.)

☐ Yes

☐ No

We thank you for completing this survey!

Prev

Done

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Appendix E

Renewable Energy Technology Report



Renewable Energy Technology Report

Dayton International Airport



INTERNATIONAL AIRPORT

Easy to and through.

Prepared By:

Heapy Engineering
1400 W Dorothy Lane
Dayton, OH 45409

January 16, 2014

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I. Overview

Heapy Engineering was engaged to review and update previous renewable energy studies completed for Dayton International Airport (DIA), as emergent renewable energy technologies are rapidly changing and current pricing and project feasibility may differ from studies completed as recently as three years ago. The updated analyses of potentially applicable renewable energy technologies will also be incorporated into Dayton International Airport's Sustainability Master Planning Process which is underway as part of an FAA Grant received by the airport.

Three major renewable energy technology categories were investigated as part of this study: solar, wind, and geothermal. Each technology offers its own application opportunities, advantages and disadvantages, and variable Return on Investment (ROI), all of which are outlined in general terms in the following report.

In summary, none of the renewable energy technologies that were evaluated have simple paybacks within a typical minimum requirement for investment consideration (5-10 years) in the 2013 market; however, payback periods are significantly lower and renewable energy systems are a more attractive option than they were only three to five years ago.

In the case of solar PV, panel efficiency output continues to increase while installed costs per watt have been reduced by 50% the last five years. Additional incentives to install renewable energy systems may further reduce payback periods and increase the project ROI. Both the federal renewable energy production tax credit (a \$0.023 per kilowatt hour tax credit for electricity generated by qualified renewable energy systems) and the Renewable Energy Credit (REC) market may significantly reduce project payback periods.

Additional financing mechanisms are also becoming more prevalent; there are now several paths to financing renewable energy systems. Options such as Power Purchase Agreements (PPA) allow organizations to purchase renewable energy at a fixed kWh rate over a period of 15 to 20 years, without investing significant capital. A third party pays for the cost of the installation and the host organization enters into an agreement to purchase the electricity produced by the system, this can protect large energy users from energy cost volatility, and in some cases, can reduce current electricity costs.

There are many issues to consider specific to the Dayton International Airport as a unique facility type; site factors such as safety, security, and primarily facility function are all major issues when considering large scale renewable energy systems. Many of the issues identified in the following report are singular in nature and apply only to DIA and its primary functions. As a primary example, while wind power at the utility scale is rapidly growing in the Midwest, it is simply not a good option relative to air traffic safety. Geothermal systems face similar logistical constraints due to existing runway infrastructure and site issues; while geothermal systems are becoming more widely deployed, and may be good solutions for some projects, cost and feasibility limitations must be accounted for on a case by case basis at DIA. Geothermal may represent a more attractive application if new construction or site planning changes impact adjacent parking areas to the north and south of the existing terminal.

Solar PV or geothermal systems represent the most attractive renewable energy technology applications at DIA over the near term. Each may represent a good investment in the next five to ten year timeframe and in the case of PV may provide DIA an opportunity to obtain energy at a relatively low and stable fixed cost. In the case of geothermal, a newly deployed well field may reduce the need for additional chiller capacity.

It is the recommendation of this study, that a continued focus on improving airport energy efficiency and upgrading older existing equipment and systems will provide the best ROI in the immediate future.

In all other areas, continued energy efficiency improvements at DIA will also improve the business case for solar PV deployment.¹ Close attention should be paid to the solar PV market as installed costs continue to drop; if any national energy policies or market conditions change in a manner that further reduces 'installed cost per watt' figures, then solar PV may merit re-consideration. A relatively quick analysis of market conditions and potential feasibility at DIA on a biannual basis may be a good practice to consider, and should be evaluated in tandem to any major airport sustainability plans and energy efficiency upgrades.

¹Reducing energy usage and demand to a maximum efficiency base load system condition is an important first step before deploying renewable energy technology; as renewable energy should be viewed as a strategy to further reduce a building or campus energy footprint only after system and equipment efficiency has been optimized.

II. Renewable Energy Technologies

Solar

Photovoltaic

In 2009, Heapy Engineering completed an Engineering Analysis and Preliminary Design to produce 715kW of DIA's electric demand onsite utilizing approximately 3,300 200W photovoltaic (PV) panels mounted to the north and east of the fuel loading racks on the north side of the airport. The system was estimated to provide 900 MWh annually, and was projected to meet 8% of DIA's annual electricity usage. Annual energy cost savings were projected to be \$65,000-\$75,000, total project cost was estimated at approximately \$5.8 million, and project payback (excluding incentives or rebates) was estimated to be over 75 years.

The PV market is rapidly changing every year; global supply and competition, federal and state level tax incentives, and the secondary Renewable Energy Credit (REC) market have all contributed to significant cost reductions, even when compared to analysis completed as recently as 2009. Current (installed) median costs for PV systems larger than 100kW are \$4.50 per Watt² (See Appendix I), but project specific costs depend largely on the size of the array and local or regional market conditions. To determine more specific local pricing estimates, Heapy Engineering contacted a commercial solar installer active in the state of Ohio and obtained the following additional details:

"Solar arrays over 600 kW and larger can expect to see installed cost per watt between \$2.70 - \$3.00 before federal tax incentives or rebates have been applied. Large arrays of at least 1 MW may see costs in the range of \$2.00-\$2.50; in comparison, the installed cost per watt for 600kW and larger systems in 2009 was estimated at \$6.00 - \$8.00."

"Ground mounted systems can typically expect to see a cost increase of approximately 5-10% or \$0.20-\$0.30 per watt in comparison to roof mounted systems."

A ground mounted system will likely be the application of choice at DIA given the availability of open space and security concerns associated with DIA facilities and roof mounted access or space.

While the cost of solar has drastically decreased over the past five years, significant increases in efficiency have also been observed. The most commonly deployed solar technologies Crystalline Silicone (Si), Thin Film Cadmium Telluride (CdTe), and Copper Indium Gallium Selenide (CIGS) technologies now all have manufacturers developing panel models which can exceed 20% efficiency.³ Solar cells based on silicon accounted for nearly 90% of all sales in 2011; industry dominant single-crystalline (c-Si) are the most common application.⁴ High-end efficiency products still have high-end price premiums, as the cost per installed watt for a 20% efficient panel may still exceed \$6; solar panels with 15%-17% efficiency are much more cost effective as the losses in panel efficiency are gained in realized cost savings and total energy production potential.⁵

In 2006, a '60 Cell' solar panel with dimensions of 40" x 65" had a 208 watt capacity; the same '60 Cell' panel built today (2013) has a capacity in the range of 250-270 watts.⁶ As a result, the 715kW solar array designed for DIA in 2009 that required approximately 3,300 panels would now provide the same power using only approximately 2,600 panels, reducing project costs and allowing for additional potential

² Photovoltaic (PV) Pricing Trends: Historical, Recent, and Near Term Projections, U.S. Department of Energy, SunShot, 2012.

³ National Center for Photovoltaics Best-Research Cell Efficiencies, National Renewable Energy Laboratory, 2013. See Appendix IV.

⁴ Technology Roadmap, Solar Voltaic Energy, International Energy Agency, 2010.

⁵ Ibid.

⁶ Discussion with Ohio Solar representative

capacity within the same site footprint. A 3,300 panel array deployed in 2013 would equate to approximately 900 kW .

In 2013, a 715 kW array is likely to cost approximately \$1.8 - \$2.2 million, provide 900 - 1,000 MWh annually and provide an annual cost savings of \$95,000. A 900 kW array would cost approximately \$2.7 - \$3.0 million and expect to produce closer to 1,300 MWh annually, and provide an annual cost savings of \$120,000. Based on 2012 utility data, the energy produced by a 900 kW solar array would account for close to 12% of DIA's annual electricity consumption.

Both projects have a payback (prior to application of incentives) in a range of 24-30 years and fall within the panel life expectancies. Solar panels are often warrantied for 25 years and can have a life expectancy well beyond that; often the inverters must be replaced during the interim lifespan of the panel, but the panel itself can last well beyond 25 years.

Additional potential incentives when installing renewable energy systems include the federal renewable energy production tax credit, which is a per kilowatt hour tax credit for electricity generated by qualified entities. A \$0.023 tax credit per kWh produced is available and assigned to the facility for 10 years after the system is commissioned, but is only available to commercial entities with an associated tax liability.⁷ DIA is unlikely to be eligible for this incentive, but the airport may have commercial partners or individual donors who could be eligible to claim these tax savings if they assisted in financing the project.

Generating electricity through solar PV also allows the owner to sell Solar Renewable Energy Credits (SRECs). In 2008 Ohio signed Senate Bill 221 into law. This law established a requirement for at least 12.5% of all electricity sold in Ohio to come from renewable sources by 2025.⁸ One option for utility companies to comply with SB 221 is to buy SRECs. The energy generated by a solar array is still utilized by the building, but the utility company (or any other party interested in RECs) pays the array owner a premium (through a third-party REC broker) to claim the array's "green" energy. SRECs are equivalent to 1 MWh of clean energy produced. So, an estimated 1,000 SRECs would be generated with a 715kW solar array. Based on a cost of \$27 per SREC, the airport could earn about \$27,000 annually (in addition to annual on-site energy production savings.)⁹ The combined incentives associated with the SREC market and federal tax incentives (if available to DIA or partner entities) may provide DIA \$50,000 annually and further reduce the simple system payback to between 15 and 20 years.

The simplest path to financing a solar project is to purchase the system directly. DIA would buy and operate the solar installation which would allow DIA to directly benefit from any available federal, state and local solar incentives. If DIA has available capital and a tax appetite to absorb tax credits and accelerated depreciation, cash purchases may be the best option.

A Power Purchase Agreement (PPA) is a financing arrangement that allows businesses or government agencies to purchase solar electricity with no upfront capital cost. To achieve this, a "host" organization (DIA) provides unused rooftop, land, or parking lot space as a location for a solar installation. A third party PPA provider pays for the cost of the solar installation and assumes all responsibility for ownership, operation, and maintenance once the solar project is complete. As the host organization, DIA would enter into an agreement to purchase the electricity produced by the system owned by the PPA provider at a predetermined rate per kilowatt-hour, the same unit of measurement on your standard utility bill.¹⁰

A well-structured PPA would allow DIA to reduce electricity costs immediately and realize increased savings over time as grid electricity prices rise. Once the PPA contract period expires (typically 15 - 20 years), DIA could purchase the system at a reduced price, initiate another PPA, or have the solar

⁷ www.dsireusa.org

⁸ *Energy, Jobs, Progress: Ohio Senate Bill 221*, Public Utilities Commission of Ohio, Ohio State Senate, 2008.

⁹ http://www.srectrade.com/ohio_srec.php (See Appendix II.)

¹⁰ The predetermined kWh rate is often competitive with or less than local grid provided energy, and is fixed for the life of the agreement.

installation removed. In Ohio, solar PPA's are most effectively deployed at a scale of 10MW or greater, PPA's in a range of 1MW to -10MW cannot provide cost competitive pricing when compared to utility generation rates at this time. There are a few reasons for this in Ohio:

1. PPA can only compete against utility generation rates, as demand reductions cannot be guaranteed due to the intermittent nature of solar power production. In typical applications, installed solar may achieve up to a 10% reduction of nameplate demand savings (71.5 kW), which will not be a significant cost savings for the airport. New opportunities for further Building Automation System integration and on-site storage are increasing the potential for demand savings, but are not yet widely adopted or scalable.
2. Current utility rates in the DP&L territory between \$0.05-0.06 are lower than those which can be offered in any PA agreements. Current PPA rates are being provided between \$0.075-0.09.
3. Depressed solar market conditions in Ohio have placed developer scale opportunities in a 'coma.' Near term renewable energy targets for the state of Ohio have already been met thus limiting SREC pricing and lower rate structures.

Other financing models do exist within the PPA framework that allow the owner to bring some (if not all) money into the capital stack. However there are two issues to consider in these circumstances as well. Given that the DIA is not a for-profit entity, depreciation write off and tax incentive opportunities do not exist. Alternatively the airport could issue debt as a way to finance a portion of the project at a rate lower than the cost of solar (current market rates for solar development are at 5 %.)

A solar lease is a financing option that allows businesses to generate solar electricity with little to no upfront capital investment. Like traditional equipment leases, solar leases provide use of the solar equipment itself in exchange for a monthly lease payment. DIA can benefit from the clean electricity generated from the rented solar installation and the combination of known lease payments may lead to a reduction in electricity costs and provide increased savings over time. In the cases of the solar PPA or lease option, the airport would have no obligation to purchase or remove the equipment at the end of the agreement; these costs fall to the owner of the solar asset.

Other options such as securitization of the solar asset through the use of mechanisms such as clean renewable energy bonds (CREBs) can be issued as investment vehicles, paying for much of the investment cost associated with the technology.¹¹ Securitization options would need to be investigated through partnership with local or regional authorities, but may be another option for project financing.

Given the confluence of changing market factors including, but not limited to: available tax incentives, potential rebates or sale of RECs, new solar finance mechanisms, increasing solar panel efficiencies and reduced costs per watt, further feasibility investigation of a solar PV system at DIA may in fact be warranted; after efficiency upgrades to the airport have brought electricity usage and demand down below 2012 levels.

If solar PV feasibility investigations proceed in the future and become more substantial due to continually improving market conditions and potential ROI, FAA specific guidance should be consulted. Specifically the FAA's "Technical Guidance for Evaluating Selected Solar Technologies on Airports, 2010" must be referenced and utilized, as FAA considerations, site assessments, and engagement processes are clearly outlined therein. One specific airport concern relative to 'glare' can be summarized as such and is currently under review by FAA as of 2012:

"Because the FAA has no specific standards for airport solar facilities and potential glare, the type of glare analysis that is needed may vary. Depending on site specifics (e.g., existing land uses, location and size of the project) an acceptable evaluation could involve one or more of the following levels of assessment:

¹¹ Property Assessed Clean Energy (PACE) is another way to securitize the investment, but is only available in parts of the state of Ohio.

- (1) A qualitative analysis of potential impact in consultation with the Control Tower, pilots, and airport officials
 - (2) A demonstration field test with solar panels at the proposed site in coordination with FAA Tower personnel
 - (3) A geometric analysis to determine days and times when an impact is predicted.
- The level of assessments should be followed step-by-step and, at the conclusion of each step, the FAA will determine if potential reflectivity issues have been addressed adequately."

The emergence of regional natural gas deposits and development, shifting utility fuel sources, increased renewable energy capacities beyond state required minimums, and limited commercial development scale opportunities have made solar PV deployment a difficult financial proposition over the immediate near term. However, over the mid-term, within the next 5-10 years, continued solar PV cost decreases, utility market volatility, and increase in capital or more favorable legislation may tip the balance in the favor of solar PV deployment; as DIA does have two key variables covered, including available space and a demand for electricity.

Thermal

Solar thermal technology is very reliable and effective. Like solar photovoltaic, it utilizes collectors and the sun. Unlike PV, solar thermal collects the sun's energy as heat instead of as electricity. This energy may be used for space or domestic water heating and, in specific cases, power generation. While solar thermal continues to be a viable option in some specific applications, it has become less prevalent as the cost of solar PV has decreased. Solar thermal applications are now typically reserved for projects with significant and consistent process related hot water loads, such as swimming pools, car washes or large commercial kitchens (such as hotels or cafeterias). Solar PV has become more prevalent as the cost premium for PV in comparison to solar thermal has decreased substantially, and because solar thermal equipment complexity and operations and maintenance requirements are often higher than PV. A solar thermal system consists of a collector, a transfer medium (often water or a glycol solution), a pump, controls, and a storage tank. Figure 1 illustrates an indirect domestic water heating system with a backup boiler.

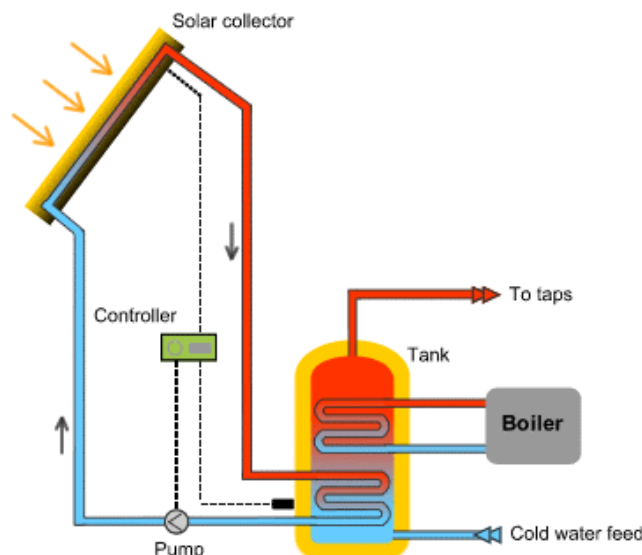


Figure 1: Solar Water Heating System

Such systems are estimated to harvest about 1,840 BTU/ft² per day. This translates to about 500 W/ft² per day compared to about 50 W/ft² per day for solar PV. As an example of typical system design, a system of 24 collectors and associated equipment would cost roughly \$75,000 (\$68 per MBH) and

provide 1,104 MBH per day.¹² Based on current national average natural gas costs, the system would save about \$2,500 per year. This yields a 30 year simple payback. However, these systems are also eligible for incentives and the 'Modified Accelerated Depreciation Schedule' for renewable energy systems.

Based on 2012 DIA utility data, it is estimated that approximately 16,081 MCF of natural gas are used for domestic water heating, annually.

As a rule of thumb, these systems are designed to provide a maximum of 70% of the total required load as total system capacity must be able to provide Domestic Hot Water (DHW) when the solar thermal system is at less than 100% output.¹³ Given the DIA DHW annual usage, an array providing closer to 30% of the DHW demand may be a more likely application. The installation of a solar thermal array to provide 30% of the DIA domestic hot water load would cost approximately \$500,000; produce 5,000 MBH per day and save \$15,000 in annual natural gas costs, this system would provide a simple payback of approximately 30 years (again prior to incentives). The siting of this system has not been considered and it is unclear where a system of this size would be placed.

When considering deployment of a solar thermal system, a number of site and design considerations should be accounted for including, but not limited to; DHW load matching analysis, collector placement, and existing system integration (pumping, piping etc.). Additional operations and maintenance costs must also be factored into projected lifetime savings as there is more equipment to maintain. The domestic hot water demand schedule must be well understood and aligned with the system's capacity. In the case of an airport, when DHW loads are expected to the highest during the day, the solar hot water system will also be at peak production capacity and is, therefore, a reasonably good fit from a load matching perspective.

Wind

Wind Turbines are defined as "devices that convert kinetic energy from the wind, also called wind energy, into mechanical energy in a process known as wind power." For the purposes of investigation at the Dayton International Airport, both Vertical Axis Wind Turbines (VAWTs) and Horizontal Axis Wind Turbines (HAWTs) were considered. As a general rule, renewable wind energy opportunities must be carefully considered given the primary function of the airport. Any applied VAWT technologies will need to be integrated onto the building or parking lot and have a minimum pole height, limiting access to consistent wind. Building integration will also severely impact wind consistency and strength. Any traditional HAWT technologies that have better power production potential, but also exceed 200 feet in height, will need to be located at a minimum distance of at least two miles from the airport given current zoning and FAA restrictions.

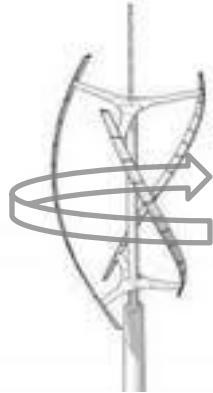
Turbine Types

VAWTs have the main rotor shaft arranged vertically and the main mechanical components are located at the base of the turbine. Turbine blades are organized parallel to the rotor shaft along the vertical axis; they are often stabilized by smaller horizontal support structures, and rotate accordingly.

HAWTs have the main rotor shaft arranged horizontally and the main mechanical components are located at the nacelle of the turbine. Turbine blades are organized perpendicular to the rotor shaft along the horizontal axis; they are often stabilized by a large base, and must be oriented in the direction of the prevailing wind and maintain a minimum separation from adjacent turbine swept areas.

¹² <http://www.dovetailsolar.com/getattachment/Solar-Thermal/Pricing-for-Solar-Heating-Systems/Commercial-SOLAR-THERMAL-Price-Sheet.pdf.aspx>

¹³ Discussion with Ohio Solar representative.



Vertical Axis Wind Turbine
Vertical Rotor-Blades Spin Horizontally



Horizontal Axis Wind Turbine
Horizontal Rotor-Blades Spin Vertically

VAWT Considerations at DIA

VAWTs have a number of advantages when compared against traditional HAWTs. Among the advantages of VAWTs are lower cost of maintenance; generators and gearboxes can be placed closer to the ground, which makes these components easier to service and repair; overall maintenance of system componentry is less involved and less expensive than horizontal turbines, often due to relative system size. Perhaps the most significant advantage is that VAWTs are omni-directional, as they do not need to be pointed in the direction of the prevailing wind. As long as VAWTs are not blocked by structures, they can function anywhere on a project site. This advantage is significant where the wind direction is highly variable or seasonally inconsistent.

Although VAWTs have greater versatility and a significant size difference, VAWTs cannot be considered as a significant power production technology for large scale buildings or project site integration. Although they are easily maintained and can be installed on relatively small ground-based support structures, any power production will be nominal relative to annual DIA kWh usage and purchase, design, and installation costs. There are a few examples nationally where airports have installed smaller building integrated wind turbines; such is the case highlighted below at Honolulu International Airport, but any airport based applications have been installed on a pilot basis only to better understand future feasibility and backup power production potential; not as a significant energy production scale option.

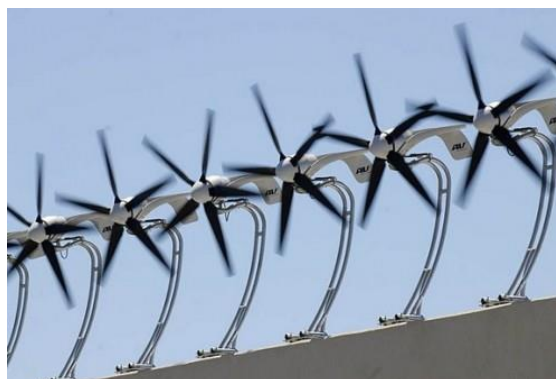


Figure 2: Small scale building integrated wind turbines serving as backup generators at the Honolulu International Airport

The table below presents a typical cost and energy production analysis for small VAWT wind turbines for a project sited in Ohio. Given average annual wind speed of less than 8 MPH at 100 feet or lower, and

VAWT initial costs, the simple payback is not attractive or reasonable given the expected lifetime of the equipment.

Table 1: Small building integrated VAWT Cost Summary

Power Output	Model (Example)	Estimated Annual Energy Production per unit	Estimated Installed Cost per unit	Estimated Annual Energy Production Value per unit
1-2 kW	eddyGT	275 kWh/year	\$15,000	\$25.00/year
3-4 kW	VisionAIR	1,000 kWh/year	\$40,000	\$100.00/year

HAWT Considerations at DIA

Traditional large utility or commercial scale horizontal wind turbines have proven to provide a good ROI and can provide a significant amount of energy on an annual basis. At 240 feet, the average wind speed near Dayton is 12-15 miles per hour.¹⁴ A 200-300 foot wind turbine rated at 1500 kW could produce in excess of 2 million kWh annually in this scenario; however, the first cost will also likely be between \$1.5 – 2 million for the turbine alone.¹⁵ Additional design, installation, transmission, operation, and maintenance costs (total life cycle cost benefit) must all be factored as well if a more- in-depth evaluation of commercial scale HAWT application at DIA is ever performed. A good rule of thumb cost per kW for wind turbines is approximately \$1000 per kW; energy output varies based on blade length, turbine height, and wind speed, but can be expected to slightly outperform solar on a cost per kW basis (at the large commercial and utility scale.)

The FAA developed a model ordinance for a “Limit to Height Objects around Airports” in 1987 and it is still used as the standard for siting vertical objects around and near airports. In addition, applicable to Montgomery County and DIA, are the Wright Patterson Air Force Base Airport Zoning Regulations.¹⁶ These two guidance documents comprehensively address the minimum requirements for siting vertical objects and clearly limit structure height within reasonable horizontal distances. The following highlights clearly illustrate the limited opportunity for siting a large commercial scale HAWT near DIA:

- A diameter totaling a minimum of 10,000 feet around the airport must be maintained and no large structures can be built upon that area, unless a variance and permitted use is deemed necessary (i.e. related to airport function).
- Runway approach zones are defined as such: “zones around the runway that are 1,000 feet wide and expand uniformly to a width of 4,000 feet at a distance of 10,000 feet”.
- A precision instrument runway ‘approach zone’ has the most strict requirements and states no objects can exceed the following vertical requirements “a slope of 50 feet outward for each foot upward extending to a horizontal distance of 10,000 feet; thence a slope of 40 feet horizontally for each foot vertically extending an additional 40,000.”

As a result wind turbines exceeding 200 feet should not be considered for siting within 5 miles of any runways used by aircraft. As Figure 3 illustrates below, the only potentially feasible area that a commercial scale HAWT can be sited near DIA is an area 2-3 miles northwest of the airport (in blue). This area is largely undeveloped and does not encroach on any of the airport’s six major runway ‘approach zones,’ nor is it located within the airport’s minimum diameter requirements associated with vertical structures. Therefore, while the minimum distance of 10,000 feet from the center of the runways

¹⁴ See Appendix III Ohio Average Wind speed at 80 Meters (240 feet), National Renewable Energy Laboratory.

¹⁵ *Wind Turbine Technology: Fundamental concepts of Wind turbine Engineering*, Second Edition, ASME Press, 2009.

¹⁶ *A Model Zoning Ordinance to Limit Height of Objects Around Airports*, U.S. DOT, FAA, 1987. *Wright Patterson Air Force Base Airport Zoning Regulations*, Wright-Patterson Air Force Base Joint Airport Zoning Board, Dayton Ohio, 1997.

must be maintained, commercial scale wind turbines 200 or 300 feet in height could theoretically be sited in this area of open farmland.

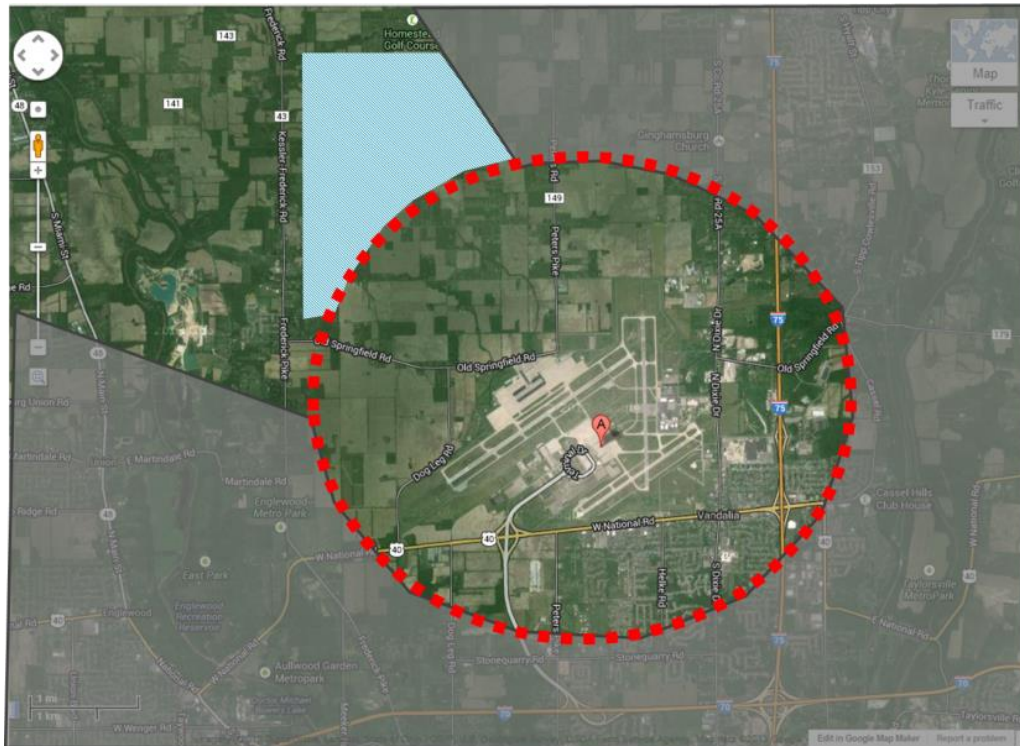


Figure 3: Vertical structure limitations (in gray) and opportunities (in blue) surrounding Dayton International Airport

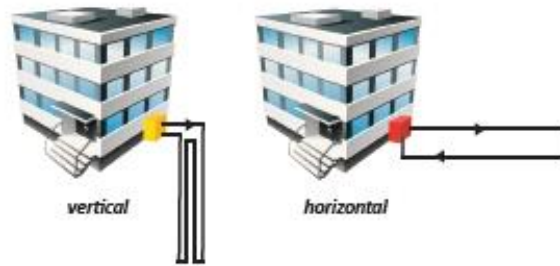
As mentioned previously, cost concerns relative to maintenance, energy transmission and distribution, local average wind speed, total power production potential, payback and ROI as well as the regulatory requirements would need to be investigated much more closely if commercial scale wind power was ever a desirable priority. Large scale wind power may provide a reasonable alternative to large scale solar power, but is unlikely to result in a lower total lifecycle system cost or be a more logical option given FAA requirements and project site factors.

Geothermal

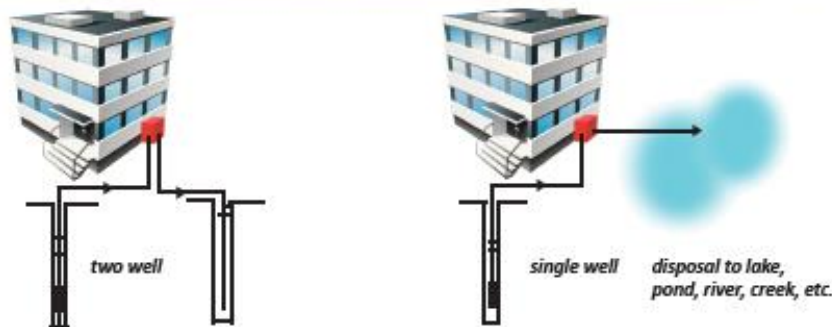
Configurations

The main differentiating factor between geothermal and conventional HVAC systems is the use of the ground as a heat sink. In all types of geothermal systems, a heat exchanger is placed in the ground, but several configurations of geothermal systems can be used. Figure 4 illustrates the most common configurations:

Ground Coupled Heat Pumps (GCHP) aka closed loop heat pumps



Groundwater Heat Pumps (GWHP) aka open loop heat pumps



Surface Water Heat Pumps (SWHP) aka lake or pond loop heat pumps

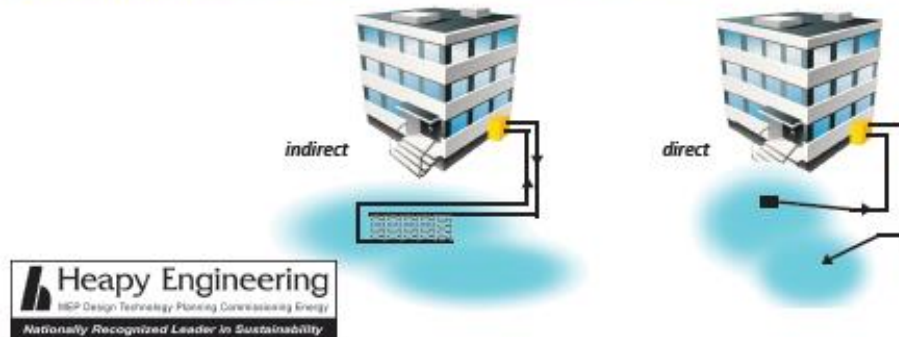


Figure 4: Geothermal Heat Pump Configurations

Most commercial buildings utilize a closed loop configuration, wherein many tubes are inserted into the ground. These tubes are filled with fluid which is used in the building, but the fluid never comes into contact with the ground. There are several configurations for closed-loop systems including vertical, where wells are bored deep into the ground, and horizontal, where the tubes are inserted into trenches. These types of systems often involve a great deal of infrastructure and can be very cost-intensive, but closed loop systems are also very resilient and reliable.

Open-loop systems require less infrastructure, utilizing one or more wells for ground-water extraction. The water extracted from the wells, is used as condenser water which is then pumped through a heat exchanger, returned to the ground, or deposited into a local body of water or storm sewer. Open loop systems offer the most consistent temperatures for use in the building. However, they are very dependent on availability of groundwater in the local water table and in some areas hard water can foul heat exchangers.

The least infrastructure intense option is the use of surface water as a heat exchanger. However, due to the size of water body required, these systems are not very common.

Applicability

The airport expressed interest in learning about the potential use of a geothermal system for building air conditioning. Heapy Engineering began an assessment in the spring of 2013, but fairly quickly realized that this type of system was not going to be financially attractive. A brief summation of the reasons for this follows.

The use of a closed loop geothermal system requires a great deal of space and while there is a more than adequate amount of property available, a well field installed in an unused area would be fairly distant from the building. This system also requires a great deal of piping both in the well field, and between the building and the well field. Due to the remoteness of the well field, the piping requirement would be greater; increasing piping and trenching costs for a system which is already quite costly.

In addition to the potential for greater piping requirements, the airport offers a unique obstacle to the installation of geothermal systems: airplane pavement. Because of the rigid requirements for the pavement used for aircraft traffic it would be impossible for piping to cross any aircraft causeway, since this would require cutting the pavement or disturbing the underlying foundation. If a system were to be installed, all piping would have to circumvent all aircraft pavement, increasing piping and trenching costs significantly.

Closed loop systems work most efficiently when the amount of heat and the amount of cooling required over the course of a year are fairly balanced. Because the ground is functioning like a battery, storing and then releasing energy between the seasons, a balanced load results in the most efficient operation. An imbalance between the heating and cooling loads can be overcome, but requires the addition of mechanical equipment (boilers or cooling towers, depending on whether heating or cooling load dominates). It is reported that the annual cooling load for the airport greatly exceeds the annual heating load due to the volume of occupants moving through the building as well as airport process equipment; accounting for this imbalance would increase equipment costs and reduce the effectiveness of wells over time.

The use of an open system also requires underground piping, although in much smaller quantities. This system directly extracts water from the ground for use in the HVAC system. However, geological data for the area of the airport tends to predict fairly limited ground water.¹⁷ This does not prevent the use of an open system, but does increase the cost. Reduced groundwater levels also increase the cost of a closed system, since lower water levels decrease the thermal conductivity of the ground and reduce performance.

All of the above will result in a relatively costly installation for this type of system at the airport. Under much better conditions, closed loop geothermal systems will usually result in paybacks approaching 15 years; in the case of the airport this payback is likely closer to a 30 year payback. Open loop systems will be less. However, the airport's desire to achieve payback of 5 to 10 years or better will not be achievable with any form of geothermal system. This payback goal essentially eliminates the potential use of geothermal systems at this facility.

Many closed-loop systems have been installed under vehicle parking areas and this may be a more viable option than installing the bore field in a currently fallow area behind the airport; especially if any changes or upgrades to parking surface lots are anticipated as part of future DIA planning efforts. There are acres of vehicle parking directly adjacent to the building. Utilizing these lots would provide for a close well-field, potentially reduce initial costs, and could be considered as a viable option in the future.

¹⁷<http://www.dnr.state.oh.us/OhioGeologicalSurvey/EnergyAndMineralResources/GeothermalGISServices/tabid/24242/Default.aspx>
<http://viewer.nationalmap.gov>

While all of the constraints mentioned above are accurate when considering geothermal in isolation (i.e. not considering removal of parking or the addition of a new terminal), there are a couple instances where geothermal may represent a good investment. It was noted in ARM's 2012 "HVAC Cooling Equipment Report" that the 540 ton main chiller is due for upgrades or replacement. If this chiller were to be removed and replaced, the premium to install a geothermal well field, and reduce the size of a new chiller needed may only be a marginal cost increase. In looking at the "Aullwood Farms: Geothermal Conductivity Analysis" performed by LoopMaster the following highlighted findings are worth re-iterating:

- *Upon data review it was found that the bore performed exceptionally well and all parameters were well within tolerance with the exception of the exceptional performance. High performance wet shale with 25% of entrained quartz has been shown to have thermal conductivity of up to 2.3 Btu/hr ft degF in limited cases.*
- *Typical values of this material will peak at around 1.8 Btu/hr ft degF for 80% of the statistical values. Sites similar to this in the Dayton area have yielded results similar to the more common midrange values of 1.25 Btu/hr ft degF. We believe the high water production capability shown on the drill log (55 gpm @ 300 ft) gives a clue in deciphering the data.*
- *Therefore, it is our opinion that the extra performance this test bore represents is most likely due to extraordinary aquifer movement. Aquifer movement can easily improve performance to this extent and can account for all of the extra performance exhibited. However this high level of aquifer movement cannot be guaranteed in all situations, seasons or even across the complete bore hole area planned.*
- *For this reason, we have chosen to override the extraordinary test results and list the bore hole performance at the maximum conductivity listed for 80% wet shale with 25% quartz. This is still substantially higher than other local sites but will still provide a level of confidence in predicting the long term performance of the borefield. This results in the following characteristics:*
Thermal Conductivity 1.8 Btu/hr ft degF
Thermal Diffusivity 1.2 ft²/day

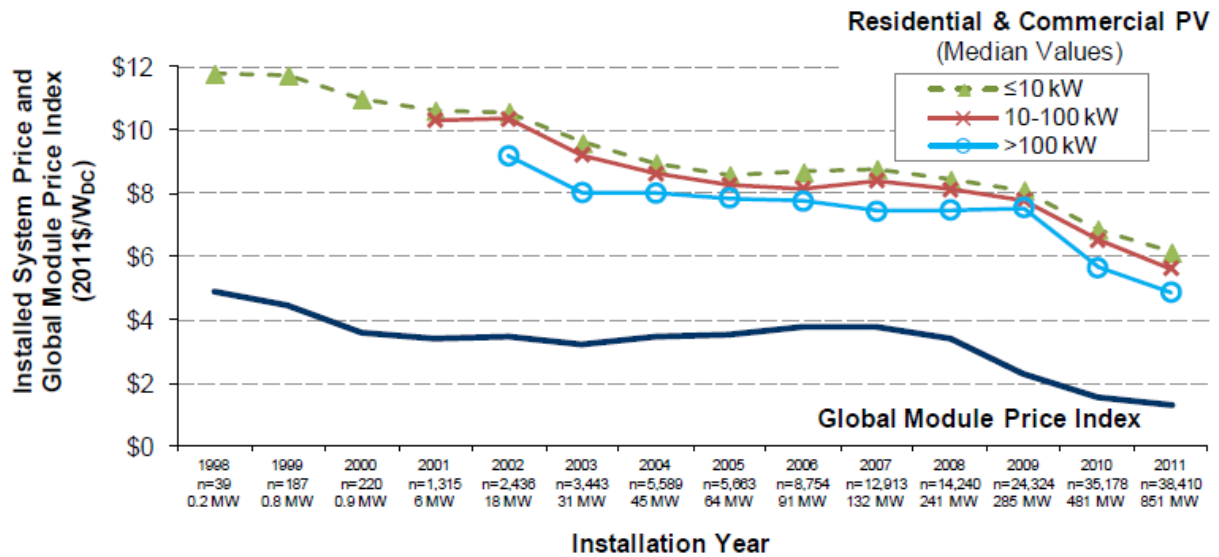
Although additional testing would need to be completed to confirm the results gathered from the Aullwood study conducted on this nearby property, the thermal conductivity of the land surrounding DIA is likely comparable. These results allow us to perform the following preliminary (and largely theoretical) analysis using some geothermal rules-of-thumb. If the airport were to build a new terminal, or significantly renovate or expand one of the existing terminals, (approximately 50,000 sq. ft.) and decided to use a geothermal system; here are the following considerations:

- Assuming a cooling load of approximately 125 - 150 Tons for new or renovated space, the geothermal well field would need to include between 75 and 100 wells, given a well capacity of 1.5 - 2 tons per well.
- The site disturbance and acreage needed to accommodate a well field of this size would be 1-1.5 acres. Well depth would need to be between 300 and 400 feet and likely cost \$5,000 per well. Total well installation cost would be approximately \$500,000. The data from a test well would influence any final depth and spacing decisions.
- **Note:** this excludes any preliminary studies and design, removal of existing infrastructure, additional pumping changes to existing systems, and correction of any heating or cooling imbalances that may exist. A more accurate total project cost for systems integration, planning, design, and construction would need to be further refined in a more comprehensive study or future design process. The resulting simple payback is estimated to be within 15-20 years.

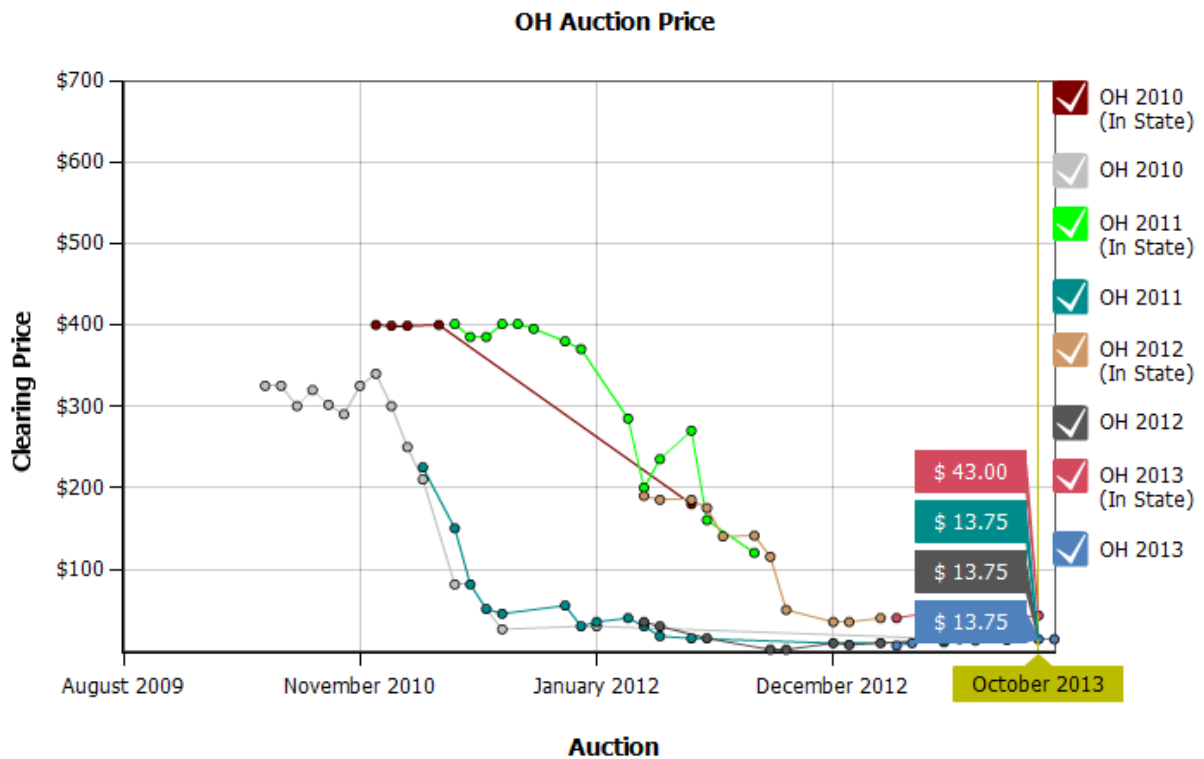
In summary, geothermal feasibility improves if DIA is in the process of, or begins to investigate, significant terminal renovation, expansion, or site planning changes.

Appendices

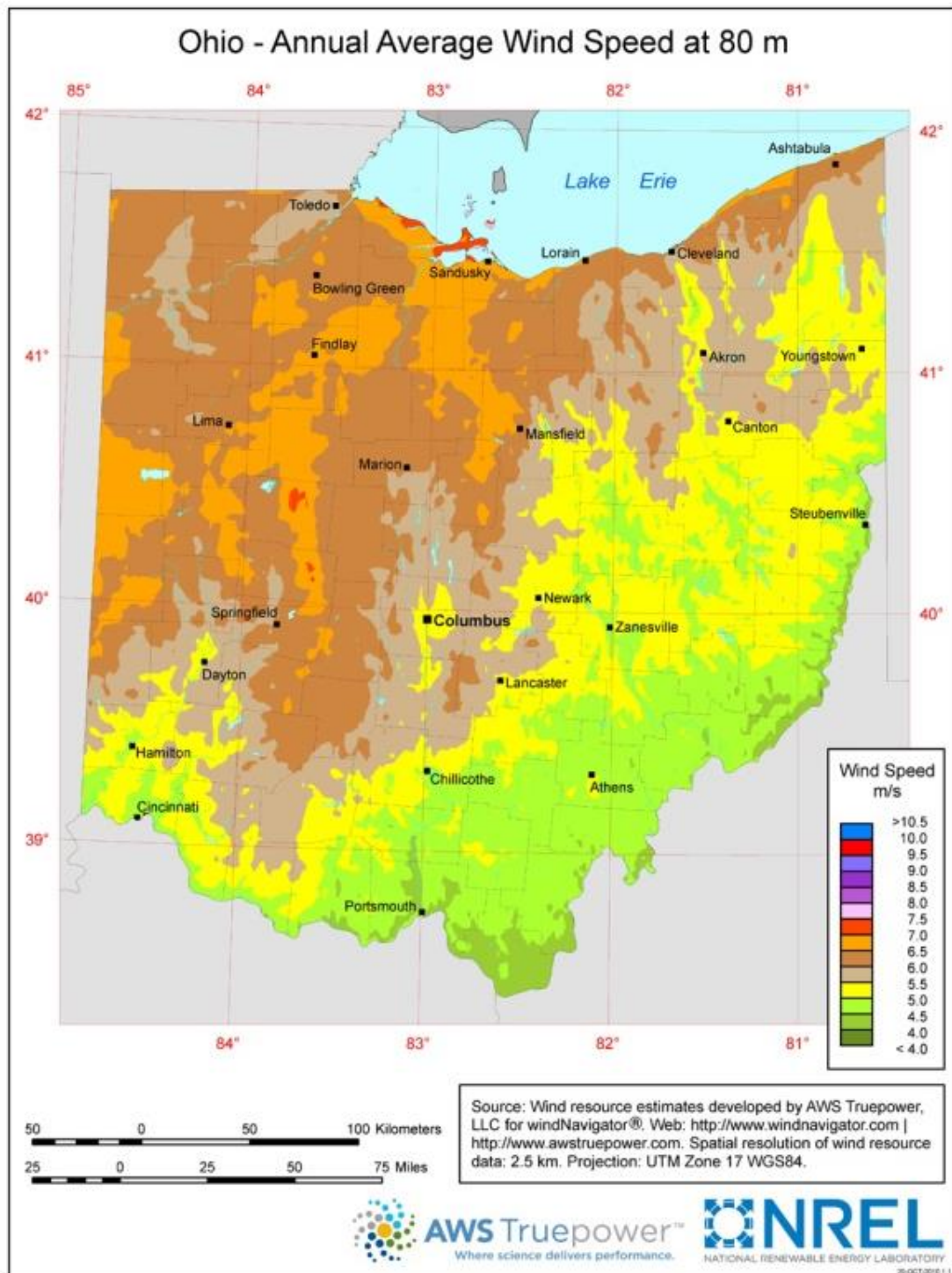
Appendix I: National Commercial PV Cost per Installed Watt and Global Module Price Index



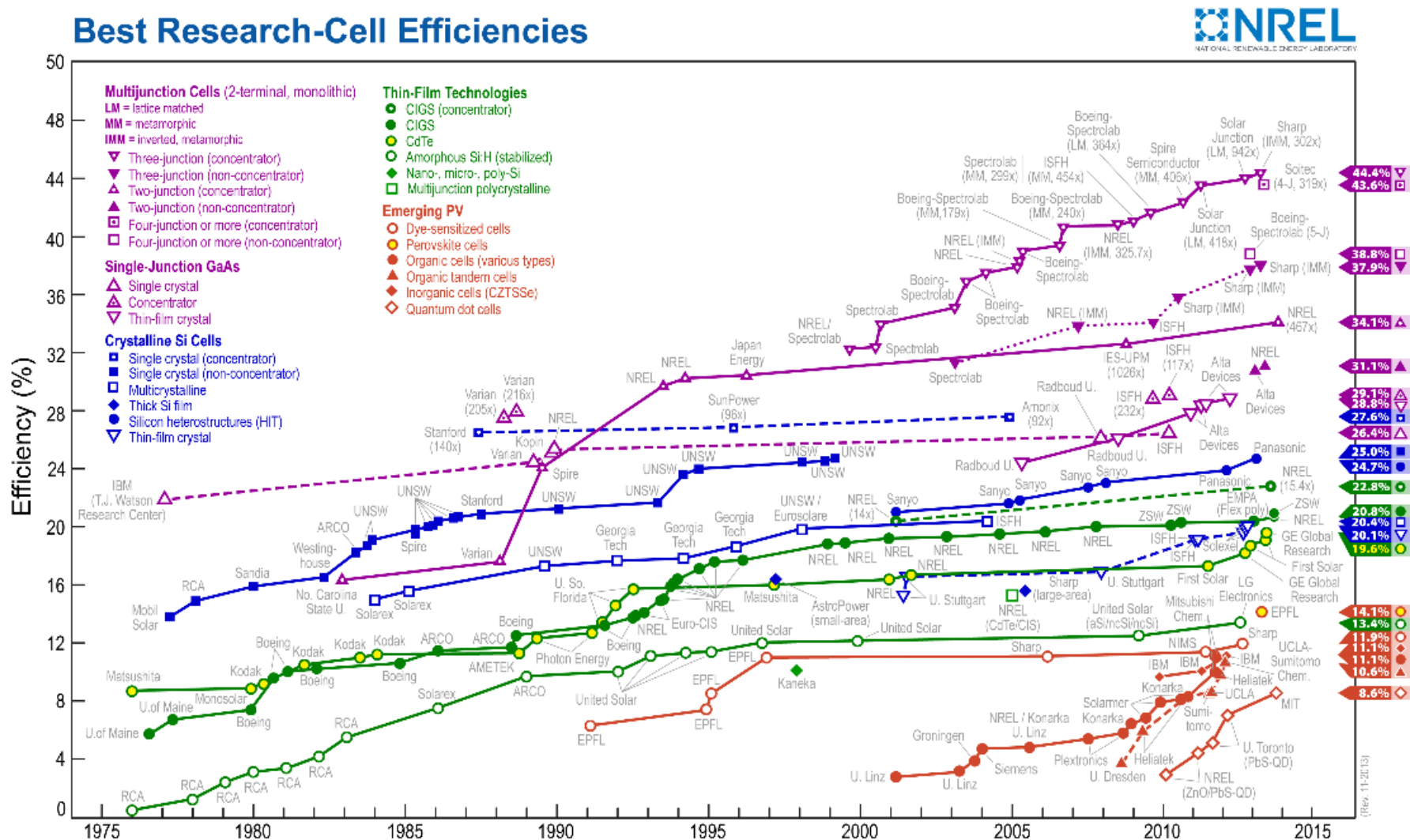
Appendix II: Current Ohio SREC Pricing



Appendix III: Average Annual Wind Speed Map: Ohio at 240 feet



Appendix IV: NREL Solar Technology Efficiency Scale



Appendix V: Renewable Technology Evaluation Summary

Renewable Energy Technology	Total Annual Energy Production Potential (kBtu)	Order of Magnitude Cost (\$) Estimate	Utility Cost (\$) per kBtu	Project Simple Payback	Pros	Cons
1. Solar PV	3.5 million	\$2 million	\$0.015 (Elec.)	25-30 Years	- Relatively Low Maintenance - On-site backup (potential) - Incentives can reduce payback - Financing options can guarantee rates	- Not currently cost competitive with local rates - Financing options and incentives are limited at DIA
2. Solar Thermal	1.2 - 1.8 million	\$500,000	\$0.003 (Gas)	80-100 Years	- Domestic hot water backup	- Moderate to high maintenance - Poor payback period
3. Wind	6 - 7 million	\$2 million	\$0.015 (Elec.)	15-20 Years	- None	- Payback period does not account for full costs* - FAA, local code and Airport site limitations - Moderate to high maintenance
4. Geothermal	1.75 – 2.5 million	\$500,000	\$0.015 (Elec.)	15-18 Years	- Can be easily integrated into new construction - May offset need for additional chiller capacity - Strong potential financial payback	- Constant cooling demand may reduce long term effectiveness

Notes and Assumptions:

All information (energy production, utility rates, costs, and paybacks) contained within the evaluation table is based on the calculations and assumptions provided in the body of the report above.

- 1. Solar PV:** Order of Magnitude cost estimate includes [very preliminary] cost accounting for design, installation (labor and materials), etc. The estimated payback period does not include potential incentives or alternative financing structures.
- 2. Solar Thermal:** None
- 3. Wind:** Order of magnitude cost estimate does not include; siting, permitting, design, transmission, and maintenance costs; likely increasing the payback and making this option not financially viable.
- 4. Geothermal:** Assumes new construction or renovation requiring additional conditioning capacity.

Appendix F

Sustainable Design and Construction Standards



Nationally Recognized Leader in Sustainability



Sustainable Design and Construction Standards

Dayton International Airport



INTERNATIONAL AIRPORT

Easy to and through.

Prepared By:

Heapy Engineering
1400 W Dorothy Lane
Dayton, OH 45409

November 12, 2013

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I. Overview

Heapy Engineering was engaged to assist Dayton International Airport in developing a series of best practices related to Sustainable Design and Construction as part of the Sustainability Master Planning Process and FAA Grant program.

Creation of **Sustainable Design and Construction Standards** allows for implementation of minimum design and construction performance criteria, ensures consistent expectations of project teams and allows the airport to more effectively meet goals as defined by the Sustainability Master Plan.

Opportunities to improve water and energy performance, optimize materials selection and minimize resource use, and effectively manage indoor environmental quality exist across the airport campus. The following **Sustainable Design Standards** have been developed in effort to emphasize effective water usage and energy performance of mechanical, electrical, and plumbing systems in both new-construction and retrofit projects. The **Sustainable Construction Standards** focus on the effective specification, selection, and use of green building materials, responsible construction waste and indoor air quality management practices, and provides minimum occupancy comfort and quality design standards for application in new-construction and retrofit situations.

The purpose of this guidance is to supplement previously developed project based design and construction standards at Dayton International Airport and provide a series of best practices to incorporate into all future projects. They are not meant to replace project specific specification sections still required for each unique project, but are meant to work in tandem with development of those documents. These standards also recognize that Airports are unique in their function and purpose and thus have incorporated design, construction, and operations criteria specific to airport functions.

The standards herein are not intended to be all-encompassing nor universally applicable, especially for specialty projects that may occur for airport specific functional activities. In those scenarios, this guidance is meant to be a point of reference or resource for integration of applicable industry best practices, and further “Resources, Definitions and References” sections have been provided for those circumstances.

A number of leading airport sustainability guidelines and Green Building Standards have been referenced for the creation of this document (and can be found in the Resources Section.) Specifically the USGBC’s LEED Building Design and Construction (BD+C) v3 Rating System was referenced as a standard for potential future application across all Dayton International Airport design and construction; so while there are no direct associations with LEED credits or points, much of the guidance contained herein provides a strong foundation for the eventual pursuit of LEED, should that rating system become an Airport standard or City policy requirement.

II. Sustainable Design Guidelines

1. Water Efficiency and Conservation Best Practices

1. Goals
 - a. Optimize the management and utilization of site water resources, including potable, stormwater and wastewater to allow for the development of a coordinated management plan at Dayton International Airport.
2. General Approach
 - a. Assess water consumption and opportunities for conservation and reclamation,
 - b. Water reclamation,
 - c. Management plan,
 - d. Water Fixtures and fittings efficiency,
3. Water Consumption Assessment
 - a. Evaluate current fixture and fitting standards.
 - b. Determine annual domestic water usage and monitor or measure usage for a more consistent opportunity to identify leaks or issues.
 - c. Incorporate the use of high-efficiency plumbing fixtures such as those recommended by the EPA water sense program.
4. Water Reclamation
 - a. Identify strategies for water conservation and on-site reclamation of storm water:
 - i. Evaluate on-site stormwater and graywater reclamation opportunities for non-potable uses such as toilet flushing or irrigation.
 - a) Evaluate projected operation and maintenance costs, utility implications and impact on overall facility operations and budget.
5. Water Management Plan
 - a. Develop a Water Management Plan that includes information on utilities, facility, operation, and maintenance schedules:
 - i. Planning
 - a) Emergency response information; describe how the facility will meet minimum water needs during potential drought conditions or other water shortage scenarios.
 - b) Provide planning and continuous improvement process details; informing staff, contractors and building occupants of water efficiency and conservation goals, ensure integration of water efficiency BMPs so they can be taken into account during the earliest stages of planning and design.
 - c) Contact local utilities to obtain information of rates, and opportunities for technical or financial resources for planning water efficiency programs.
 - ii. Education
 - a) Educate maintenance staff and building occupants on strategies to make water conservation efforts a success.
 - iii. Measurement
 - a) Develop a schedule to track life cycle water cost savings and retrofit analysis opportunities as technology continues to advance.
 - b) Install a water metering network to ensure accurate measurement of actual usage.
 - c) Include water pressure testing for piping within project boundaries in the construction specifications.
 - d) Evaluate on-site stormwater treatment opportunities such as constructed bioswales, rain gardens, green roof areas, and storage basis where reuse is viable.
 - e) Identify major water using processes, location and accuracy of water measurement devices, main shut off valves, verify occupancy and operating schedules.

6. Water Fixtures and Fittings Efficiency

- a. Minimize water use within building and reduce potable water requirements of the campus.
 - i. Evaluate products certified by US EPA WaterSense program.
 - ii. Evaluate dry fixtures such as waterless urinals.
 - iii. Evaluate reclaimed water use for cooling tower makeup.
 - iv. Evaluate low impact cooling tower water treatment technologies (i.e. ozone treatment).
 - v. Investigate opportunities for separate non-potable water supplies for irrigation or vehicle maintenance.
- b. Utilize Efficient Fixtures and Fittings
 - i. Compare proposed or designed fixtures against EPA 1992 baseline flow rates to determine annual water and water usage cost savings for any project that includes plumbing fixtures.
 - a) All water closets shall be a maximum of 1.28 gpf unless dual flush.
 - b) All urinals shall be a maximum of 0.5 gpf.
 - c) All public lavatories shall be no more than 0.5 gpm and shall utilize electric sensors.
 1. Consider electric hard-wired sensors for faucets due to issues with shortened battery life in faucet applications.
 - d) All other faucets shall be a maximum of 1.5 gpm.
 - e) All showers shall be no greater than 1.5 gpm, with the exception of safety showers.
- c. Utilize Efficient Irrigation Systems
 - ii. Evaluate and strongly consider elimination of irrigation on a per project basis.
 - iii. If considering irrigation, specify alternative plant species that are either native or adapted and are known to be more drought tolerant, thereby reducing irrigation demand.
 - iv. If irrigation will be installed, improve irrigation efficiency by including the following measures:
 - a) Soil moisture sensors,
 - b) Controller overrides,
 - c) Efficient systems such as mist or drip systems where applicable.

2. Energy Efficiency and Conservation Best Practices

1. Goals

- a. Design building envelope, HVAC and lighting and plumbing systems with energy usage in mind; apply a life cycle equipment and payback analysis to all 'premium' measures under consideration.

2. General Approach

- a. For projects over 20,000 square feet all designs shall comply with the ASHRAE 90.1-2010 prescriptive method or perform at least 20% better than an ASHRAE 90.1-2007 baseline building as proven by a detailed ASHRAE 90.1-2007 Appendix G energy model.
- b. Major equipment must meet ASHRAE 90.1-2010 Minimum Efficiency Requirements, and should refer to the indexed tables for all of the following systems:
 - i. Envelope
 1. Building Envelope Requirements: Table 5.5-5
 - ii. HVAC
 1. Economizers: Section 6.5.1
 2. Piping System Design Maximum Flow Rate in GPM: Table 6.5.4.5
 3. Energy Recovery Equipment: Table 6.5.6.1
 4. Electronically Operated unitary Air Conditioners and Condensing Units- Minimum Efficiency Requirements: Table 6.8.1A
 5. Electronically operated Unitary and Applied Heat Pumps- Minimum Efficiency Requirements: Table 6.8.1B
 6. Water Chilling Packages: Table 6.8.1C

7. Electrically Operated Packaged Terminal Air Conditioner Units, Packaged Terminal Heat Pumps, Single Package Vertical Air Conditioners and Heat Pumps, room Air Conditioners and Heat Pumps: Table 6.8.1D
8. Warm Air Furnaces and Combination Warm Air Furnaces/Air Conditioner Units: Table 6.8.1E
9. Gas and oil Fired Boilers: Table 6.8.1F
10. Heat Rejection Equipment: Table 6.8.1G
11. Electrically Operated Variable refrigerant Flow Air Conditioners: Table 6.8.1I
12. Electrically Operated Variable Refrigerant Flow Air to Air and Applied Heat Pumps; Table 6.8.1J
13. Air conditioners and condensing Units Serving Computer Rooms: table 6.8.1K
14. Minimum Duct and Pipe Insulation Requirements: Tables 6.8.2, 6.8.3
- iii. Water Heating
 1. Performance Requirements: Table 7.8
- iv. Power
 1. Minimum nominal Efficiency Levels for NEMA Class I Low Voltage Dry Type Distribution Transformers: Table 8.1
- v. Lighting
 1. Individual Power Allowances for Building Exteriors: Table 9.4.3B
 2. Lighting Power Density Space by Space Method: Table 9.6.1
- vi. Motors
 1. Minimum Nominal Efficiencies: Tables 10.8A-10.8C

Commissioning

1. Verify that energy systems have been installed and calibrated to perform according to the construction submittals; verify that the construction submittals have been developed from the Owners Project Requirements and Basis of Design documents.
 - a. Designate an individual or firm separate from the design and construction teams to lead the commissioning process.
 - b. Ensure that the owner develops Owner's Project Requirements (OPR) including performance standards related to these guidelines and any additional project specific requirements.
 - c. Incorporate Commissioning specifications into all projects.
 - d. Ensure the commissioning agent documents the process and project progress through the creation of a commissioning plan and report.
 - e. Perform functional testing and verification of equipment performance; provide training, and operations and maintenance documentation to the owner at the end of the project.
2. Commissioning requirements may be developed for the following systems to include but not limited to:

a. Building Automation Systems b. HVAC c. Lighting Controls and Sensors d. Site Lighting e. Refrigeration Systems f. Building Envelope g. UPS Systems h. Domestic and Process Water i. Data and communications	j. Security k. Irrigation Systems l. Plumbing m. Emergency Power n. Life Safety o. Runway Lighting p. Traffic Systems q. Pump Systems
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Envelope

1. Roofing
 - a. Reflective Roofing reduces heat island effects and can save energy and costs related to cooling.
 - b. Roofing should either meet the following SRI thresholds or be vegetated:
 - i. Flat or low sloped roof (<2:12) SRI = 78
 - ii. Sloped Roof SRI (>2:12) SRI = 29
 - c. The minimum U-value of the roof assembly should be 0.0432 (or a 10% improvement over ASHRAE 90.1-2007, whichever is more stringent)
 - d. The minimum R value for roof insulation should be R-20 for metal buildings and R-40 for attics or other building types.
2. Wall Assemblies
 - a. The minimum U-value should be 0.0576 (or a 10% improvement over ASHRAE 90.1-2007, whichever is more stringent)
 - b. The minimum R value for walls above grade should be:
 - i. Metal building R-15
 - ii. Steel framed R-15 + R 7.5 continuous insulation
3. Windows
 - a. Minimum U-value should be 0.495 (or a 10% improvement over ASHRAE 90.1-2007, whichever is more stringent)

HVAC

1. Primary Heating, Ventilating, and Air Conditioning Systems
 - a. This guidance focuses on central plant-based Variable Air Volume (VAV) systems with hot water reheat terminals, as this has been the primary design concept for recent projects.
2. Central Hot Water Heating Plant
 - a. Efficiency for natural gas fired equipment shall be capable of providing a minimum of 88% efficiency at 140 degree return water temperature while performing natural gas heating.
 - b. Hot water boiler plant pumping shall be configured for primary\secondary flow.
 - c. High efficiency condensing type boilers should be utilized.
 - d. Design supply water temperatures shall be a maximum of 140 degrees Fahrenheit for heating hot water.
 - e. Design water temperature drop in the system shall be maintained between 20 degrees Fahrenheit and 40 degrees Fahrenheit.
 - f. All pump motors shall exceed NEMA Premium Efficiency. If no such option is feasible, the motor shall be NEMA Premium Efficiency.
 - g. All secondary hot water pumps should utilize their own VFD, controlled based on differential pressure or equal method.
 - h. All hot water systems shall employ a hot water temperature reset based on outside air temperature.
3. Central Cooling Plant
 - a. Any new chiller system shall include one of the following chiller types
 - b. Indoor, water-cooled centrifugal – min COP 6.5
 - c. Indoor, water-cooled rotary screw – min COP 6.5
 - d. Outdoor, air-cooled (as noted below)
 - i. Air-cooled chillers are acceptable only when the total system tonnage is less than 400 tons and there is no existing water cooled chiller plant at the airport.
 - e. Water cooled chiller systems shall not contain glycol.
 - f. Provide heat recovery chillers where feasible creating 130-140 degree hot water, sized to preheat the domestic hot water makeup and the hot water heating system for comfort.
 - g. Design water supply temperatures shall range between 40 degrees Fahrenheit and 45 degrees Fahrenheit. (Note even if the current operation of the chilled water plant is below 40 degree supply water temperature to meet requirements of existing air side

equipment, new air side equipment shall be selected between 40 and 45 degree entering water temperature so that supply water temperatures can be increased in the future for energy efficiency purposes.)

- h. Design water temperature rise at new air handling units in the system shall be maintained between 14 and 16 degrees Fahrenheit.
 - i. All pump motors shall exceed NEMA Premium Efficiency. If no such option is feasible, the motor shall be NEMA Premium Efficiency.
 - j. All variable primary or secondary chilled water pumps greater than 5 hp shall utilize its own VFD.
 - k. All chilled water systems shall employ a chilled water temperature reset.
 - l. All cooling tower water systems shall employ condenser water reset.
 - m. Heat rejection equipment shall be sized to maintain condenser water temperature to the chillers during a design day with ambient wet-bulb temperatures equal to the 0.4 percent design wet-bulb value.
 - n. Condenser water temperatures shall be selected to obtain maximum energy efficiency.
 - i. Condenser water optimization to minimize the total equipment energy (including pumping) is required for various wet bulb temperatures during the cooling season.
 - ii. The optimal setpoint will vary for different compressor (screw, centrifugal and scroll) types and their unloading method.
 - iii. The use of increased condenser water delta T from 10 degrees F to 15 degrees F shall be reviewed during design to decrease pumping energy.
 - iv. The goal is to optimize the chilled water system total operating power to its lowest practical value.
 - o. All heat rejection fans greater than 5 hp will be required to include a VFD.
 - p. Waterside economizer systems shall generally be used in lieu of airside economizers.
4. Motors
- a. Premium efficiency motors shall be equal to Century "E + 3", General Electric "Energy Saver Premium Efficiency", Baldor "Super E Premium Efficient" or Reliance "Premium Energy Efficient" series.
 - i. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
5. Air Systems
- a. Air Handler Fans
 - i. Fans shall be direct drive where appropriate. Motors provided for direct drive fan operation shall be 1150 RPM minimum.
 - b. Air Handling Units
 - i. Each air handling unit fan (supply, return or, exhaust) shall be equipped with a VFD if 5 hp or greater.
 - ii. Energy recovery methods shall be considered to precondition the outside air.
 - 1. The energy recovery method selected by the HVAC Design Professional must consider latent heat recovery as well as sensible heat recovery unless cross contamination of exhaust air into outside air is a concern.
 - 2. When cross contamination is a concern sensible heat recovery only, will be acceptable.
 - iii. Unless utilizing waterside economizer, airside enthalpy economizer cycles shall be utilized in all air handling units
 - iv. Air handling units shall include a discharge air temperature reset to conserve reheat energy. The discharge air reset sequence shall not compromise humidity control.
 - v. All variable volume air handling units shall employ a static pressure reset based on box damper positions.
 - vi. CO2 sensors and demand control ventilation should be utilized in any areas that would benefit, such as dining areas and conference rooms, as indicated by the HVAC Design Professional.

- vii. Night time setbacks should be implemented wherever occupancy is not around the clock and allowed by medical equipment located in the space.
 - c. Ductwork Distribution System
 - i. All (supply and return) ductwork shall be seal class A.
- 6. Controls
 - a. All new and renovated areas of the airport should be integrated into the existing DIA controls system and sequencing.
 - i. Insert Spec Section 230923 and 230993-95 as utilized on the DIA 2nd floor and bathroom renovation projects completed in 2012 as appropriate based on project scope and requirements
- 7. Supplemental Cooling Systems
 - a. DX Units
 - i. All DX units must meet the minimum efficiency requirement of ASHRAE 90.1-2010 table 6.8.1B.
 - b. CRAC Units
 - i. Computer room units may be utilized for any small, high internal load spaces that are expected to be cooled all year.
 - ii. All CRAC units must meet the minimum efficiency requirement of ASHRAE 90.1-2010 table 6.8.1K.
- 8. Piping and Duct Insulation
 - a. Specify the use of only non-asbestos containing materials.
 - b. Duct insulation R value and sustainability requirements:
 - i. Insulation shall be manufactured by Johns Manville, Owens-Corning, Certainteed, Knauf, Manson, or as listed below. Insulation for duct systems required to be insulated shall have a minimum installed R-value of 4.2 (at a 75°F mean rating temperature).
 - 1. "Installed" R-value for blanket insulation is the calculated R-value with 25% compression.
 - 2. "Installed" R-value for board insulation is the published nominal R-value.
 - ii. Insulation on concealed ductwork shall be fiberglass blanket insulation with factory applied reinforced foil and kraft paper vapor barrier jacket, minimum 1.50" thickness and 0.75" p.c.f. density, formaldehyde-free or GreenGuard Certified for low formaldehyde and VOC emissions.
 - iii. Insulation on exposed ductwork shall be fiberglass board insulation with factory applied "all service" jacket with vapor barrier, minimum 2" thickness and 3 p.c.f. density, formaldehyde-free or GreenGuard Certified for low formaldehyde and VOC emissions.
 - c. Pipe Insulation Requirements:
 - i. The following HVAC and plumbing piping shall be covered with insulation of thickness listed, to meet or exceed ASHRAE 90.1, latest publication:

Pipe System	.75" and smaller	1.0" to 1.25"	1.50" to 3"
Hot water, 200°F and below	1"	1"	1"
Chilled water, 40°F and above	0.50"	1"	1"
Cooling condensate drainage	0.50"	0.50"	0.50"

Pipe System	0.75" and smaller	1.0" to 1.25"	1.50" to 3"
Domestic cold water	0.50"	0.50"	1"
Domestic hot water	1"	1"	1.50"

- ii. Unless specified otherwise, pipe insulation shall be factory molded tubular fiberglass with "all service" jacket having an integral vapor barrier. Longitudinal joints of the jacket shall be overlapping with factory applied adhesive. In lieu of

the factory adhesive, staples on 6" centers may be used with vapor barrier mastic applied to seal both the joint and staple holes. Butt joints shall be sealed with 3" wide ASJ pressure sensitive tape. Insulation shall be GreenGuard Certified for low formaldehyde and VOC emissions. Thermal conductivity (k) shall be as specified below:

Maximum Conductivity k Mean Rating BTU in / (h x ft ² x °F)	Temp °F
0.34	250
0.32	200
0.30	150
0.29	125
0.28	100

Lighting

1. Interiors
 - a. Interior spaces shall be artificially illuminated with energy-efficient and high efficiency fluorescent light fixtures with electronic ballasts and lamps or LED light fixtures/sources.
2. Natural Lighting
 - a. When adequate natural light is available to a space, photo-cells shall be provided for the day lighting in that space; the photocell shall have the ability to control the artificial light in that room based on the amount of day light entering the space. Artificial light shall be adjusted as needed based on the type of space and usage.
3. The illumination (footcandle) levels shall conform to the established Illuminating Engineering Society (IES) Guidelines (10th Edition Handbook).
4. All exit lighting shall be of LED type and no more than 5 watts.
5. Exterior parking areas shall be illuminated with LED type light fixtures.
6. Controls
 - a. Interior lighting shall be controlled by occupancy sensors, automatic timed lighting controlled system or a combination of both to comply with ASHRAE 90.1-2010. Exterior lighting shall be controlled by photo-sensor, astronomical time clock, building lighting control system or temperature control system to comply with ASHRAE 90.1-2010. Occupancy sensors and time of day controls shall also be utilized in all spaces that would benefit at the Lighting Professional's discretion.
7. Lighting Power Density
 - a. Interior and Exterior lighting allowable power densities shall be in compliance with ASHRAE 90.1-2010 and at most 80% of the total allowable when life cycle cost appropriate.
 - b. Insert Spec Section 260923—Lighting Controls and 265113—Interior Luminaires, Lamps and ballasts as utilized on the DIA 2nd floor and bathroom renovation projects completed in 2012 and if applicable to project scope of work.

Plumbing

1. All gas fired domestic water heaters shall be condensing equipment and have a minimum efficiency per ANSI 21.10.3 of 94%.
2. If central steam is converted for domestic hot water usage, steam to hot water converters shall be double-wall heat exchangers. As much as practical, steam systems should not be used for domestic water heating.
3. Instantaneous water heaters with a storage tank shall be required for high use applications in buildings with kitchens and/or shower room facilities, or a combination of 2 power vented heaters installed in a common tank could be used.
4. Domestic water heating equipment shall be set to store water at a minimum 140 degrees Fahrenheit and a mixing assembly shall be utilized to distribute DHW at approximately 120 degrees Fahrenheit. On very large systems, consideration should be given to using an electronic

mixing assembly similar to Armstrong's "Brain". Semi-instantaneous water heating should be provided.

5. Hot water recirculating pumps 5 hp or greater shall utilize a VFD.

3. Materials and Resources Best Practices

1. Storage and Collection of Recyclables
 - a. Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area. Identify local waste handlers and buyers for glass, plastic, metals, office paper and newspaper, cardboard and organic wastes. Instruct occupants on recycling procedures. Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste management strategies to further enhance the recycling program.
 - b. Designated recycling areas must be included on construction plans.
2. Demolition and Recycling
 - a. Develop a construction waste management plan to identify major potential waste streams and divert them from landfill.
 - b. During demolition design; consider contacting and working with organizations such as "Habitat for Humanity" to donate re-useable materials instead of demolishing them.
3. Materials Reuse
 - a. Identify opportunities to incorporate salvaged materials into the building design, and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick, and decorative items.
 - b. Use salvaged, refurbished or reused materials, the sum of which constitutes at least 5% or 10%, based on cost, of the total value of materials on the project.
4. Sustainable Materials Specification
 - a. Recycled Content
 - i. Establish a project goal for recycled content materials, and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.
 - ii. Use materials with recycled content (Division 3-10 31, 32) such that the sum of postconsumer recycled content plus 1/2 of the preconsumer content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project.
 - b. Regional Materials
 - i. Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed, and quantify the total percentage of local materials installed.
 - ii. Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within a specified distance of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) must contribute to the regional value.
 - iii. Regional is defined as products that have been extracted, harvested, recovered and manufactured with a 500 mile radius of the project site.
 - c. Certified Wood
 - i. Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of wood that is FSC certified on the project.
 - ii. Use a minimum of 50% (based on cost) of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles

and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes. Include only materials permanently installed in the project. Wood products purchased for temporary use on the project (e.g., formwork, bracing, scaffolding, sidewalk protection, and guard rails) may be included in the calculation at the project team's discretion. If any such materials are included, all such materials must be included in the calculation.

4. Indoor Environmental Quality Best Practices

1. Minimum IAQ Performance
 - a. Establish minimum indoor air quality performance to enhance air quality in buildings, contributing to the comfort and well-being of occupants. Design the project to comply with the EPA Compendium of Methods for the Determination of Air Pollutant in Indoor Air. Do not exceed the following contaminant limits:
 - i. Formaldehyde: 27 parts per billion
 - ii. Particulates (PM10): 50 micrograms per cubic meter
 - iii. Total volatile Organic Compounds: 500 micrograms per cubic meter
 - iv. 4 Phenylcyclohexene: 6.5 micrograms per cubic meter
 - v. Carbon monoxide: 9 parts per million and no greater than 2 parts per million above outdoor levels.
 - b. Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE 62.1-2007 standard. Use the ASHRAE Standard 62.1-2007 User's Manual (with errata but without addenda) for detailed guidance on meeting the referenced requirements.
 - i. Mechanical ventilation systems must be designed using the ventilation rate procedure as defined by ASHRAE 62.1-2007, or the applicable local code, whichever is more stringent.
 - ii. Naturally ventilated buildings must comply with ASHRAE Standard 62.1-2007, Paragraph 5.1 (with errata but without addenda).

III. Sustainable Construction Guidelines

1. Sustainable Construction Best Practices

1. Goals
 - a. Employ sustainable construction techniques and project delivery methods to minimize environmental impact of construction, specify and supply materials that reduce the transportation and virgin materials market burdens and ensure a high performance building using a lifecycle perspective.
2. General Approach
 - a. Utilize construction management sustainability best practices.
 - b. Ensure proper levels of coordination and engagement with the construction team early in the process.
 - c. Require sustainable submittals review and adherence to specifications as written.
 - d. Select materials that can be sourced regionally or renewably to minimize the environmental impact of a project's materials life cycle.
 - e. Design and build with the ability to deconstruct in mind.
3. Contractor Sustainability Performance Requirements
 - a. Promote the use of Contractors with sustainability experience to provide firsthand experience in daily management of sustainability goals for the project.
 - b. Make on-site and management construction team members aware, prior to the start of construction, of sustainability practices in order to gain an understanding of the principles of sustainability.
 - i. Facilitate proactively based decisions and methods of work that are sustainable.
 - ii. Discuss the construction impacts on overall project sustainability.
 - iii. Conduct training to discuss potential issues and opportunities for employment of sustainable practices throughout the project.
 1. Develop a training program that periodically updates team members and provides an opportunity to discuss issues during project progress.
4. Construction Sequencing
 - a. Reduce impacts, including moisture exposure and physical damage, due to unnecessary on-site storage of materials during construction. Prevent impacts to surrounding environment due to activities conducted during ecologically sensitive times. Restore the site to pre-construction conditions.
 - i. Closely coordinate materials delivery and installation.
 1. Coordinate deliveries with installation times.
 - ii. Avoid construction during the wet and rainy season if possible to minimize runoff and erosion.
 1. Minimize the extent and duration that bare ground is exposed or 'open' to prevent erosion.
 - iii. Minimize storage of materials on-site.
 - iv. Develop pre-construction plans and schedules that detail material deliveries and installation timeframes.
 - v. Include restoration plans and activities for post construction site improvement.

2. Construction Related Water Conservation

1. Construction Management
 - a. Obtain a meter from the water department for fire hydrant of local water source use during construction activities to use for dust control, pavement cleaning and other construction related maintenance activities.
2. Erosion and Sedimentation Controls
 - a. For projects over 1 acre: Stormwater plan must meet EPA NPEDS requirements
 - i. Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2003 EPA Construction General

- Permit OR local standards and codes, whichever is more stringent. The plan must describe the measures implemented to accomplish the following objectives:
1. To prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
 2. To prevent sedimentation of storm sewers or receiving streams
 3. To prevent pollution of the air with dust and particulate matter
 - ii. Inspect erosion controls weekly and during rain events in accordance with the National Pollutant Discharge Elimination System (NPDES) General Permit.
 - iii. Refer to the existing DIA Stormwater Pollution Plan and NPDES permit for current site best practices.
 - b. For projects less than 1 acre: projects that do not have to comply with an NPDES permit
 - i. Refer to the existing DIA Stormwater Pollution Plan and NPDES permit for current site best practices.
 - ii. Meet minimum requirements to minimize erosion and sedimentation utilizing basic structural controls, including but not limited to deployment of the following as applicable to the project:
 1. Silt fencing
 2. Permanent seeding
 3. Temporary seeding to minimize erosion
 4. Mulching
 5. Dike placement
 6. Sediment traps
 7. Sediment basins
 8. Dandy bags and outlet protection devices
 9. Weirs and channels to retention areas.

3. Materials and Resources Best Practices

1. Goals
 - a. Reduce the environmental impact of material selection and use during project construction.
2. General Approach
 - a. Adopt a Construction Waste Management Plan that provides guidance including the following (but not limited to) elements: materials to be recycled, sequencing and logistics, measurement or performance and financial performance.
 - i. Designated recycling areas must be included on construction plans.
 - b. Specify materials that reduce the environmental burden on virgin materials sources.
 - c. Ensure all construction practices meet relevant local permitting and code requirements.
 - i. Do not use materials containing asbestos, PCBs or CFCs.
 - d. Avoid use of landfills and incinerators for construction debris, recycle and reuse as much material as possible and eliminate the amount of waste produced on the jobsite as part of the project.
3. Construction Waste Management
 - a. Evaluate (at a minimum) the following waste for recycling:

i. Cardboard	viii. Clean wood
ii. Land-clearing debris	ix. Glass
iii. Metal	x. Gypsum wallboard
iv. Brick	xi. Carpet
v. Concrete	xii. Insulation
vi. Asphalt	xiii. Cable/wire
vii. Plastic	
 - b. Develop a detailed sequencing plan
 - i. Designate a specific area and protocol for recycling areas.
 - ii. Determine if materials sorting will occur on-site or comingled and sorted remotely.
 - c. Require haulers to cover truck beds.
 - d. Identify waste that may be a resource for re-use on site or for other jobs:

- i. Advertise for salvage activities prior to demolition.
 - ii. List salvaged materials for sale or donation.
 - iii. Coordinate with salvaged materials secondary markets for the following materials:
 - 1. Concrete
 - 2. Fill
 - 3. Asphalt
 - 4. Structural Demolition components
 - 5. Building Components
 - e. Track recycling efforts throughout the construction process
- 4. Sustainable Materials Specification
 - a. Recycled Content
 - i. Establish a project goal for recycled content materials, and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.
 - ii. Use materials with recycled content (Division 3-10 31, 32) such that the sum of postconsumer recycled content plus 1/2 of the preconsumer content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project.
 - b. Regional Materials
 - i. Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed, and quantify the total percentage of local materials installed.
 - ii. Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within a specified distance of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) must contribute to the regional value.
 - iii. Regional is defined as products that have been extracted, harvested, recovered and manufactured with a 500 mile radius of the project site.
 - c. Certified Wood
 - i. Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of wood that is FSC certified on the project.
 - ii. Use a minimum of 50% (based on cost) of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes. Include only materials permanently installed in the project. Wood products purchased for temporary use on the project (e.g., formwork, bracing, scaffolding, sidewalk protection, and guard rails) may be included in the calculation at the project team's discretion. If any such materials are included, all such materials must be included in the calculation.

4. Indoor Environmental Quality Best Practices

- 1. Construction Indoor Air Quality
 - a. During Construction
 - i. Meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition 2007, ANSI/ SMACNA 008-2008 (Chapter 3).

- ii. Protect stored on-site and installed absorptive materials from moisture damage.
 - iii. Cover ductwork, open grilles and any other openings in which dust can settle.
 - iv. Control all potential sources of air pollution; such as open paint containers; keep potentially harmful construction materials in a single location.
 - v. Use temporary barriers to separate construction areas from areas of non-construction.
 - 1. Exhaust or negatively pressurize area.
 - 2. Sweep regularly and avoid spills; if they occur, clean up immediately.
 - vi. Sequence arrival of materials so as to not need to store them for extended periods of time.
 - vii. If permanently installed air handlers are used during construction, filtration media must be used at each return air grille that meets one of the following criteria below. Replace all filtration media immediately prior to occupancy.
 - 1. Filtration media with a minimum efficiency reporting value (MERV) of 8 as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda¹).
 - 2. Filtration media with a minimum dust spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3–10 µg.
 - b. Prior to occupancy
 - i. Perform a building flush-out or test the air contaminant levels in the building. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly.
 - 1. Building flushouts should deliver 14,000 cubic feet per square foot of outdoor air to the space; while maintain an internal temperature of at least 60 degrees and an RH below 60%.
 - ii. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or as the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.
 - 1. All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
 - 2. All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
 - 3. The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
 - 4. Air samples must be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.
2. Low Emitting Materials
- a. Adhesives and sealants
 - i. Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed. Common products to evaluate include general construction adhesives, flooring adhesives, fire-stopping sealants, caulking, duct sealants, plumbing adhesives and cove base adhesives. Review product cut sheets, material safety data (MSD) sheets, signed attestations or other official

literature from the manufacturer clearly identifying the VOC contents or compliance with referenced standards.

b. Paints and Coatings

- i. Specify low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed. Track the VOC content of all interior paints and coatings during construction.
- ii. Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied onsite) must comply with the following criteria as applicable to the project scope: Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
- iii. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2 lb/gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
- iv. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

c. Flooring

- i. Clearly specify requirements for product testing and/or certification in the construction documents. Select products that are either certified under the Green Label Plus program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.
- ii. Sustainable Criteria tables can be found in the reference section.

d. Composite Wood

- i. Specify wood and agrifiber products that contain no added urea-formaldehyde resins. Specify laminating adhesives for field and shop-applied assemblies that contain no added urea-formaldehyde resins.
- ii. Review product cut sheets, material safety data (MSD) sheets, signed attestations or other official literature from the manufacturer.
- iii. Composite wood and agrifiber products are defined as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores.
- iv. Materials considered fixtures, furniture and equipment (FF&E) are not considered base building elements and are not included.

IV. Resources

1. References

Reports:

“ACRP Synthesis 10: A Synthesis of Airport Sustainability Practices” Transportation Research Board, Airport Cooperative Research Program. 2008. Available at: www.trb.org

“Chicago Department of Aviation: Sustainable Airport Manual,” Chicago Department of Aviation, 2012.

“LEED Reference Guide for Building Design and Construction,” Version 3, U.S. Green Building Council (USGBC), 2009.

“Sustainable Airport Planning, Design and Construction Guidelines: for Implementation on all Airport Projects Version 5.0” Los Angeles World Airports, 2010.

“Sustainable Aviation Resource Guide: Planning Implementing and Maintaining a Sustainability Program at Airports,” Sustainable Aviation Guidance Alliance, 2008.

Web Resources:

www.airportsgoinggreen.org

www.airportsustainability.org

www.faa.gov/airports/environmental/sustainability

2. Terms and Definitions

Biodiversity is the variety of life in all forms, levels, and combinations, including ecosystem diversity, species diversity, and genetic diversity.

A **building automation system (BAS)** uses computer-based monitoring to coordinate, organize, and optimize building control subsystems, including lighting, equipment scheduling, and alarm reporting.

Chain-of-custody certification is awarded to companies that produce, sell, promote, or trade forest products after audits verify proper accounting of material flows and proper use of the Forest Stewardship Council name and logo. The COC certificate number is listed on invoices for nonlabeled products to document that an entity has followed FSC guidelines for product accounting.

Chlorofluorocarbons (CFCs) are hydrocarbons that are used as refrigerants and cause depletion of the stratospheric ozone layer.

Combined heat and power (CHP), or cogeneration, generates both electrical power and thermal energy from a single fuel source.

Commissioning (Cx) is the process of verifying and documenting that a building and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements.

Conditioned space is the part of a building that is heated or cooled, or both, for the comfort of occupants. (ASHRAE 62.1–2007)

A **construction IAQ management plan** outlines measures to minimize contamination in a specific project building during construction and describes procedures to flush the building of contaminants prior to occupancy.

Construction and demolition debris includes waste and recyclables generated from construction and from the renovation, demolition, or deconstruction of preexisting structures. It does not include land-clearing debris, such as soil, vegetation, and rocks.

Contaminants are unwanted airborne elements that may reduce indoor air quality. (ASHRAE 62.1–2007)

Controls are mechanisms that allow occupants to direct power to devices (e.g., lights, heaters) or adjust devices or systems within a range (e.g., brightness, temperature).

Conventional irrigation refers to the most common irrigation system used in the region where the building is located. A conventional irrigation system commonly uses pressure to deliver water and distributes it through sprinkler heads above the ground.

Daylighting is the controlled admission of natural light into a space, used to reduce or eliminate electric lighting.

Daylight-responsive lighting controls are photosensors used in conjunction with other switching and dimming devices to control the amount of artificial lighting in relationship to the amount and quality of natural daylight.

Densely occupied space is an area with a design occupant density of 25 people or more per 1,000 square feet (40 square feet or less per person).

A **district energy system** is a central energy conversion plant and transmission and distribution system that provides thermal energy to a group of buildings (e.g., a central cooling plant on a university campus). Central energy systems that provide only electricity are not included.

Downstream equipment consists of all heating or cooling systems, equipment, and controls located within the project building and site associated with transporting thermal energy into heated or cooled spaces. This includes the thermal connection or interface with the district energy system, secondary distribution systems in the building, and terminal units.

Drip irrigation delivers water at low pressure through buried mains and submains. From the submains, water is distributed to the soil through a network of perforated tubes or emitters. Drip irrigation is a high-efficiency type of microirrigation.

Durable goods have a useful life of 2 years or more and are replaced infrequently or may require capital program outlays. Examples include furniture, office equipment, appliances, external power adapters, televisions, and audiovisual equipment.

The **durable goods waste stream** consists of durable goods leaving the project site that are fully depreciated and have reached the end of their useful lives for normal business operations.

An **economizer** is a device used to make building systems more energy efficient. Examples include

HVAC enthalpy controls, which are based on humidity and temperature.

An **ecosystem** is a basic unit of nature that includes a community of organisms and their nonliving environment linked by biological, chemical, and physical processes.

Embodied energy is the energy used during the entire life cycle of a product, including its manufacture, transportation, and disposal, as well as the inherent energy captured within the product itself.

Emissions reduction reporting is the calculating, tracking, and documenting of the greenhouse gas emissions that result directly from energy use and other operations of a building.

Energy conservation measures are installations or modifications of equipment or systems intended to reduce energy use and costs.

An **energy simulation model**, or **energy model**, is a computer-generated representation of the anticipated energy consumption of a building. It permits a comparison of energy performance, given proposed energy efficiency measures, with the baseline.

An **ENERGY STAR** rating is a measure of a building's energy performance compared with that of similar buildings, as determined by the ENERGY STAR Portfolio Manager. A score of 50 represents average building performance.

Enhanced commissioning is a set of best practices that go beyond fundamental commissioning to ensure that building systems perform as intended by the owner. These practices include designating a commissioning authority prior to the construction documents phase, conducting commissioning design reviews, reviewing contractor submittals, developing a systems manual, verifying operator training, and performing a postoccupancy operations review.

Erosion is a combination of processes or events by which materials of the earth's surface are loosened, dissolved, or worn away and transported by natural agents (e.g., water, wind, or gravity).

Eutrophication is the increase in chemical nutrients, such as the nitrogen and phosphorus often found in fertilizers, in an ecosystem. The added nutrients stimulate excessive plant growth, promoting algal blooms or weeds. The enhanced plant growth reduces oxygen in the land and water, reducing water quality and fish and other animal populations.

Fundamental commissioning is a set of essential best practices used to ensure that building performance requirements have been identified early in the project's development and to verify that the designed systems have been installed in compliance with those requirements. These practices include designating a commissioning authority, documenting the owner's project requirements and basis of design, incorporating commissioning requirements into the construction documents, establishing a commissioning plan, verifying installation and performance of specified building systems, and completing a summary commissioning report.

Graywater is defined by the Uniform Plumbing Code (UPC) in its Appendix G, Gray Water Systems for Single-Family Dwellings, as "untreated household waste water which has not come into contact with toilet waste. Greywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs. It must not include waste water from kitchen sinks or dishwashers." The International Plumbing Code (IPC) defines graywater in its Appendix C, GrayWater Recycling Systems, as "waste water discharged from lavatories, bathtubs, showers, clothes washers and laundry sinks." Some states and local authorities allow kitchen sink wastewater to be included in graywater. Other differences with the UPC and IPC definitions can likely be found in state and local codes. Project teams should comply with graywater definitions as established by the authority having jurisdiction in the project area.

Green cleaning is the use of cleaning products and practices that have lower environmental impacts and more positive indoor air quality impacts than conventional products and practices.

Greenhouse gases (GHGs) absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by Earth's surface, clouds, and the atmosphere itself. Increased concentrations of greenhouse gases are a root cause of global climate change.

HVAC systems are equipment, distribution systems, and terminals that provide the processes of heating, ventilating, or air-conditioning. (ASHRAE 90.1–2007)

Indoor air quality (IAQ) is the nature of air inside the space that affects the health and wellbeing of building occupants. It is considered acceptable when there are no known contaminants at harmful concentrations and a substantial majority (80% or more) of the occupants do not express dissatisfaction. (ASHRAE 62.1–2007)

Integrated pest management (IPM) is the coordinated use of knowledge about pests, the environment, and pest prevention and control methods to minimize pest infestation and damage by the most economical means while minimizing hazards to people, property, and the environment.

Material safety data sheets (MSDS) are detailed, written instructions documenting a method to achieve uniformity of performance.

Mechanical ventilation, or **active ventilation**, is provided by mechanically powered equipment, such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows. (ASHRAE 62.1–2004)

Minimum efficiency reporting value (MERV) is a filter rating established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE 52.2–1999, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size). MERV categories range from 1 (very low efficiency) to 16 (very high).

The **National Pollutant Discharge Elimination System (NPDES)** is a permit program that controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

Natural ventilation, or **passive ventilation**, is provided by thermal, wind, or diffusion effects through doors, windows, or other intentional openings in the building; it uses the building layout, fabric, and form to achieve heat transfer and air movement.

Net metering is a metering and billing arrangement that allows on-site generators to send excess electricity flows to the regional power grid. These electricity flows offset a portion of those drawn from the grid.

Owner's project requirements is a written document that details the ideas, concepts, and criteria that are determined by the owner to be important to the success of the project.

Pollutants include emissions of carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x), mercury (Hg), small particulates (PM_{2.5}), and large particulates (PM₁₀).

Postconsumer recycled content is the percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain. Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings). (ISO 14021)

Potable water meets or exceeds EPA's drinking water quality standards and is approved for human consumption by the state or local authorities having jurisdiction; it may be supplied from wells or municipal water systems.

Preconsumer recycled content, formerly known as postindustrial content, is the percentage of material in a product that is recycled from manufacturing waste. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. Excluded are rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them. (ISO 14021)

Process water is used for industrial processes and building systems such as cooling towers, boilers, and chillers. It can also refer to water used in operational processes, such as dishwashing, clothes washing, and ice making.

Proposed building performance is the annual energy cost calculated for a proposed design, as defined in ANSI/ASHRAE/IESNA Standard 90.1–2007, Appendix G.

Recycled content is the proportion, by mass, of preconsumer or postconsumer recycled material in a product. (ISO 14021)

Recycling is the collection, reprocessing, marketing, and use of materials that were diverted or recovered from the solid waste stream.

A **recycling collection area** is located in regularly occupied space in the building for the collection of occupants' recyclables. A building may have numerous collection areas from which recyclable materials are typically removed to a central collection and storage area.

Refrigerants are the working fluids of refrigeration cycles that absorb heat from a reservoir at low temperatures and reject heat at higher temperatures.

Regionally extracted materials are raw materials taken from within a 500-mile radius of the project site.

Regionally manufactured materials are assembled as finished products within a 500-mile radius of the project site. Assembly does not include on-site assembly, erection, or installation of finished components.

Renewable energy comes from sources that are not depleted by use. Examples include energy from the sun, wind, and small (low-impact) hydropower, plus geothermal energy and wave and tidal systems. Ways to capture energy from the sun include photovoltaic, solar thermal, and bioenergy systems based on wood waste, agricultural crops or residue, animal and other organic waste, or landfill gas.

Sedimentation is the addition of soil particles to water bodies by natural and human-related activities. Sedimentation often decreases water quality and can accelerate the aging process of lakes, rivers, and streams.

Setpoints are normal operating ranges for building systems and indoor environmental quality.

When the building systems are outside of their normal operating range, action is taken by the building operator or automation system.

A **site assessment** is an evaluation of a site's aboveground and subsurface characteristics, including its structures, geology, and hydrology. Site assessments are typically used to determine whether contamination has occurred, as well as the extent and concentration of any release of pollutants.

Information generated during a site assessment is used to make remedial action decisions.

The **solar reflectance index (SRI)** is a measure of a material's ability to reject solar heat, as shown by a small temperature rise. Standard black (reflectance 0.05, emittance 0.90) is 0 and standard white (reflectance 0.80, emittance 0.90) is 100. For example, a standard black surface has a temperature rise of 90°F (50°C) in full sun, and a standard white surface has a temperature rise of 14.6°F (8.1°C). Once the maximum temperature rise of a given material has been computed, the SRI can be calculated by interpolating between the values for white and black. Materials with the highest SRI values are the coolest choices for paving. Because of the way SRI is defined, particularly hot materials can even take slightly negative values, and particularly cool materials can even exceed 100. (Lawrence Berkeley National Laboratory Cool Roofing Materials Database)

Standard operating procedures are detailed, written instructions documenting a method to achieve uniformity of performance.

Stormwater runoff consists of water from precipitation that flows over surfaces into sewer systems or receiving water bodies. All precipitation that leaves project site boundaries on the surface is considered stormwater runoff.

A **stormwater pollution prevention plan** describes all measures to prevent stormwater contamination, control sedimentation and erosion during construction, and comply with the requirements of the Clean Water Act.

Submetering is used to determine the proportion of energy use within a building attributable to specific end uses or subsystems (e.g., the heating subsystem of an HVAC system).

Ventilation is the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space. (ASHRAE 62.1-2007).

Volatile organic compounds (VOCs) are carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). The compounds vaporize (become a gas) at normal room temperatures.

Waste comprises all materials that flow from the building to final disposal. Examples include paper, grass trimmings, food scraps, and plastics.

Waste diversion is a management activity that disposes of waste other than through incineration or the use of landfills. Examples include reuse and recycling.

A **waste reduction program** encompasses source reduction, reuse, and recycling. Such a program assigns responsibility within the organization for implementation, lists the general actions that will be taken to reduce waste, and describes tracking and review procedures to monitor waste reduction and improve performance.

The **waste stream** is the overall flow of waste from the building to a landfill, incinerator, or other disposal site.

Wastewater is the spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

3. Sustainability Specification Templates

SECTION 018113 –SUSTAINABILITY REQUIREMENTS

PART 1– GENERAL

1.1 SUMMARY

A Section Includes:

- 1 Sustainable project goals
- 2 Sustainable product requirements

B Related Sections:

- 1 Section 01 57 19 – Indoor Air Quality Management
- 2 Section 01 74 19 – Construction Waste Management
- 3 Section 01 91 00 – Commissioning: General Commissioning Requirements
- 4 Section 23 08 00 – Commissioning of HVAC: Mechanical Systems Commissioning Requirements
- 5 Section 26 08 00: Electrical Systems Commissioning Requirements
- 6 Section 22 08 00: Plumbing Systems Commissioning Requirements
- 7 Section 21 08 00: Fire Suppression Systems Commissioning Requirements
- 8 Individual specification sections for additional product requirements

C Project Limitations

- 1 EDIT THIS SECTION IF A PROJECT HAS CERTAIN LIMITATIONS SUCH AS CONSTRUCTION PHASE OR LEED BOUNDARY

1.2 DEFINITIONS

DELETE DEFINITIONS THAT DO NOT APPLY TO PROJECT

A LEED®: Leadership in Energy & Environmental Design.

B Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process or after consumer use.

- 1 Post-consumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.
- 2 Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. Reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it are excluded.

C Local and Regional Materials: Materials that are manufactured, extracted, and processed within a radius of 500 miles from the project site

D Rapidly Renewable Materials: Materials that have a harvest cycle of 10 years or less

- E Certified Wood: Wood certified by the Forest Stewardship Council (FSC). Vendors are defined as those companies that sell products to the project contractor or subcontractors (i.e. installing contractors). These vendors must be Chain of Custody certified with the FSC for products to qualify.

1.3 REFERENCES

- A American Society of Heating, Refrigerating and Air-Conditioning Engineers:
- 1 ASHRAE 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
 - 2 ASHRAE 55-2004 – Thermal Comfort Conditions for Human Occupancy
 - 3 ASHRAE 62.1-2007 – Ventilation for Acceptable Indoor Air Quality
 - 4 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- B ASTM International:
- 1 ASTM E408 – Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
 - 2 ASTM E903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- C Carpet and Rug Institute:
- 1 CRI Green Label Program
 - 2 CRI Green Label Plus Program
- D Efficiency Valuation Organization:
- 1 International Performance Measurement & Verification Protocol
- E Forest Stewardship Council:
- 1 FSC Guidelines – Forest Stewardship Council Guidelines
- F Green Seal:
- 1 GC-03 – Anti-Corrosive Paints
 - 2 GS-11 – Paints
- G Sheet Metal and Air Conditioning Contractors:
- 1 SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3
- H South Coast Air Quality Management District:
- 1 SCAQMD Rule 1113, Architectural Coatings as of January
 - 2 SCAQMD Rule 1168, Adhesive and Sealant Applications
- I U.S. Environmental Protection Agency:
- 1 EPA 832-R-92-005 – Storm Water Management for Construction Activities: Development Pollution Prevention Plans and Best Management Practices

J U.S. Green Building Council:

- 1 Green Building Design and Construction Version 3 LEED Reference Guide, 2009 Edition (including all errata)

1.4 SUSTAINABLE PROJECT GOALS

- A LEED® Construction Project Goals: Refer to LEED® Rating System Project Checklist attached to this section for Sustainable Goals.
- B Notify Owner and Architect/Engineer when conflicts arise between work performance and sustainable project goals.

1.5 SUBMITTALS

EDIT EACH SECTION SUCH THAT ONLY THE CREDITS WHICH THE PROJECT IS PURSUING ARE MENTIONED BELOW

- A **Each Contractor** shall be responsible for LEED® submittal requirements included in this section as well as other specification sections.
- 1 LEED® submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit one (1) duplicate copy to LEED Program Manager as a separate submittal to review LEED® related product info.
- B **Each Contractor** shall provide Schedule of Values (or similar document) indicating project cost data separated by labor and material for all items in CSI MasterFormat 2004 Division 2 – 10, and 31 – 33. The estimated material costs shall be updated throughout construction to reflect the actual purchased material cost. The material cost for each product shall match the material cost provided on the LEED Product Data Sheet submittal. An updated schedule of values document shall be provided with each application for payment.
- C **Each Contractor** is to complete the following LEED® Action Plan submittals **seven business days prior to the Preconstruction Meeting**:
- 1 The LEED® Action Plan should utilize the Schedule of Values to provide preliminary estimated costs for all Divisions 2-10, 31-33 materials ONLY, broken out by division.

As materials are purchased, the actual materials cost (as submitted on the LEED Product Data Sheet for that product) must be recorded in the LEED Action Plan in place of the previously estimated Schedule of Values cost. This plan must be submitted to the LEED Project Manager on a monthly basis in the form of a LEED Progress Report (see item 1.5 D, item 4 below).
 - 2 The construction team may also choose to predict and track the following credits on the LEED® Action Plan. The construction team will not be required to provide documentation for these credits. However, it is highly recommended that the team do so as it may help the construction team determine which types of products must be purchased in order to meet the construction team's required LEED Credits.
 - a Credit MRc4 Recycled Content, **20%**: List of proposed materials with recycled content.

- 1) Indicate product name and vendor, cost, percentage post-consumer recycled content, and percentage pre-consumer recycled content for each product having recycled content.
 - b Credit MRc5 Regional Materials, **30%**: List of proposed regionally extracted, processed and manufactured materials.
 - 1) Identify each material and its location of manufacture, along with the location of extraction for any material components. Identify material cost for each material.
 - c Credit MRc6 Rapidly Renewable Materials, **2.5%**: List of proposed rapidly renewable materials
 - 1) Identify each material and its percentage rapidly renewable. Identify material cost for each material.
 - d Credit MRc7 Certified Wood: List of proposed wood products (minimum **50%** FSC Certified)
 - 1) Indicate each virgin wood product, its source, percentage of wood that is FSC Certified and cost.
 - 2) Include statement indicating total cost for wood-based materials used for Project
 - 3) Vendor invoices must be provided for all wood products.
- D **Each Contractor** is to complete LEED® Progress Reports. Concurrent with each application for Payment, submit reports comparing actual construction and purchasing activities with LEED® Action Plans for the following:
- 1 Prerequisite SSp1 Construction Activity Pollution Prevention: The General Contractor is to provide at least three (3) date-stamped photos every month.
 - 2 Credit MRc2 Construction Waste Management, Divert **75%** from Disposal: Waste reduction progress reports complying with Division 1 Section “Construction Waste Management.”
 - 3 Credit EQc3.1 Construction Indoor Air Quality Management Plan: Provide a written narrative or photographs showing how the project has complied with each section of the Construction IAQ Management Plan complying with Division 1 Section “Indoor Air Quality (IAQ) Management.”
 - 4 LEED Action Plan including updated materials cost for all materials purchased prior to the application for payment.
- E **Each Contractor** is to provide the following completed documentation related to the following LEED® Credits or Prerequisites:
- 1 Prerequisite SSp1 Construction Activity Pollution Prevention: Construction Activity Pollution Prevention referencing Ohio EPA/NPDES General Permit No: OHC000003 or local erosion and sedimentation control standards. The General Contractor is to provide at least three (3) date-stamped photos every month.
 - 2 Prerequisite EAp3 Fundamental Refrigerant Management and Credit EAc4 Enhanced Refrigerant Management: Each Contractor shall provide product data for new Plumbing, HVAC, or Kitchen equipment indicating nominal tonnage and

refrigerant charge, as installed, for all equipment with greater than 0.5 lbs of refrigerant.

- 3 Credit MRc2 Construction Waste Management: Reference Section 01 74 19 for submittal requirements.
- 4 Credit EQc3.1 Construction IAQ Management Plan, During Construction: Reference Section 01 57 19 for submittal requirements.
- 5 Per LEED® Online requirements, the contractor is responsible for initialing certain Minimum Program Requirements, Prerequisites, and Credits. The contractor is to create a LEED® Online User Account to appropriately upload initials.

F **Each Contractor** is to complete LEED® Product Data Sheets according to the following specifications:

- 1 For each product and material in Division 2 – 10, 31 – 33, submit fully completed LEED® Product Data Sheet including at a minimum:
 - a Name of Product
 - b Description of Product
 - c Material Cost (no labor cost is to be included)
 - d Manufacturer
 - e Recycled Content in terms of pre-consumer (aka post-industrial) and post-consumer, as applicable.
 - f Location of Manufacture (city, state and country)
 - g Source Location for each product component (city, state and country).
 - h Percentage of total material (determined by weight) for each product component.
 - i For each adhesive, sealant, sealant primer, paint, coating, primer, clear wood finish, stain, sealer, and shellac applied on-site, within the vapor barrier:
 - 1) VOC content in g/L
 - 2) Category from those listed in paragraph 2.8 Low Emitting Materials –Indoor Applications
 - j Name and company of individual providing information.
 - k Trade and firm responsible for product installation or use.
- 2 In addition to LEED Product Data Sheets, submit formal manufacturer's letter, Material Safety Data Sheet (MSDS), or other supporting documentation to verify the accuracy of all above noted information (items d through h). The construction team is required to submit supporting documentation for at least 25% of the materials (by cost) for each of the following Credits: MRc4 Recycled Content, MRc5 Regional Materials, MRc6 Rapidly Renewable Materials, MRc7 Certified Wood, EQc4.1 Adhesives and Sealants, EQc4.2 Paints and Coatings, EQc4.3 Flooring Systems, EQc4.4 Composite Wood and Agrifiber Products.

G **Each Contractor** is to provide the following Additional Submittals along with LEED Product Data Sheets.

- 1 For Concrete, Submit the following information for concrete-based products, for each product or concrete mix:
 - a Concrete Mix / Batch Ingredients and location of extraction / processing for each ingredient (e.g. Portland Cement, slag, fly ash, aggregate, water, etc.)
 - b Location of final ingredient assembly for each mix / batch.

- c Mass of Portland cement per cubic yard.
- d Mass of Recycled Supplementary Cementitious Materials (SCM) per cubic yard. SCMs include, but are not limited to, fly ash and slag.
- e Dollar value of all cementitious materials per cubic yard.
- f Total cubic yards used on project.

2 For Steel, Submit the following information for steel-based products:

- a Record from Steel Supplier of Steel Manufacturers providing steel for project and, for each Steel Manufacturer, indication of:
 - 1) Quantity provided by each manufacture.
 - 2) Recycled content percentages for each product and manufacturer.
 - 3) Location of manufacturing plant for each product and manufacturer.
 - 4) Source location of raw materials (if applicable) for each product and manufacturer.
 - 5) Source location of recycled content (if applicable) for each product and manufacturer.

3 For Wood, Submit the following information for wood-based products:

- a Vendor invoice identifying each wood-based product on a line-item basis, including the following information for each product:
 - 1) Identification of the appropriate FSC designation, as applicable, for each item (e.g. FSC Pure, FSC Mixed Credit, FSC Mixed [NN]%, etc).
 - 2) FSC Chain of Custody (COC) certificate number, as applicable, for each item.
 - 3) Material cost for each item.
- b Product data sheet or manufacturer's letter indicating that the product is free of added urea-formaldehyde resins.

4 For Rapidly Renewable Materials, Submit the following information for rapidly renewable materials:

- a Product data sheet indicating the percentage of product that meets the rapidly renewable criteria

5 For Paving and Hardscape Materials: Submit the following information for paving and hardscape materials:

- a Product data sheet or manufacturer's letter indicating the product's Solar Reflectance Index (SRI).
- b Surface area of material in final installed condition (from plan view).

1.6 LEED® PROJECT MEETINGS

- A LEED® Construction Phase Kick-Off Meeting – will be held at the beginning of construction to introduce the Construction Team to the LEED® process. This meeting may be combined with a scheduled construction kickoff meeting if possible.
- B All LEED® Meetings will be combined with the regularly scheduled job meetings when possible. These meetings are to address open LEED® issues, answer questions regarding LEED® submittals or requirements, and discuss upcoming LEED® deliverables.

1.7 QUALITY ASSURANCE

- A Perform Work in accordance with Green Building Design and Construction Version 3 LEED Reference Guide, 2009 Edition (including all errata) to permit application and certification to achieve a Silver Rating under LEED® Rating System
- B Perform storm water management and erosion control work in accordance with Ohio EPA/NPDES General Permit No: OHC000003 or local erosion and sedimentation control standards whichever is more stringent
- C Perform commissioning work as specified in Section 01810 – Commissioning.
- D Perform work to meet or exceed minimum energy efficiency and performance in accordance with ASHRAE 90.1 – 2007.
- E Perform work without use of CFC based refrigerants in HVAC building systems.
- F Perform ventilation work in accordance with ASHRAE 62.1-2007.
- G Develop and implement Construction Indoor Air Quality Management Plan according to Section 01352.

PART 2– PRODUCTS

2.1 PROHIBITED MATERIALS

- A Do not use CFC based refrigerants or Halon extinguishing agents.
- B Do not use materials that exceed the VOC limitations in Para. 2.3.

2.2 HVAC FILTERS

- A Temporary filters during construction: Minimum Efficiency Reporting Value (MERV) 8 as determined by ASHRAE 52.2 1999.
- B Permanent filters before occupancy: Minimum Efficiency Reporting Value (MERV) 13 as determined by ASHRAE 52.2 1999.

2.3 LOW-EMITTING MATERIALS – INDOOR APPLICATIONS

- A Credit EQc4.1 and EQc4.2: Low Emitting Materials For interior applications including MEP systems use adhesives and sealants (Reference: Section 1.5 F.1.i) that comply with the following limits for VOC content:
 - 1 Adhesives, Sealants, and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
 - a Wood Glues: 30 g/L.
 - b Metal to Metal Adhesives: 30 g/L.
 - c Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d Subfloor Adhesives: 50 g/L.
 - e Plastic Foam Adhesives: 50 g/L.
 - f Carpet Adhesives: 50 g/L.
 - g Carpet Pad Adhesives: 50 g/L.
 - h VCT and Asphalt Tile Adhesives: 50 g/L.
 - i Cove Base Adhesives: 50 g/L.
 - j Gypsum Board and Panel Adhesives: 50 g/L.
 - k Rubber Floor Adhesives: 60 g/L.
 - l Ceramic Tile Adhesives: 65 g/L.
 - m Multipurpose Construction Adhesives: 70 g/L.
 - n Contact Adhesive: 80 g/L.
 - o Fiberglass Adhesives: 80 g/L.
 - p Structural Glazing Adhesives: 100 g/L.

- q Wood Flooring Adhesive: 100 g/L.
- r Plastic Cement Welding Compounds: 250 g/L.
- s ABS Welding Compounds: 325 g/L.
- t CPVC Welding Compounds: 490 g/L.
- u PVC Welding Compounds: 510 g/L.
- v Adhesive Primer for Plastic: 550 g/L.
- w Architectural Sealants: 250 g/L.
- x Sealant Primers for Nonporous Substrates: 250 g/L.
- y Sealant Primers for Porous Substrates: 775 g/L.

2 Paints and Coatings: Maximum volatile organic compound content in accordance with GS-11.

- a Flat Paints and Coatings: VOC not more than 50 g/L.
- b Non-Flat Paints and Coatings: VOC not more than 150 g/L.
- c Anti-Corrosive Coatings: VOC not more than 250 g/L.
- d Varnishes and Sanding Sealers: VOC not more than 350 g/L.
- e Stains: VOC not more than 250 g/L.
- f Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene ring).

B Credit EQc4.3 Low Emitting Materials Flooring Systems

- 1 Carpet must comply with CRI Green Label Plus Program.
- 2 Carpet Cushion must comply with Green Label Program.
- 3 Carpet Adhesives must have a VOC content of no more than 50 g/L.
- 4 All hard surface flooring (i.e. tile, masonry, terrazzo, and cut stone) must meet the FloorScore standard requirements
- 5 Concrete, wood, bamboo and cork floor finishes must meet SCAQMD Rule 1113, Architectural Coatings, effective January 1, 2004
- 6 Tile setting adhesives and grouts must meet SCAQMD Rule 1168 effective July 1, 2005 including the January 7, 2005 amendment.

C Credit EQc4.4 Low Emitting Materials Composite Wood and Agrifiber Products shall contain no added urea-formaldehyde resins.

PART 3– EXECUTION

3.1 Refer to Construction Waste Management Section 01351.

3.2 Refer to Construction Indoor Air Quality Management Section 01352.

END OF SECTION 01111

SECTION 01 57 19 – INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes special requirements for Indoor Air Quality (IAQ) management during construction operations.
 - 1. Control of emissions during construction.
 - 2. Control of moisture during construction.
- B. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

Coordinate sections below with Architect/Division 01 Spec Writer
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- C. Related Sections:
 - 1. Administrative requirements – Ref: Section 01 31 00.
 - 2. Project meetings – Ref: Section 01 31 00.
 - 3. Submittal requirements – Ref: Section 01 33 00.
 - 4. Quality assurance testing - Ref: Section 01 45 00.
 - 5. Closeout documentation, cleaning, and final submittals – Ref: Section 01 77 00.
 - 6. Sustainability Requirements – Ref: Section 01 81 13.
 - 7. Commissioning – Ref: Section 01 91 13.

1.2 DEFINITIONS

- A. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- B. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
 - 1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- C. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
- D. Interior final finishes: Materials and products applied within the vapor barrier of the building that will be exposed at interior, occupied spaces; including (but not limited to) flooring, wall covering, finish carpentry, and ceilings.

- E. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
- F. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.3 SUBMITTALS

- A. Submit Indoor Air Quality (IAQ) Management Plan: Not less than **10 business days prior to the beginning of ANY CONSTRUCTION ACTIVITY**, prepare and submit an IAQ Management Plan including, but not limited to the IAQ management criteria found in PART 3-EXECUTION.
 - 1. Revise and resubmit IAQ Management Plan as requested by Heapy Engineering to ensure planned LEED credits will be attained.
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Photograph Documentation: **Photographs must be taken** at 10 or more different instances throughout construction of all 5 IAQ measures above to demonstrate that SMACNA IAQ guidelines have been followed.
- C. Submit Product Data:
 - 1. Submit product data for filtration media to be used during construction and prior to occupancy. Include Minimum Efficiency Reporting Value (MERV).
- D. With each application for payment, submit a narrative along with available photographs demonstrating how the project has complied with each section of the Construction IAQ Management Plan. By the completion of the project, the team will need to have provided, in sum, a minimum 10 photographs of 10 different locations on at least 3 different occasions during construction. For each of the 3 different occasions, 2 photographs of **each** of the IAQ measures described in Part 2 – EXECUTION below. Each photo must include a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

1.4 MEETINGS

- A. Pre-construction meeting – As part of the Pre-construction meeting, discuss the proposed IAQ Management Plan and to develop mutual understanding relative to details of environmental protection. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours' advance notice to participants before holding the Pre-construction meeting.

PART 2- EXECUTION

2.1 IAQ MANAGEMENT CRITERIA

- A. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction Second Edition – November 2007 Chapter 3.

B. HVAC Protection:

1. HVAC system should be protected from both dust and odors and all ducts and equipment openings sealed with plastic.
2. Provide temporary exhaust during construction operations.
3. The return/negative pressure side of the system should be protected if system must be operated. To the greatest extent possible, isolate and/or shut down the HVAC system during construction. When ventilation system must be operational during construction activities, provide Minimum Efficiency Reporting Value (**MERV**) 8 or greater temporary filtration as determined by ASHRAE 52.2-1999 on all return air grilles.
4. Replace all filtration media just before occupancy.

C. Source Control: Architect or designer should specify finish materials which contain low or no toxicity levels. Containers housing toxic materials should be recovered, isolated and ventilated. Provide materials and products with low pollutant emissions as specified.

1. Potential sources of Volatile Organic Compound (VOC) emissions include the following:
 - a. Paints, stains, and varnishes.
 - b. Solvents.
 - c. Adhesives and wood preservatives.
 - d. Waxes, polishes, and cleansers.
 - e. Lubricants and sealants.
 - f. Fuels.
 - g. Plastics.
2. Potential sources of Combustion Contaminants include the following:
 - a. Furnaces and generators.
 - b. Gas or kerosene space heaters.
 - c. Tobacco products.
 - d. Vehicles.
3. Potential sources of Formaldehyde Contaminants include the following:
 - a. Particle board and plywood.
 - b. Cabinetry.
 - c. Insulation.
4. Potential sources of Particle and Fiber Contaminants include the following:
 - a. Paper printing and handling.
 - b. Insulation.
 - c. Vacuuming and cleaning of construction areas.

D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. During installation of materials containing VOCs ventilate or exhaust contaminated air with or to outside air. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces to contain construction.

E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.

1. Keep materials dry and store in a clean area. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
 3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.
 4. Use vacuum with high efficiency particulate filters and wetting agents for dust.
- F. Scheduling: Coordinate construction to limit disruption of operations in occupied portions of building. Plan enough time for flush out and IAQ test procedures before occupancy. Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
1. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.
 2. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.

2.2 POST-CONSTRUCTION IAQ MEASURES

- A. The General Contractor will be contracting a firm to perform IAQ Testing with the intent of meeting the requirements of LEED BD+C v3.0 EQc3.2. The General Contractor must provide allowances in the construction schedule to allow for testing to be completed prior to planned occupancy date. Testing cannot occur until all interior finishes are installed and punch lists are complete. Anticipated duration of testing shall be confirmed with Owner during schedule development.
- B. OR General Contractor to provide a building flushout with the intent of meeting the requirements of LEED BD+C v3.0 EQc3.2. The General Contractor must provide allowances in the construction schedule to allow the flushout to be completed prior to planned occupancy date. The building flushout cannot occur until all interior finishes are installed and punch lists are complete. Supply a total air volume of 14,000 cu. ft. of outdoor air per square foot of floor while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%. Anticipated duration of testing shall be confirmed with Owner during schedule development. The General Contractor is required to submit a letter describing the flush-out dates, outdoor air delivery rates (if different than minimum outside air operation of each system), internal temperature, and relative humidity.

END OF SECTION 01 57 19

SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for waste management during demolition and construction operations.
 - a. Protect the environment, both on-site and off-site, during demolition and construction operations.
 - b. Prevent environmental pollution and damage.
 - c. Maximize source reduction, reuse and recycling of solid waste.

Coordinate sections below with Architect/Division 01 Spec Writer

B. Related Sections:

1. 01 30 00 – Administrative Requirements: Environmental Manager and Contractor training requirements.
2. 01 40 00 – Quality Requirements: Meetings and project coordination.
3. 01 81 13 – Sustainability Requirements.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

1.3 QUALITY ASSURANCE

- A. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
- B. Diversion Goals: The project goal is to divert **75%** by weight or volume.

1.4 PRECONSTRUCTION MEETING

- A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed Waste Management Plan and to develop mutual understanding relative to details of environmental protection.

1.5 SUBMITTALS

- A. Solid Waste Management Plan: Not less than **seven business days within the Preconstruction Meeting** prepare and submit a Construction Waste Management Plan including, but not limited to, the following:
1. List of the recycling facilities, reuse facilities, municipal solid waste landfills and other disposal area(s) to be used. Include:
 - a. Name, location, and phone number.
 - b. Copy of permit or license for each facility.
 2. Identify materials that cannot be recycled or reused. Provide explanation or justification.
 3. Documentation form to be used for progress documentation and record submittal.

4. Revise and resubmit Plan as required to ensure attainment of planned LEED Credits.
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Progress Documentation: Document solid waste disposal and diversion by submitting a monthly construction waste progress report and associated waste tickets by both weight and volume for all diverted, recycled, and non-diverted waste. Include the quantity by weight of waste generated; waste diverted through sale, reuse, or recycling; and waste disposed by landfill or incineration. Identify landfills, recycling centers, waste processors, and other organizations that process or receive the solid waste.
 1. Document on form in Appendix A of this Section, or similar form as approved by Owner and LEED Program Manager.
 2. With each Application for Payment, submit updated Documentation for solid waste disposal and diversion.
 3. With each Application for Payment, submit manifests, receipts, waste tickets by both weight and volume for all diverted, recycled, and non-diverted waste, and invoices specifically identifying the Project and waste material.
- C. Record Submittals: Submit the following:
 1. Summary of solid waste disposal and diversion. Submit on form in Appendix A of this Section, or similar form as approved by Owner.
 2. Waste tickets. Submit all waste tickets monthly. The **Construction Manager** is responsible for maintaining the tickets for the entire duration of the project. A final copy of the waste tickets shall be turned over to the LEED Project Manager upon project completion.

PART 2 - PRODUCTS

PART 3 EXECUTION

3.1 SOLID WASTE MANAGEMENT

- A. Develop and implement a waste management program in order to meet the project goal of a minimum **75** percent by weight or volume of total project solid waste to be diverted from landfill as required by the **LEED BD+C version 3.0 Rating System**
- B. Collection: Implement a recycling/reuse program that includes separate collection of waste materials of the following types as appropriate to the project waste and to the available recycling and reuse programs in the project area:
 1. Asphalt.
 2. Concrete and Masonry.
 3. Metal
 - a. Ferrous.
 - b. Non-ferrous.
 4. Wood, nails and staples allowed.
 5. Debris (not including soil/land clearing debris).
 6. Glass.
 7. Paper.
 - a. Bond.
 - b. Newsprint.
 - c. Cardboard and paper packaging materials.
 8. Plastic.
 - a. Type 1: Polyethylene Terephthalate (PET, PETE).
 - b. Type 2: High Density Polyethylene (HDPE).

- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
 - d. Type 4: Low Density Polyethylene (LDPE).
 - e. Type 5: Polypropylene (PP).
 - f. Type 6: Polystyrene (PS).
 - g. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.
- 9. Gypsum.
 - 10. Non-hazardous paint and paint cans.
 - 11. Carpet.
 - 12. Insulation.
 - 13. Others as appropriate.
- C. Recycling/Reuse: Maximize recycling and reuse of materials.
- 1. Recycling/Reuse on project site: As approved, noted or specified by Owner and Architect.
 - 2. Recycling/Reuse off project site: Contact the State Department of Environmental Quality and/or the local Integrated Solid Waste Management Office.
- D. Handling:
- 1. Clean materials that are contaminated prior to placing in collection containers. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process).
 - 2. Arrange for collection by or delivery to the appropriate recycling or reuse facility.
 - 3. Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

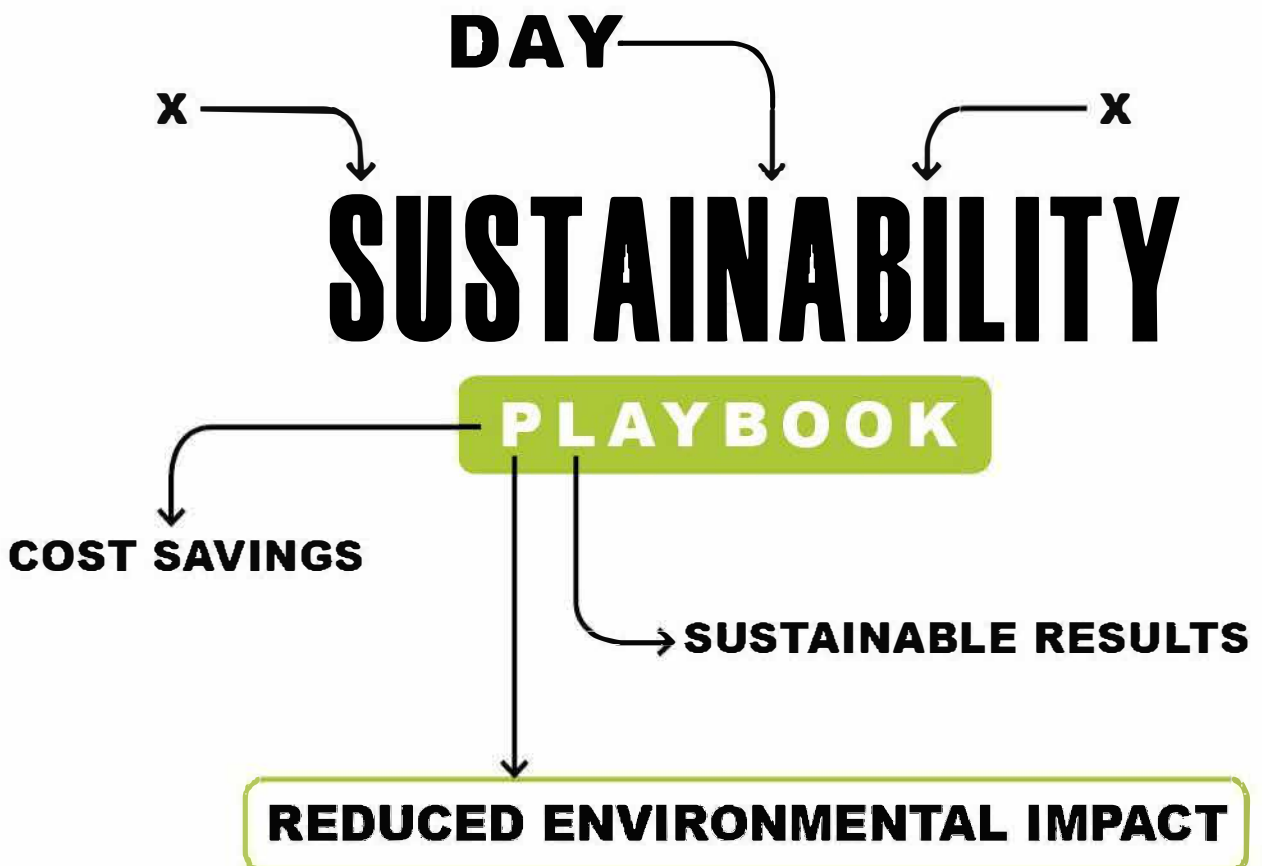
END OF SECTION 01 74 19

Appendix G

Implementation Playbook



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN





DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN

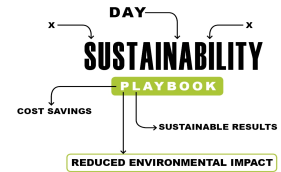


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Appendix A - Sustainability Initiatives and Strategies Matrix (Fold out Spread Sheet)	



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



Introduction

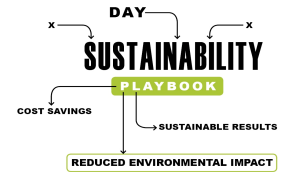
In an effort to implement and track the Sustainability initiatives and strategies developed for the Dayton International Airport (DAY), the Sustainability Advisory Committee (SAC) and the Airport's planning team developed a strategy of implementing a "Playbook", which could be used by the Airport's support staff to achieve sustainability goals and monitor the progress over a period of time. The "Playbook" concept focuses on Airport owned and operated facilities only and not facilities/equipment occupied or operated by Tenants. It is the goal of the SAC that the methodologies and strategies employed by the Airport will also serve as a reference or guide for Airport Tenants as they implement their own improvement projects. The "Playbook" includes detailed information or Highlight Sheets for each of the priority short term initiatives for each sustainability goal category. This document can be used as a quick reference guidance document for members of the Airport's staff who volunteer to be part of the "DAY-Sustainability Green Team".

As the "Playbook" implementation program moves forward, it will be important to track the progress of achieving the Airport's Sustainability goals. The ability to monitor the progress will provide the DAY – Green Team feedback and information for future adjustments. It will also serve as a "report card" to Airport Sr. Management and City officials and provide quantitative information with regard to the results of the efforts (such as energy saved, people or passengers affected, environmental impact, etc.)

Performance Monitoring spreadsheets were developed for each of the primary goal categories. Each spreadsheet contains the progress to date of the top ranked initiatives, responsible party (or parties), and the opportunity to provide self scores or grades for the team.



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



DAY-Airport Green Team / Organization Chart

This section of the Playbook outlines the Airport staff members, Tenants, and other volunteers who may serve to participate as part of the Dayton International Airport's DAY – Sustainability Green Team. The function of the DAY- Sustainability Green Team will be to operate with common goals in achieving the Sustainability initiatives. The Team captain will be responsible for updating the Organizational chart as members change in the future.

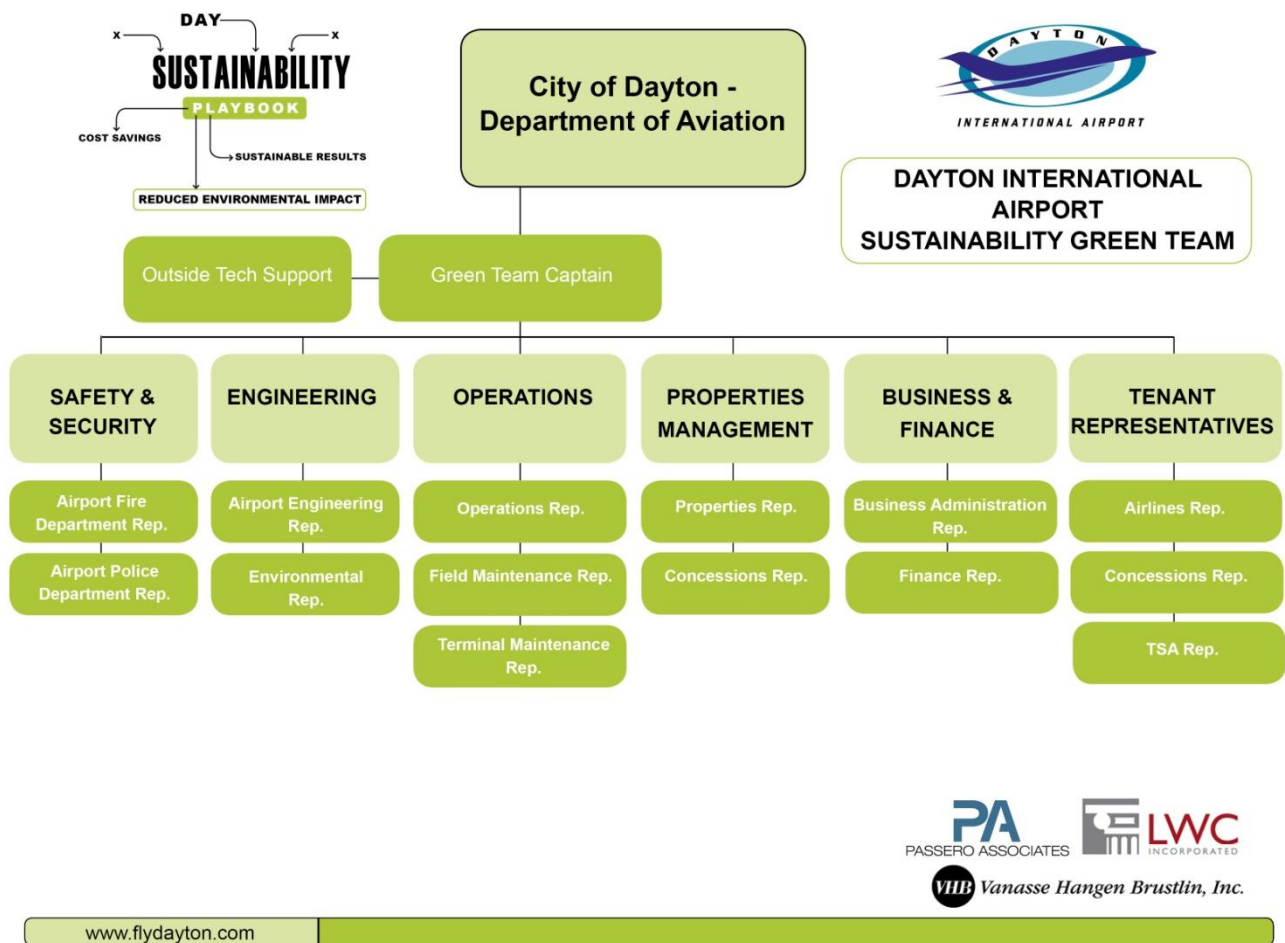
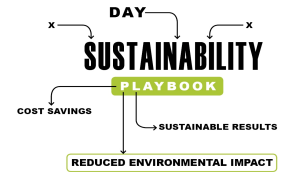


Figure 1.0 – DAY – Sustainability Green Team - Organizational Chart



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



Sustainability Initiatives and Strategies

As part of this study, Sustainability initiatives and strategies were developed based on many factors, including several site specific studies conducted for the Dayton International Airport (DAY), such as Renewable Energy Alternatives, Waste Stream Audit, Evaluation of Terminal Mechanical/Electrical/HVAC systems, and so forth. In addition to these focused studies, multiple workshops and meetings were conducted with the Sustainability Advisory Committee (SAC) to generate discussion, new ideas, and review the various initiatives and strategies which could potentially be advanced at DAY. In an effort to obtain feedback from the Airport tenants, an On-line Survey was conducted to offer a facility user's perspective for initiatives which either may be successfully working for a Tenant or new ideas which may include the Tenant to help further sustainability.

During the course of the SAC workshops, the planning team provided additional information for the groups' consideration. This information included examples of successful sustainability strategies and initiatives which have been implemented at other similar airports. These airports were not only similar in size to that of DAY, but also similar in operational characteristics to those of DAY.

The results of these efforts were tabulated in an overall Candidate Sustainability Initiatives & Strategies Matrix. The Matrix outlines each of the candidate strategies developed during the planning effort and workshops described above. Detailed information for each initiative can be found on the Matrix including:

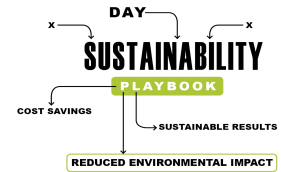
- Number of Sustainability Goals (achievable)
- Overall ability of the initiative to advance Sustainability (Effect)
- Cost Ranges (Low, Medium, High) for Capital (implementation) Costs
- Cost Ranges (Low, Medium, High) for Maintenance Costs
- Estimated Return on Investment (ROI) in years
- Additional Resources and References for the type of initiative listed

To streamline the Matrix, follow up meetings and teleconferences were conducted with Airport Staff which included representatives from Airport Environmental, Airport Engineering, and key members of the Senior Administrative Staff. The proposed strategies were also reviewed in detail with the SAC during workshop meetings which included an opportunity to provide feedback for preferred strategies through electronic/anonymous voting.

Due to the overall size and detail associated with the Matrix, a copy is provided in Appendix "A" (both hard copy and editable electronic copy on flash drive). The Matrix will need to be updated regularly to reflect initiatives which have been implemented, as priorities change, or as new initiatives are added.



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



The Team captain will be responsible for updating the Sustainability Initiatives and Strategies Matrix on a quarterly or semi-annual basis.

Prioritization Charts (per Goal Category and Overall)

After consolidating the initiatives and strategies in the Matrix, the following primary considerations were used for prioritizing the list:

- Overall ability of the Initiative or Strategy to advance Sustainability.
- Financial implications of implementing the initiative including front-end capital cost, annual cost of maintenance, and level of Staff effort required to maintain the initiative.
- Estimated level of Staff effort required to maintain the initiative.
- Estimated Return on Investment (time period)
- Consideration for future development plans

As noted in the Matrix and based on the factors noted above, a score (using a scale of 1 being low to 5 being high) was provided for two primary categories:

1. Overall Relative Ability to Advance Sustainability
2. Overall Relative Cost /Staff Level of Effort

A two part score was then plotted on a simple X-Y axis graph, as shown in Figure 2.0 on the next page. Plotting these onto a graph provided an opportunity to visually identify the lower cost / high effect initiatives (or the low hanging fruit), as well as other initiatives which may have a lower effect and still be worth consideration due to lower costs. The graph also visual shows other initiatives which may be longer term candidates due to the higher cost implications.

For example, an initiative with a two part score of “4-1” would fall near the lower right hand corner of the graph due to its “higher effect to advance sustainability and its lower cost impact”. Conversely, a two part score of 1-5 would fall in the upper left hand corner of the graph due to its “lower effect to advance sustainability and its high cost impact”.



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN

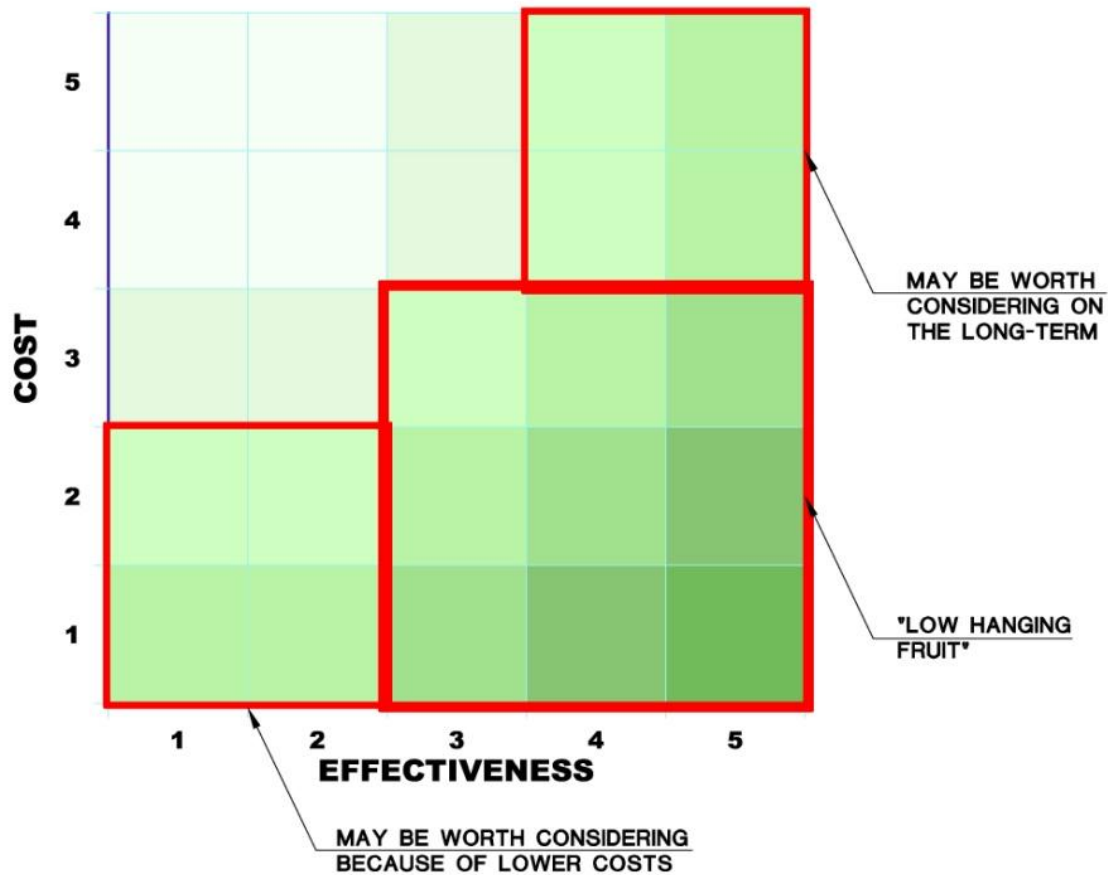
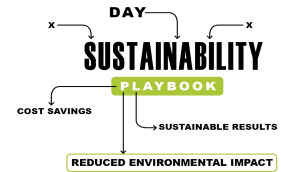


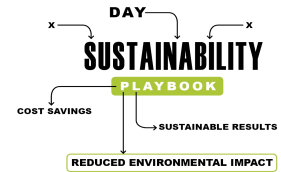
Figure 2.0 – X-Y Graph (Cost –vs. - Effectiveness) for evaluating 2- part score

For each primary Sustainability Goal Category, the results were then plotted on the same matrix based on Sustainability effect and costs. The initiatives with the highest effect for advancing Sustainability with the lowest cost were considered to be the highest priority for each Goal Category.

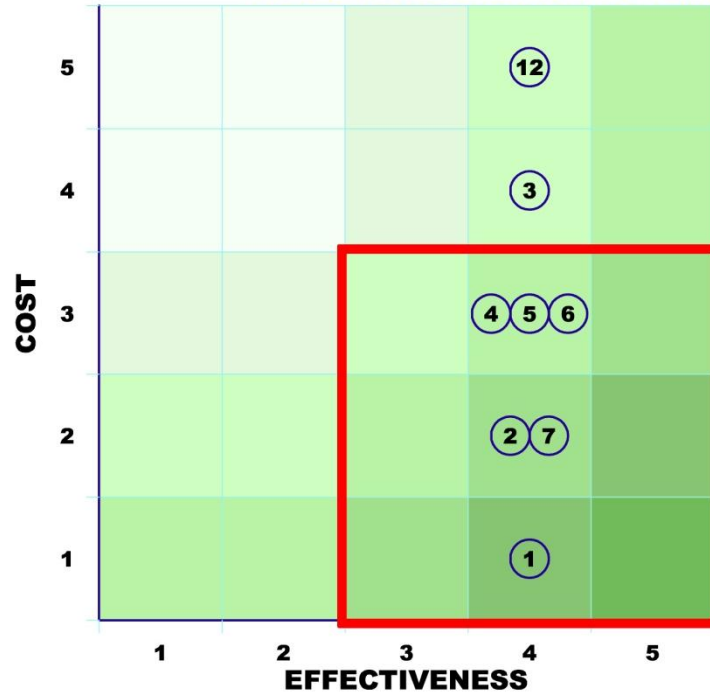
Initiatives which fell toward the center of the graph were also prioritized in the same way, however additional factors such as Return on Investment, number of Goal Categories addressed, and level of staffing involvement were considered more heavily in the prioritization process. The graphs for each Goal Category (Energy, People, Environmental Stewardship, Sustainable Investment, and Resiliency) are shown on the following pages.



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: **ENERGY** OBJECTIVE: **REDUCE CONSUMPTION OF FOSSIL FUELS FOR BUILDING SYSTEMS**

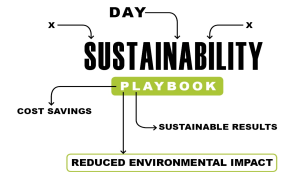


LIST OF INITIATIVES

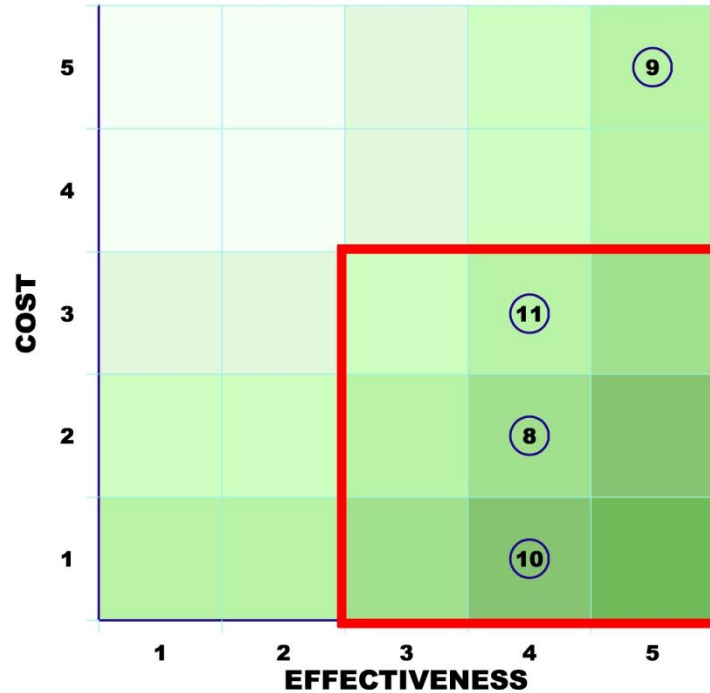
PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	REDUCE CONSUMPTION OF FOSSIL FUELS (BUILDING SYSTEMS)
1	1	RETROFIT/REPLACE EXISTING LIGHT FIXTURES WITH LED STYLE FIXTURES
2	2	REPLACE EXISTING AIRFIELD LIGHT FIXTURES WITH LED STYLE FIXTURES
	3	IMPLEMENT BUILDING MANAGEMENT SYSTEMS
	4	IMPLEMENT NEW CENTRAL CHILLED WATER PLANT AND RE-PIPING OF THE LOOP SYSTEM
	5	CONVERT AIR HANDLER FROM DX TO CHILLED WATER
	6	MODIFY EXISTING AIR HANDLERS TO OUTDOOR AIR ECONOMIZATION
3	7	REPLACE WATER BOILERS AND WATER HEATERS WITH MORE EFFICIENT SYSTEMS
		INCREASE CAPACITY FOR RENEWABLE ENERGY
	12	POTENTIAL INSTALLATION OF GEOTHERMAL HVAC SYSTEMS, SOLAR PHOTOVOLTAIC AND WIND TURBINES FOR FUTURE BUILDING EXPANSION/DEVELOPMENT PROJECTS



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: **ENERGY** OBJECTIVE: **REDUCE CONSUMPTION OF FOSSIL FUELS FOR VEHICLES AND MOBILE EQUIPMENT**

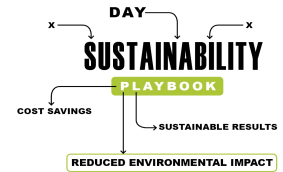


LIST OF INITIATIVES

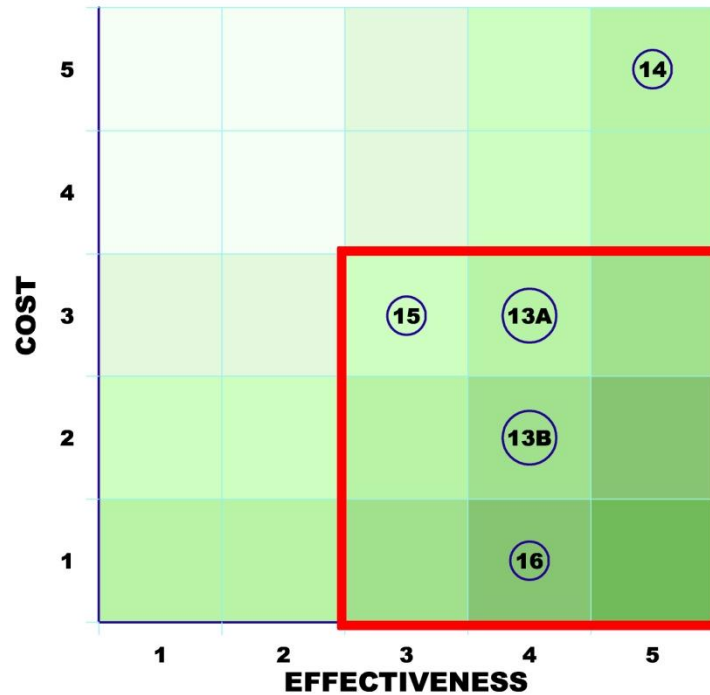
PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	REDUCE CONSUMPTION OF FOSSIL FUELS (VEHICLES AND MOBILE EQUIPMENT)
2	8	CONVERT OR PURCHASE AIRPORT MAINTENANCE EQUIPMENT AND FLEET VEHICLES TO BIODIESEL, CNG OR OTHER ALTERNATIVE FUELS
	9	CONSOLIDATE ALL RENTAL CAR FUNCTIONS INTO ONE FACILITY
1	10	ENCOURAGE THE CONVERSION OF GROUND SUPPORT VEHICLES/EQUIPMENT TO ELECTRIC OR HYBRID
3	11	INSTALL ELECTRIC CHARGING STATION/INFRASTRUCTURE TO SUPPORT ELECTRIC GROUND SURFACE EQUIPMENT (eGSE)



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: **PEOPLE** OBJECTIVE: **AIRPORT ENVIRONMENT**

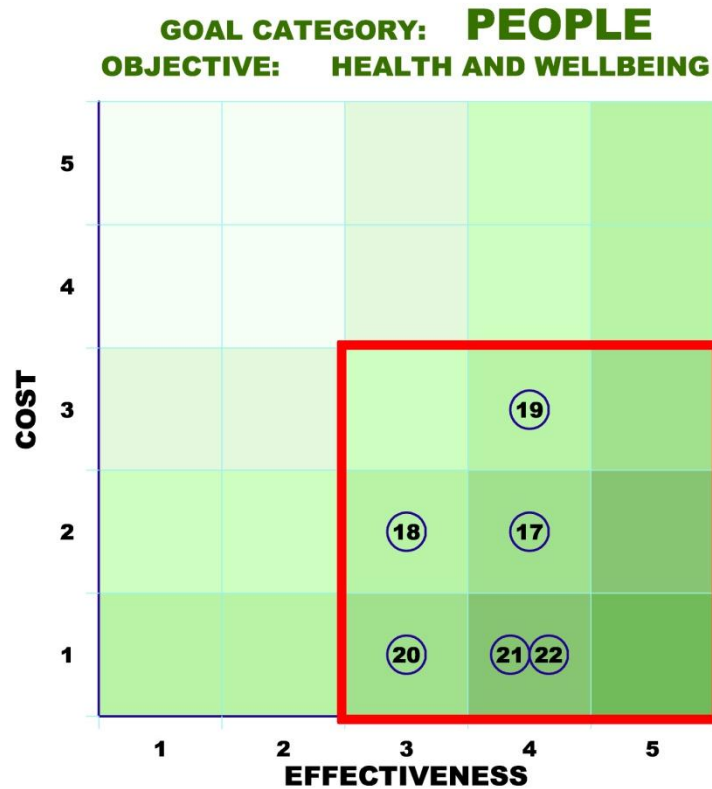
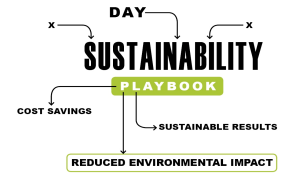


LIST OF INITIATIVES

PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	CREATE AND MAINTAIN PLEASANT AIRPORT ENVIRONMENT
3	13A	UPGRADE INTERIOR LIGHTING (INCLUDING NATURAL LIGHT)
2	13B	UPGRADE INTERIOR LIGHTING CONTROL SYSTEM
	14	REPLACE THE PASSENGER TERMINAL FACILITY AND CONCOURSES
	15	INTRODUCE ORGANIC VEGETATION TO PROMOTE IMPROVED AIR QUALITY WITHIN THE TERMINAL
		PROVIDE AMENITIES FOR ENHANCING PASSENGER EXPERIENCE
1	16	CONTINUE TO PROVIDE CHARGING STATIONS FOR ELECTRONICS (WITH USB PORTS) THROUGHOUT THE TERMINAL



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN

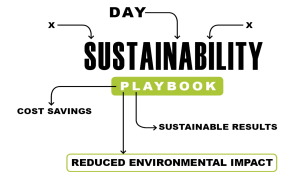


LIST OF INITIATIVES

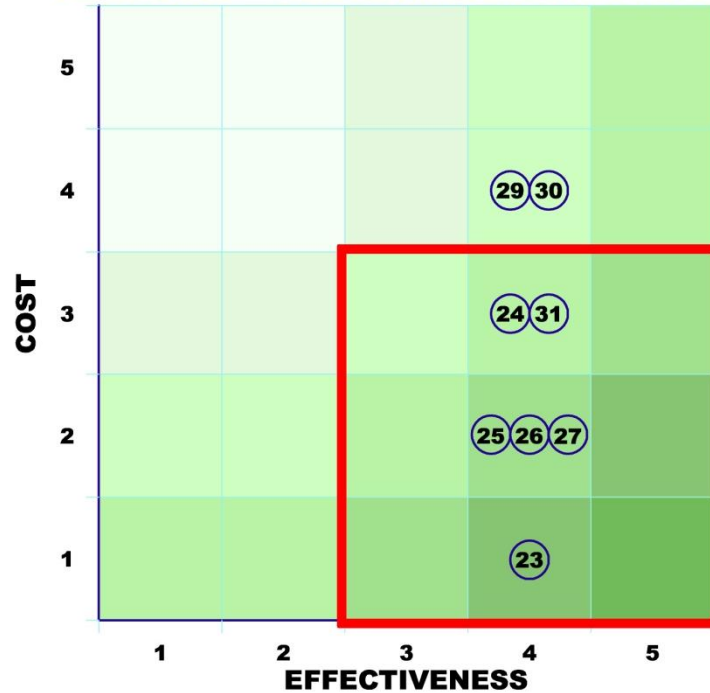
PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	ENSURE HEALTH AND WELLBEING OF PASSENGERS, TENANTS AND EMPLOYEES
3	17	CREATE A MULTI-MEDIA DISPLAY ABOUT SUSTAINABILITY AND EFFICIENCIES WITHIN THE TERMINAL
	18	ENHANCE INDOOR AIR QUALITY MONITORING
	19	COORDINATE AND IMPLEMENT PROGRAM TO SELL/USE LOCAL FARM PRODUCE AND GOODS
	20	PARTNER WITH THE TSA, AIRLINES AND LOCAL ORGANIZATIONS TO HOLD AN ANNUAL EVENT FOR AUTISTIC CHILDREN GOING ON THEIR FIRST FLIGHT
		<u>ENGAGE EMPLOYEES AND STAKEHOLDERS IN SUSTAINABILITY ACTIVITIES OF THE AIRPORT</u>
2	21	COORDINATE A FOOD DONATION PROGRAM AND ENCOURAGE TENANT/ VENDOR PARTICIPATION
1	22	ORGANIZE A "GREEN TEAM" OF AIRPORT EMPLOYEES REPRESENTING ALL FUNCTIONAL AREAS



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: ENVIRONMENTAL STEWARDSHIP OBJECTIVE: REDUCE WATER CONSUMPTION



LIST OF INITIATIVES

PRIORITY
BY GOAL/
OBJECTIVE

MATRIX
I.D. #

ALTERNATIVE USES OF NON-AERONAUTICAL AIRPORT PROPERTIES

- 23** EVALUATE NATIVE GRASSES TO REPLACE AGRICULTURAL LAND
- 24** PROVIDE LAND TO ESTABLISH AN APIARY

REDUCE WATER CONSUMPTION

- 2** **25** REPLACE NORMAL GRASS/TURF AREAS WITH SPECIALIZED NATURAL OR SYNTHETIC GRASS PRODUCTS
- 3** **26** INSTALL LOW FLOW FIXTURES IN ALL FUTURE PLUMBING DESIGN PROJECTS
- 1** **27** ESTABLISH RECLAIMED WATER STORAGE (INCLUDING RAIN WATER) AND SUPPLY SYSTEM FOR USING RECYCLED WATER
- 28** INSTALL GRAY WATER SYSTEM FOR WASHING VEHICLES AND EQUIPMENT

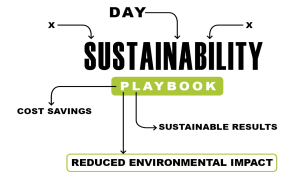
MINIMIZE NEGATIVE IMPACTS TO LOCAL WATER QUALITY

- 29** IMPLEMENT AND INSTALL BIOSWALES AS PART OF FUTURE PROJECTS IN AN EFFORT TO IMPROVE SURFACE STORM WATER QUALITY
- 30** ENCOURAGE AIRLINES OR OTHER TENANTS TO IMPLEMENT THE USE OF FORCED AIR/HYBRID OR OTHER ALTERNATIVE DEICING SYSTEMS
- 31** PROVIDE ANTI-ICING FLUIDS TO REDUCE THE USE OF DEICING FLUID

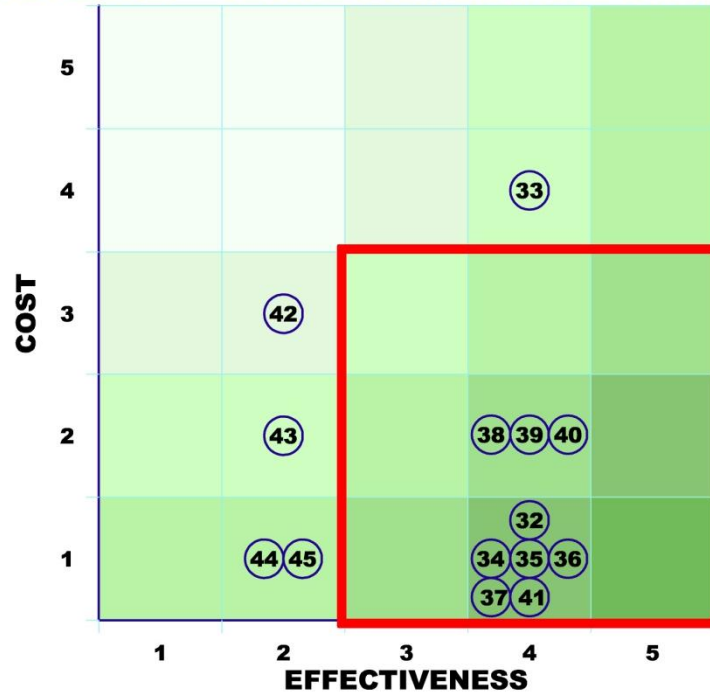




DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: **ENVIRONMENTAL STEWARDSHIP** OBJECTIVE: **REDUCE OVERALL WASTE GENERATION**

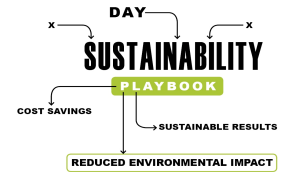


LIST OF INITIATIVES

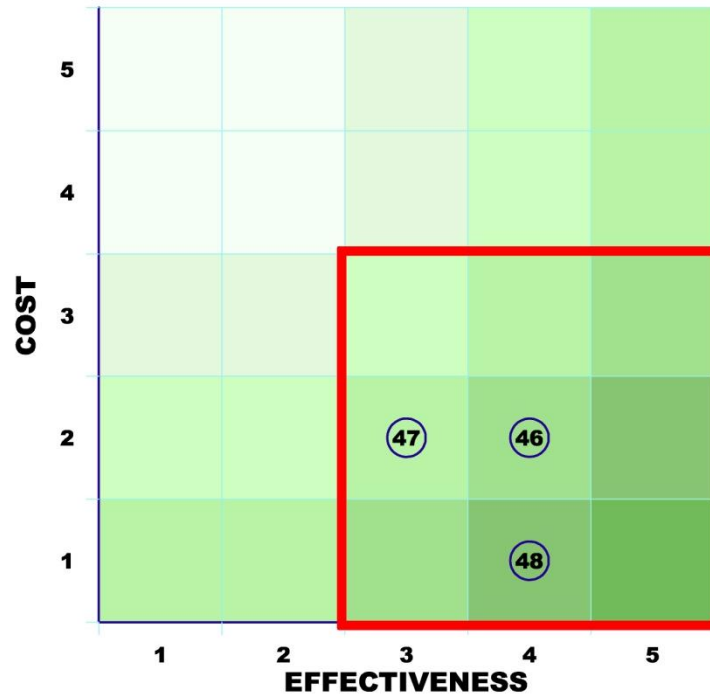
PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	REDUCE OVERALL WASTE GENERATION
2	32	IMPLEMENT A BULK RECYCLING PROGRAM
	33	IMPLEMENT AND LOCATE COMPOSTING PROGRAM ON AIRPORT OWNED AGRICULTURAL LAND
	34	INCREASE THE NUMBER OF RECYCLING RECEPTACLES
	35	ENCOURAGE VENDORS TO REDUCE PLASTIC AND CARDBOARD PACKAGING
	36	CONTINUE TO PROMOTE OR REQUIRE THE USE OF BIODEGRADABLE PRODUCTS FOR FOOD CONCESSIONAIRES
1	37	REDUCE PAPER WASTE BY INCREASING USE OF ELECTRONIC DOCUMENTS AND SUBMITTALS
3	38	EXPAND RECYCLING PROGRAM FOR WASTE FROM DEPLANED AIRCRAFT
	39	INSTALL ADDITIONAL LIQUID DISPOSAL STATIONS
	40	INSTALL ADDITIONAL WATER BOTTLE REFILLING STATIONS
	41	DEVELOP AND IMPLEMENT NEW CONSTRUCTION WASTE MANAGEMENT STANDARDS
		NATURAL RESOURCE CONSERVATION
	42	OFFER VOLUNTARY CARBON OFFSETS FOR PASSENGERS
	43	PROVIDE PRIORITY VEHICLE PARKING FOR EMISSIONS-FRIENDLY VEHICLES
	44	PROVIDE PREFERENTIAL CAR/VANPOOL PARKING FOR EMPLOYEES
	45	PROMOTE ALTERNATIVE FUEL VEHICLES FOR RENTAL CARS AND COMMERCIAL VEHICLES



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



GOAL CATEGORY: SUSTAINABLE INVESTMENT

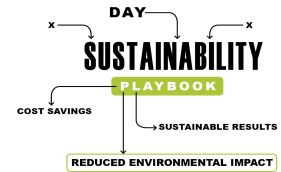


LIST OF INITIATIVES

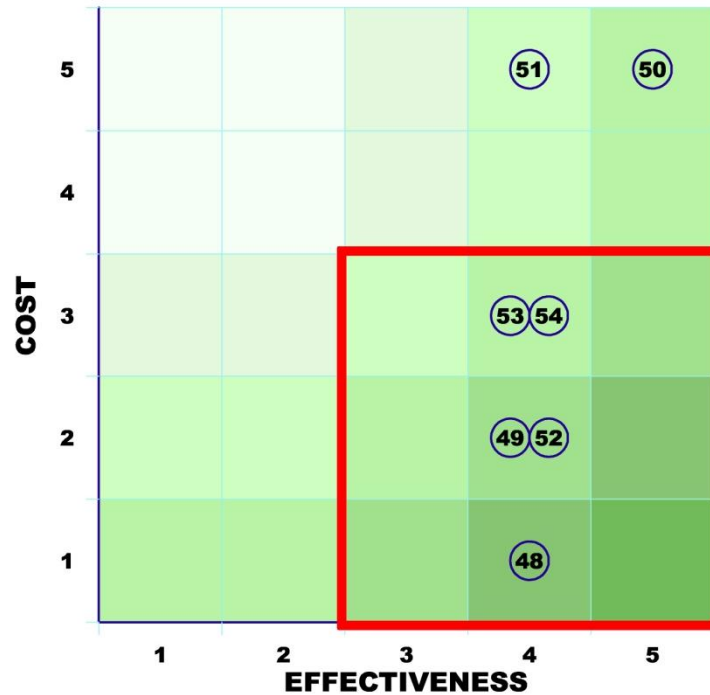
PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	INCORPORATE LIFE CYCLE ANALYSIS INTO ALL AIRPORT PLANNING AND OPERATION
1	46	PROVIDE LIFE CYCLE AND COST/BENEFIT ANALYSIS FOR EACH NEW IMPROVEMENT OR REHABILITATION PROJECT <u>SUPPORT LOCAL AND REGIONAL ECONOMY</u>
2	47	UTILIZE LOCAL MATERIALS AND RESOURCES <u>ENGAGEMENT IN ACTIVITIES TO PROMOTE ENVIRONMENTAL SUSTAINABILITY</u>
3	48	PARTICIPATE IN A "WASTE TO PROFIT" NETWORK TO IDENTIFY BY-PRODUCT SYNERGY AND MATERIAL REUSE OPPORTUNITIES



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



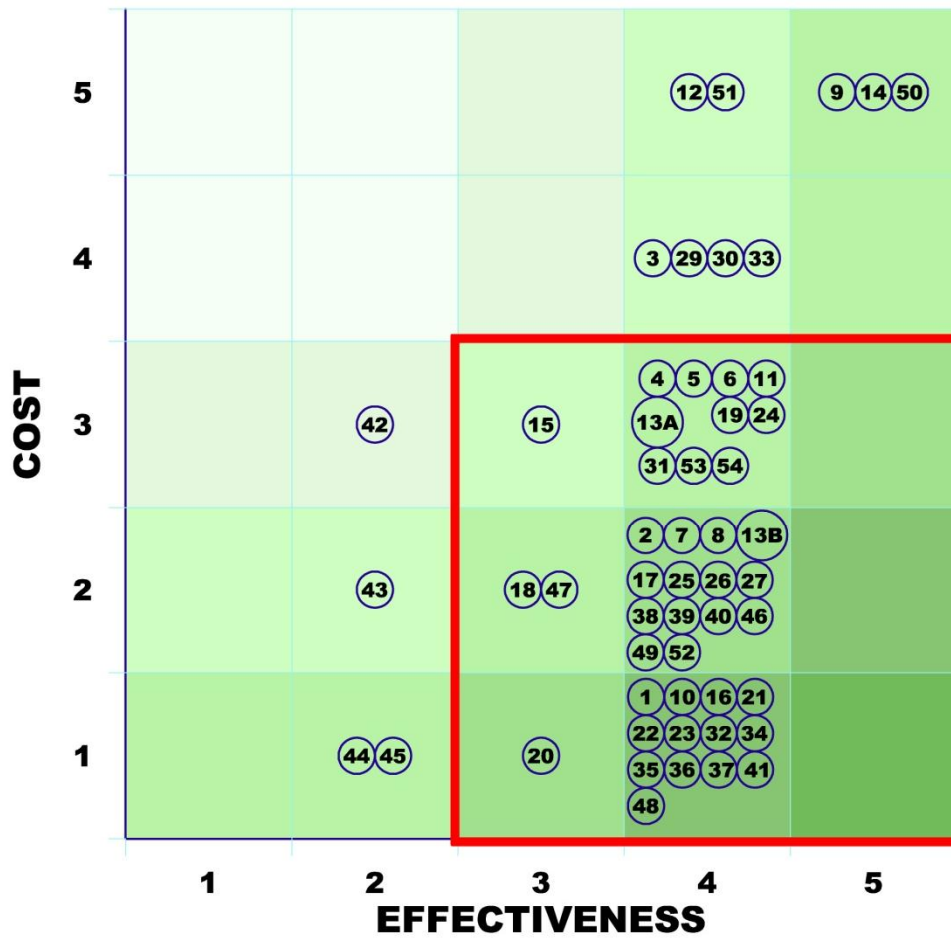
GOAL CATEGORY: RESILIENCY



LIST OF INITIATIVES

PRIORITY BY GOAL/ OBJECTIVE	MATRIX I.D. #	INITIATIVE
		UPDATE INFRASTRUCTURE TO WITHSTAND EXTREME WEATHER EVENTS
	49	CONDUCT AN EVALUATION OF EXISTING INFRASTRUCTURE AND ASSESS OPPORTUNITIES TO IMPROVE HARDENING/RESILIENCY OF EXISTING AND FUTURE INFRASTRUCTURE
	50	REPLACE THE AGING TERMINAL BUILDING AND CONCOURSES WITH A NEW LEED-CERTIFIED FACILITY
	51	INTEGRATE CLIMATE CHANGE IMPACT ASSESSMENTS FOR PLANNING IN STORMWATER, FLOOD RISK AND FLOOD PLAIN MANAGEMENT, AND OTHER INFRASTRUCTURE ASSESSMENTS
		INCORPORATE GREEN INFRASTRUCTURE STANDARDS INTO THE AIRPORT'S DESIGN AND CONSTRUCTION STANDARDS
1	52	UTILIZE GUIDELINES AND SPECIFICATIONS TO PROMOTE ASSET PROTECTION IN FUTURE INFRASTRUCTURE PROJECTS
		DEVELOP PLANS TO ENSURE THE AIRPORT HAS THE RIGHT PEOPLE AND EQUIPMENT FOR DISASTER RESPONSE
2	53	MODIFY IRREGULAR OPERATIONS (IROPS) PLAN TO ADDRESS DISASTER RESPONSE COORDINATION AND MANAGE UNUSUAL EVENTS
3	54	DEVELOP AN AIRPORT MICROGRID AT DAY

OVERALL INITIATIVES PRIORITIZATION



Note : Key Tag = Initiative (Matrix) I.D. Number



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



LIST OF INITIATIVES

MATRIX

- | I.D. # | INITIATIVE |
|--------|---|
| | REDUCE CONSUMPTION OF FOSSIL FUELS (BUILDING SYSTEMS) |
| 1 | RETROFIT OR REPLACE EXISTING LIGHT FIXTURES WITH LED STYLE FIXTURES |
| 2 | REPLACE EXISTING AIRFIELD LIGHT FIXTURES WITH LED STYLE FIXTURES |
| 3 | IMPLEMENT BUILDING MANAGEMENT SYSTEMS |
| 4 | IMPLEMENT NEW CENTRAL CHILLED WATER PLANT AND RE-PIPING OF THE LOOP SYSTEM |
| 5 | CONVERT AIR HANDLER FROM DX TO CHILLED WATER |
| 6 | MODIFY EXISTING AIR HANDLERS TO OUTDOOR AIR ECONOMIZATION |
| 7 | REPLACE WATER BOILERS AND WATER HEATERS WITH MORE EFFICIENT SYSTEMS |
| | INCREASE CAPACITY FOR RENEWABLE ENERGY |
| 12 | POTENTIAL INSTALLATION OF GEOTHERMAL HVAC SYSTEMS, SOLAR PHOTOVOLTAIC, AND WIND TURBINES FOR FUTURE BUILDING EXPANSION/DEVELOPMENT PROJECTS |
| | REDUCE CONSUMPTION OF FOSSIL FUELS (VEHICLES AND MOBILE EQUIPMENT) |
| 8 | CONVERT OR PURCHASE AIRPORT MAINTENANCE EQUIPMENT AND FLEET VEHICLES TO BIODIESEL CNG OR OTHER ALTERNATIVE FUELS |
| 9 | CONSOLIDATE ALL RENTAL CAR FUNCTIONS INTO ONE FACILITY |
| 10 | ENCOURAGE THE CONVERSION OF GROUND SUPPORT VEHICLES/EQUIPMENT TO ELECTRIC OR HYBRID |
| 11 | INSTALL ELECTRIC CHARGING STATION/INFRASTRUCTURE TO SUPPORT ELECTRIC GROUND SURFACE EQUIPMENT (eGSE) |
| | CREATE AND MAINTAIN PLEASANT AIRPORT ENVIRONMENT |
| 13A | UPGRADE INTERIOR LIGHTING (INCLUDING NATURAL LIGHT) |
| 13B | UPGRADE INTERIOR LIGHTING CONTROL SYSTEM |
| 14 | REPLACE THE PASSENGER TERMINAL FACILITY AND CONCOURSES |
| 15 | INTRODUCE ORGANIC VEGETATION TO PROMOTE IMPROVED AIR QUALITY WITHIN THE TERMINAL |
| | PROVIDE AMENITIES FOR ENHANCING PASSENGER EXPERIENCE |
| 16 | CONTINUE TO PROVIDE CHARGING STATIONS FOR ELECTRONICS (WITH USB PORTS) THROUGHOUT THE TERMINAL |
| | ENSURE HEALTH AND WELLBEING OF PASSENGERS, TENANTS AND EMPLOYEES |
| 17 | CREATE A MULTI-MEDIA DISPLAY ABOUT SUSTAINABILITY AND EFFICIENCIES WITHIN THE TERMINAL |
| 18 | ENHANCE INDOOR AIR QUALITY MONITORING |
| 19 | COORDINATE AND IMPLEMENT PROGRAM TO SELL/USE LOCAL FARM PRODUCE AND GOODS |
| 20 | PARTNER WITH THE TSA, AIRLINES AND LOCAL ORGANIZATIONS TO HOLD AN ANNUAL EVENT FOR AUTISTIC CHILDREN GOING ON THEIR FIRST FLIGHT |
| | ENGAGE EMPLOYEES AND STAKEHOLDERS IN SUSTAINABILITY ACTIVITIES OF THE AIRPORT |
| 21 | COORDINATE A FOOD DONATION PROGRAM AND ENCOURAGE TENANT/VENDOR PARTICIPATION |
| 22 | ORGANIZE A "GREEN TEAM" OF AIRPORT EMPLOYEES REPRESENTING ALL FUNCTIONAL AREAS |
| | ALTERNATIVE USES OF NON-AERONAUTICAL AIRPORT PROPERTIES |
| 23 | EVALUATE NATIVE GRASSES TO REPLACE AGRICULTURAL LAND |
| 24 | PROVIDE LAND TO ESTABLISH AN APIARY |
| | REDUCE WATER CONSUMPTION |
| 25 | REPLACE NORMAL GRASS/TURF AREAS WITH SPECIALIZED NATURAL OR SYNTHETIC GRASS PRODUCTS |
| 26 | INSTALL LOW FLOW FIXTURES IN ALL FUTURE PLUMBING DESIGN PROJECTS |
| 27 | ESTABLISH RECLAIMED WATER STORAGE (INCLUDING RAIN WATER) AND SUPPLY SYSTEM FOR USING RECYCLED WATER |
| 28 | INSTALL GRAY WATER SYSTEM FOR WASHING VEHICLES AND EQUIPMENT |



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



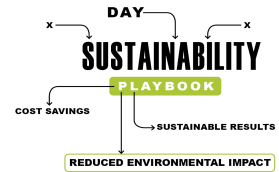
LIST OF INITIATIVES

MATRIX

- I.D. # MINIMIZE NEGATIVE IMPACTS TO LOCAL WATER QUALITY**
- 29** IMPLEMENT AND INSTALL BIOSWALES AS PART OF FUTURE PROJECTS IN AN EFFORT TO IMPROVE SURFACE STORM WATER QUALITY
 - 30** ENCOURAGE AIRLINES OR OTHER TENANTS TO IMPLEMENT THE USE OF FORCED AIR/HYBRID OR OTHER ALTERNATIVE DEICING SYSTEMS
 - 31** PROVIDE ANTI-ICING FLUIDS TO REDUCE THE USE OF DEICING FLUID
- REDUCE OVERALL WASTE GENERATION**
- 32** IMPLEMENT A BULK RECYCLING PROGRAM
 - 33** IMPLEMENT AND LOCATE A COMPOSTING PROGRAM ON AIRPORT OWNED AGRICULTURAL LAND
 - 34** INCREASE THE NUMBER OF RECYCLING RECEPTACLES
 - 35** ENCOURAGE VENDORS TO REDUCE PLASTIC AND CARDBOARD PACKAGING
 - 36** CONTINUE TO PROMOTE OR REQUIRE THE USE OF BIODEGRADABLE PRODUCTS FOR FOOD CONCESSIONAIRES
 - 37** REDUCE PAPER WASTE BY INCREASING USE OF ELECTRONIC DOCUMENTS AND SUBMITTALS
 - 38** EXPAND RECYCLING PROGRAM FOR WASTE FROM DEPLANED AIRCRAFT
 - 39** INSTALL ADDITIONAL LIQUID DISPOSAL STATIONS
 - 40** INSTALL ADDITIONAL WATER BOTTLE REFILLING STATIONS
 - 41** DEVELOP AND IMPLEMENT NEW CONSTRUCTION WASTE MANAGEMENT STANDARDS
- NATURAL RESOURCE CONSERVATION**
- 42** OFFER VOLUNTARY CARBON OFFSETS FOR PASSENGERS
 - 43** PROVIDE PRIORITY VEHICLE PARKING FOR EMISSIONS-FRIENDLY VEHICLES
 - 44** PROVIDE PREFERENTIAL CAR/VANPOOL PARKING FOR EMPLOYEES
 - 45** PROMOTE ALTERNATIVELY FUELED VEHICLES FOR RENTAL CARS AND COMMERCIAL VEHICLES
- INCORPORATE LIFE CYCLE ANALYSIS INTO ALL AIRPORT PLANNING AND OPERATION**
- 46** PROVIDE LIFE CYCLE AND COST/BENEFIT ANALYSIS FOR EACH NEW IMPROVEMENT OR REHABILITATION PROJECT
- SUPPORT LOCAL AND REGIONAL ECONOMY**
- 47** UTILIZE LOCAL MATERIALS AND RESOURCES
- ENGAGEMENT IN ACTIVITIES TO PROMOTE ENVIRONMENTAL SUSTAINABILITY**
- 48** PARTICIPATE IN A "WASTE TO PROFIT" NETWORK TO IDENTIFY BY-PRODUCT SYNERGY AND MATERIAL REUSE OPPORTUNITIES
- UPDATE INFRASTRUCTURE TO WITHSTAND EXTREME WEATHER EVENTS**
- 49** CONDUCT AN EVALUATION OF EXISTING INFRASTRUCTURE AND ASSESS OPPORTUNITIES TO IMPROVE HARDENING/RESILIENCY OF EXISTING AND FUTURE INFRASTRUCTURE
 - 50** REPLACE THE AGING TERMINAL BUILDING AND CONCOURSES WITH A NEW LEED-CERTIFIED FACILITY
 - 51** INTEGRATE CLIMATE CHANGE IMPACT ASSESSMENTS FOR PLANNING IN STORMWATER, FLOOD RISK AND FLOOD PLAIN MANAGEMENT, AND OTHER INFRASTRUCTURE ASSESSMENTS
- INCORPORATE GREEN INFRASTRUCTURE STANDARDS INTO THE AIRPORT'S DESIGN AND CONSTRUCTION STANDARDS**
- 52** UTILIZE GUIDELINES AND SPECIFICATIONS TO PROMOTE ASSET PROTECTION IN FUTURE INFRASTRUCTURE PROJECTS
- DEVELOP PLANS TO ENSURE THE AIRPORT HAS THE RIGHT PEOPLE AND EQUIPMENT FOR DISASTER RESPONSE**
- 53** MODIFY IRREGULAR OPERATIONS (IROPS) PLAN TO ADDRESS DISASTER RESPONSE COORDINATION AND MANAGE UNUSUAL EVENTS
 - 54** DEVELOP AN AIRPORT MICROGRID AT DAY



DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



Highlight (Playbook) Sheets

Individual detailed Highlight or Playbook sheets were developed for each of the priority initiatives for each goal category. These sheets contain detailed information with regard to number of goal categories the initiative covers, general cost information (capital and maintenance), technical references, locations where the initiative may have been implemented elsewhere, etc. and more detailed description and information for the initiative. As such a total of 25 overall short term initiatives were tabulated.

The Playbook sheets can be found on the following pages with the next two pages providing an overall summary and sequential prioritization of the selected short term initiatives.

CATEGORY	OBJECTIVE	INITIATIVE ID #	INITIATIVE	OVERALL PRIORITY
People	Ensure Health & Well being of Passengers, Tenants, & Employees	ID # 22	Organize a "Green Team" of airport employees representing all functional areas	1
Environmental Stewardship	Reduce Overall Waste Generation	ID # 37	Reduce paper waste by increasing use of electronic documents and submittals	2
Energy	Reduce Consumption of Fossil Fuels - Building Systems	ID # 1	Retrofit or replace existing light fixtures with LED style fixtures	3
Environmental Stewardship	Reduce Overall Waste Generation	ID # 32	Implement a bulk recycling program	4
People	Create a Pleasant Airport Environment	ID # 16	Continue providing charging stations for electronics (with USB ports) throughout the terminal	5
Environmental Stewardship	Alternative Uses of Non-Aeronautical Airport Property	ID # 23	Convert agricultural land to Native Warm Season Grasses	6
Energy	Reduce Consumption of Fossil Fuels - Vehicles and Mobile Equipment	ID # 10	Encourage the conversion of ground support vehicles/equipment to electric or hybrid	7
People	Create a Pleasant Airport Environment	ID # 21	Coordinate a food donation program and encourage tenant/vendor participation	8
Sustainable Investment	Incorporate Life/Cycle Analysis into all Airport Planning and Operations	ID # 46	Provide life cycle and cost/benefit analysis for each new improvement or rehabilitation project	9
Energy	Reduce Consumption of Fossil Fuels - Building Systems	ID # 2	Replace existing airfield light fixtures with LED style fixtures	10
Sustainable Investment	Engagement in activities to promote environmental sustainability	ID # 48	Participate in a "waste to profit" network to identify by-product synergy and material reuse opportunities	11
Energy	Reduce Consumption of Fossil Fuels - Building Systems	ID # 7	Replace water boilers and water heaters with more efficient systems	12
Resiliency	Incorporate green infrastructure standards into the Airport's Design and Construction Standards	ID # 52	Utilize guidelines and specifications to promote asset protection in future infrastructure projects	13
Energy	Reduce Consumption of Fossil Fuels - Vehicles and Mobile Equipment	ID # 8	Convert or purchase airport maintenance equipment and fleet vehicles to biodiesel, CNG or other alternative fuels	14

CATEGORY	OBJECTIVE	INITIATIVE ID #	INITIATIVE	OVERALL PRIORITY
Environmental Stewardship	Reduce Water Consumption	ID # 27	Establish reclaimed water storage (including rain water) and supply system for using recycles water	15
Environmental Stewardship	Reduce Water Consumption	ID # 25	Replace normal grass/turf areas with specialized natural or synthetic grass products	16
Environmental Stewardship	Reduce Water Consumption	ID # 26	Install low flow fixtures in all future plumbing design projects	17
Environmental Stewardship	Reduce Overall Waste Generation	ID # 38	Expand recycling program for waste from deplaned aircraft	18
People	Create a Pleasant Airport Environment	ID # 17	Create a multi-media display about sustainability and efficiencies within the terminal	19
People	Create a Pleasant Airport Environment	ID # 13B	Upgrade interior lighting control system	20
People	Create a Pleasant Airport Environment	ID # 13A	Upgrade interior lighting (including natural light)	21
Energy	Reduce Consumption of Fossil Fuels - Vehicles and Mobile Equipment	ID # 11	Install electric charging station/infrastructure to support electric ground surface equipment (eGSE)	22
Resiliency	Develop plans to ensure the Airport has right people and equipment for disaster response	ID # 53	Modify irregular operations (IROPs) plan to address disaster response coordination and manage unusual events	23
Sustainable Investment	Support local and regional economy	ID # 47	Utilize local materials and resources	24
Resiliency	Emergency Preparedness	ID # 54	Develop an airport microgrid at DAY	25



Organize a "Green Team" of Airport Employees Representing All Functional Areas



Description

Creating a Green Team is an effective way to generate ongoing sustainability solutions. The Green Team should be comprised of airport employees and representatives from tenants, airlines, and other agencies present at the Airport, such as TSA. A Green Team meets on a consistent basis to develop and implement ongoing and new sustainability strategies. The Green Team should work together to brainstorm improving efficiency and sustainability throughout the airport as well as helping each other with ideas and suggestions.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations	
Target Timeframe	Proposed 2014 - 2017	
Location	N/A	
Industry Guidelines	N/A	
Performance Metric	Number of Meetings per Year	
Estimated Costs	Capital Costs:	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits	N/A	
Qualitative Benefits	Employee Engagement	
	Opportunities for Innovation	
	Enhanced Implementation of Sustainability Initiatives	

Implementation Steps

- ☐ Post a bulletin asking for volunteers to be a part of a Green Team
- ☐ Assign certain Airport employees to serve on the Green Team
- ☐ Assign a lead facilitator
- ☐ Meet on a monthly or bi-monthly (once every two months) basis to brainstorm ideas

References

- Heathrow Airport Sustainability: <http://www.heathrowairport.com/about-us/community-and-environment/sustainability/heathrow-sustainability-partnership>
- STAR: Stewards of Tomorrow's Airport Resources: <http://www.mspairport.com/docs/about-msp/sustainability/Star8page.aspx>

Contributes to DAY's Goals



Energy



People



Environmental
Stewardship



Sustainable
Investment



Resiliency/
Adaptation



Reduce Paper Waste by Increasing use of Electronic Documents and Submittals



Description

Utilize an electronic document management system to manage submittals, documents, plans, specifications, reports, etc. Convert to an online / electronic system for all bidding and construction documents. Scanning documents and integrating them into a document management system can greatly reduce the amount of prime storage space required by paper. Start by producing only electronic copies.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations & Administration	
Target Timeframe	In Progress 2014 - 2015	
Location	N/A	
Industry Guidelines	N/A	
Performance Metric	Reduced Waste Removal Cost	
Estimated Costs	Capital Costs:	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits	Lower Disposal Costs	
	Improves Productivity	
	Reduces Storage	
Qualitative Benefits	Conserves Resources	
	Reduces Landfills	
	Improved Internal Operations	

Implementation Steps

- ☐ Use electronic distribution media for all documents whenever possible, such as; FTP sites, websites, emails, CDs, digital document libraries, memory sticks, etc.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Administrative Procedures - AP.2 Prerequisite 2 - Document Reduction and Recycling InitiativeAP-9 & AP-10
- Example Airports include City of Atlanta, Jackson Hartfield (ATL), Monroe County- Greater Rochester International Airport (ROC), and many others throughout the US.
- <http://www.atlanta-airport.com/business/DoingBusiness/>

Contributes to DAY's Goals



People



Environmental
Stewardship



Retrofit and /or Replace Existing Light Fixtures with LED Lamps & Fixtures



Description

With each new project within the Terminal or airport owned landside facilities, replace aging, less efficient light fixtures with energy efficient LED fixtures. Convert fluorescent and metal halide to LED lighting by retrofitting existing T8 fluorescent fixtures with new LED tubes which will provide additional energy savings (as the LED tubes utilize about 60% amperage draw compared to a standard T8 tube) until the fixtures are replaced in the future. It should also be noted that LED's are typically rated for 50,000 hours of operation as compared to 20,000 hour for the T8's.

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		In Progress 2014 - 2017
Location		Terminal & Landside Facilities
Industry Guidelines		US Green Building Council
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$ (\$10,001 - 100,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	(0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment 7-10 yrs
		Estimated Annual Energy Savings / GHG Savings \$10,000 (entire Terminal)
		Long Life (+/- 2.5 x Longer)
Qualitative Benefits:		Ecologically Friendly
		Better Lighting Quality
		Energy Efficiency

Implementation Steps

- ☐ On a continuing basis replace old burnt out fluorescent tubes with new LED style lamps.
- ☐ For all future airport projects require LED style fixtures in the specifications.

References

- Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013
- Recommended resource conservation measure or RCM (RCM #10 and #11 of Report).
- Applied Resource Management, LLC - Commercial applications including Lockheed Martin (Akron OH) and Tulsa Air and Space Museum (Tulsa, OK).

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment



Implement a Bulk Recycling Program



Your Mission Starts Here to "Win the War Against Waste".

Description

Organize annual or bi-annual events to recycle bulk non-hazardous materials and products such as furniture, carpets, etc. within various airport departments, tenant areas, etc. Provide the opportunity to participate to airport departments, tenants, and vendors. The materials are then deconstructed for recycling, donated, or disposed.

Implementation Steps

- ☐ Advertise and promote annual or bi-annual clean-up events that allow tenants, airlines and airport employees to dispose of bulky, non-hazardous items.
- ☐ Materials are collected and brought to the transfer facility, sorted, placed in larger containers or bailed, then sent to various vendors for further processing.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 4.0 Materials & Resources: Waste Reduction..... OM-85 [page 375]
- EPA - Developing and Implementing an Airport Recycling Program:
<http://www.epa.gov/osw/conserve/tools/rogo/documents/airport-recycling-guide.pdf>

Contributes to DAY's Goals



People



Environmental
Stewardship

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations	
Target Timeframe	Proposed 2015	
Location	N/A	
Industry Guidelines	EPA	
Performance Metric	Reduced Waste Removal Cost	
Estimated Costs	Capital Costs:	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits	Lower Disposal Costs	
	Recovered Resources	
	Lower Carbon Footprint	
Qualitative Benefits	Promotes DAY's Image	
	Opportunities to Serve the Community	
	Environmental Awareness	



Provide Charging Stations for Electronics (w/USB ports) throughout the Terminal



Description

Our goal is to make the airport experience easy and comfortable, facilitating passengers' need to conduct business while traveling by providing charging stations and USB ports for electronics (for passenger convenience) throughout the Terminal and Concourses.

Implementation Steps

- ☐ Evaluate and provide in existing high-traffic passenger use areas as well as include in the future Terminal redevelopment.
- ☐ Install charging kiosks to provide power for passengers' electronic devices.

References

- Airport Installing 60 Free-To-Use Charging Stations For Personal Electronics Systems
<https://www.mitchellairport.com/airport-information/news-releases/>
- New Kiosks Allow Passengers to Recharge Electronic Devices and Stay Connected During Holiday Travel
<http://www.bwiairport.com/en/about-bwi/press-releases/1114>

Contributes to DAY's Goals



People

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		In Progress 2014 - 2017
Location		Terminal & Concourses
Industry Guidelines		USB Implementers Forum
Performance Metric		Passenger Feedback
Estimated Costs	Capital Costs	\$ (\$0-\$10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		High Quality
		Cost Effective
		Durable / Reliable
Qualitative Benefits:		Promotes DAY's Image
		Better Customer Service
		Enhanced the Passenger Experience



Convert Agricultural Land to Native Warm Season Grasses



Description

The Native Warm Season Grasses refer to Ohio's tallgrass prairies, which are native to the state. In addition to such grasses, prairies typically consist of wildflowers that manage stormwater well and are tolerant to periods of drought. The diversity of plant species in the prairie grass systems helps make them less likely to be wiped out by disease or pests.

Implementation Steps

- ☐ Use the Sustainable Land Use Evaluation Tool with quantitative decision-making tool to make informed decisions about Airport property uses that make financial sense, are compatible with other airport uses and consistent with the Airport's sustainability mission.
- ☐ Work with local Audubon Society and other eco friendly organizations to provide (non-aeronautical) land areas which allow native grasses / prairies to thrive.
- ☐ Evaluate native grasses to replace some agricultural use lands.
- ☐ Plant some agricultural use land with Native Warm Season Grasses and monitor.

References

- ARKANSAS WILDLIFE ACTION PLAN - 2006 STATE WILDLIFE GRANT: Prairie and Grassland Bird Habitat Restoration at the Stuttgart Airport in Arkansas' Grand Prairie Region of the Mississippi Alluvial Valley
- Sustainable Land Use Evaluation Tool as developed for the Airport. (2014 Sustainability Master Plan)

Contributes to DAY's Goals



Environmental
Stewardship



Sustainable
Investment



Resiliency/
Adaptation

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Maintenance, Engineering
Target Timeframe		In Progress 2014 - 2018
Location		Non-Aeronautical Airport Land
Industry Guidelines		USDA
Performance Metric		Metric Tons Carbon Dioxide Equivalent (MTCDE) per Acre
Estimated Costs	Capital Costs	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0 -10,000/year)
	Staff Level of Effort	👤 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Reduce Greenhouse Gas Emissions (Lower Carbon Footprint)
		1.4 (MTCDE) per Acre Reduction
Qualitative Benefits:		Promotes DAY & Aullwood
		Stormwater/Pollution Management

Encourage Conversion of Ground Support Vehicles & Equipment to Electric/Hybrid



Description

Encourage Tenants to replace conventional gasoline/diesel Ground Service Equipment (GSE) with electric or hybrid technology (GSE) equipment by providing necessary infrastructure. Set the standard by converting to or purchasing alternative fueled maintenance equipment and fleet vehicles.

Implementation Steps

- ☐ Develop strategies designed to reduce emissions from vehicles that support aircraft and airport maintenance.
- ☐ Encourage replacement of conventional gasoline based vehicles with alternative electric or hybrid vehicles with support infrastructure.
- ☐ Convert or purchase Airport maintenance equipment and fleet vehicles to bio-diesel, CNG, or other alternative fuels, where possible. Develop implementation steps for funding.

References

- FAA VALE Program Information
http://www.faa.gov/airports/environmental/vale/media/vale_techreport_v7.pdf
- Hybrid Fuel Cell Electric Airport Ground Support Equipment Feasibility Study:
http://www.fraserbasin.bc.ca/Library/CCAQ_BCCLEAR/bcclear_project_airport_fuel_cells-grant.pdf
- ACRP Report 56 - Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment



Resiliency/
Adaptation

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		Proposed 2014 - 2017
Location		Airport Fleet
Industry Guidelines		U.S. Department of Energy
Performance Metric		Cost per MPG
Estimated Costs	Capital Costs	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment 5 - 7 yrs
		Estimated Annual Energy Savings / GHG Savings
		Operation & Maintenance Costs
		Lower Carbon Footprint
Qualitative Benefits:		Promotes DAY's Sustainability
		Opportunities for innovation
		Enhanced implementation of sustainability initiatives



Coordinate a Food Donation Program and Encourage Tenant / Vendor Participation



Description

In September 2013, Dayton International Airport and Rumpke Recycling performed a Waste Audit and observed that many items were discarded at the TSA checkpoint including unopened containers, bottles, etc. of various food items. Develop and implement public food waste collection stations at TSA Checkpoints and work with vendors and tenants to implement a surplus food donation program for unused or perishable foods which were not sold.

These foods could be sent to a local food bank, homeless shelter, or to other social organizations. Potential foods include pre-packed sandwiches, salads, pastries, muffins, cookies, etc. The "Good Samaritan Food Donation Act" offers protection to citizens, businesses, and nonprofit organizations that proceed in good faith to donate, recover, and distribute excess food.

Implementation Steps

- ☐ Collect and distribute un-opened / un-used food items which are not permitted to pass through the TSA Security Checkpoint and instead of discarding these items, donate to local food banks/ pantries/ churches/ homeless shelters.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 12.6 Surplus Food Sent to Local Organizations.....CT-200 [page 628]
- USDA: Feeding the Hungry and Reducing Solid Waste Through Food Recovery:
http://www.epa.gov/osw/conserve/pubs/wast_not.pdf
- Food Donation Connection manages food donation programs: www.foodtodonate.org

Contributes to DAY's Goals



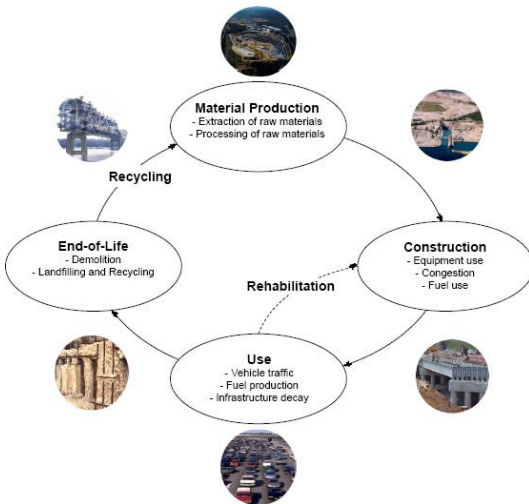
People



Environmental
Stewardship

INITIATIVE NOTES		
Lead Department	Operations	
Supporting Department(s)	Terminal Maintenance	
Target Timeframe	Proposed 2015	
Location	Terminal & Concourses	
Industry Guidelines	N/A	
Performance Metric	Waste Reduction	
Estimated Costs	Capital Costs:	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	👤 (0-10 hours/week)
BENEFITS		
Quantitative Benefits	Reduced Solid Waste	
	Feeding the Hungry	
Qualitative Benefits	Promotes DAY's Image	
	Opportunities to Serve the Local Community	
	Enhanced Passenger Engagement	

Provide Life Cycle and Cost / Benefit Analysis for Each New Project



Description

Provide life cycle and cost / benefit analysis for each new improvement or rehabilitation project. Include provisions in contracts for planning and design phases of an improvement project requiring life cycle and cost / benefit analyses. This effort would be integrated into the design and construction standards and can be used to help prioritize the sequence of each new improvement project as well as a tool to maximize grant funding opportunities.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations	
Target Timeframe	In Progress 2014 -	
Location	Terminal and Concourses	
Industry Guidelines	ASCE / USGBC	
Performance Metric	Construction Costs	
Estimated Costs	Capital Costs	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0 - 10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Lower Disposal Costs	
	Recovered Resources	
	Lower Carbon Footprint	
Qualitative Benefits:	Opportunities for Innovation	
	Reduces Landfills	
	Environmental Awareness	

Implementation Steps

- ☐ Include provisions for various consultants, scope of services to provide this type of service in both planning and design phases of a new improvement or rehabilitation project.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Planning - PL.3 Prerequisite 3: Sustainability Baseline Assessment and Cost/Benefit..... PL-14 [page 66]
- Implementing Sustainability Concepts & LEED Awareness for Airfield Pavement Projects
http://www.captg.ca/docs/pdf/11presentations/CAPTG/D_Hein_-_Workshop.pdf
- ACRP Report 42 Sustainable Airport Construction Practices

Contributes to DAY's Goals



People



Sustainable
Investment



Replace existing Airfield Light Fixtures with LED Style Fixtures where Feasible



Description

With each new airfield pavement/lighting project replace aging light fixtures with FAA-approved LED style fixtures. This initiative can also become part of the design and construction standards for future capital projects. Replacement of these less efficient fixtures with more energy efficient LED style fixtures will need to be accomplished for full length of pavement of each Runways and Taxiways (and not phased in sections or partial lengths), (Partial sections not permitted). Additional benefits include reduced maintenance costs, as LED style bulb life is expected to be over 100,000 hours of operation as compared to 1,000 hours for non-LED bulbs.

INITIATIVE NOTES		
Lead Department		Engineering
Supporting Department(s)		N/A
Target Timeframe		In Progress 2014 - 2020
Location		Taxiways & Runways
Industry Guidelines		FAA
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$\$\$ (\$100,001 +)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment 3 - 5 yrs
		Estimated Annual Energy Savings / GHG Savings \$40.00 - \$70.00 per Fixture
		Long Life (100x Conventional)
Qualitative Benefits:		Ecologically Friendly
		Better lighting quality
		Energy Efficiency

Implementation Steps

- ☐ Opportunities available with future AIP improvement projects.(Include w/ applicable AIP projects)
- ☐ Provide design and construction standards incorporating FAA-Approved LED style fixtures in all future capital projects.

References

- ACRP Synthesis 35 -Issues with Airfield LED Lighting (Transportation Research Board) 2012.
- April 2011 -College of Engineering University of Missouri --Study- LED Efficiency Design for Medium Capacity Airports.
- FAA AC 150/5345-53C, Airport Lighting Equipment Certification Program, Addendum,
http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/0B467310A914F788862570C800719ED7?OpenDocument

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment

Participate in a "Waste-to-Profit" Network



Description

The Center for Resilience at The Ohio State University is launching a new By-Product Synergy (BPS) network in Central Ohio. The Ohio BPS network is bringing together large and small companies interested in converting waste by identifying by-products for reuse. BPS will facilitate meetings and analysis of opportunities to reduce supply chain materials management costs, increase manufacturing productivity, and enhance environmental leadership with those involved in the network.

Implementation Steps

- ☐ Participate in a "Waste-to-Profit" network to identify by product synergy and material reuse opportunities.
- ☐ Identify Airport by products through waste audit.
- ☐ Coordinate with OSU Center for resilience to determine needs of other participating companies.

References

- Ohio By-Product Synergy Network: http://www.sustainable-ohio.org/index.php?option=com_content&view=frontpage&Itemid=1
- From Waste to Profit: <http://www.sustainable-ohio.org/documents/EcoFlowNews.pdf>
- Waste to Profit Network: <http://www.wastetoprofit.org/>
- P&L Waste Management Solutions: <http://www.plsoft.co.uk/>
- United States Business Council for Sustainable Development: <http://usbcsd.org/>

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment

INITIATIVE NOTES		
Lead Department		Engineering
Supporting Department(s)		N/A
Target Timeframe		Proposed 2016 - 2020
Location		N/A
Industry Guidelines		USBCSD
Performance Metric		Reduced Waste Removal Cost
Estimated Costs	Capital Costs	\$ (\$0 - 10,001)
	Ongoing Costs	\$ (\$0 - 10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Lower Disposal Costs
		Recovered Resources
		Lower Carbon Footprint
Qualitative Benefits:		Promotes DAY's Image
		Opportunities for Innovation
		Diminishing Landfills

Replace Water Boilers and Water Heaters with more Efficient Systems



Description

Replace current boilers with high efficiency condensing boilers. Replace domestic water (tank) heaters with tankless (on-demand) instantaneous water heaters. Tankless systems provide that hot water on demand, instantaneously, when you need it, so you don't have to waste energy heating unused water. You're also not losing heat that's idly sitting in a tank that, while insulated, is still going to lose heat and require constant reheating. Water is saved since you do not have to wait for the running -water to heat-up.

Implementation Steps

- ☐ Replace the existing hot water heater in the main Terminal and in Concourses B and C with instantaneous natural gas fired tank-less water heaters.
- ☐ Convert the domestic hot water loops systems to demand based systems. This is accomplished by re-piping the hot water to a direct single feed.

References

- Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013 Recommended resource conservation measure or RCM (RCM #8 and #9 of Report).
- GREATER TORONTO AIRPORTS AUTHORITY
<http://www.partnersinprojectgreen.com/resources/business-directory/details/41731>

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment

INITIATIVE NOTES

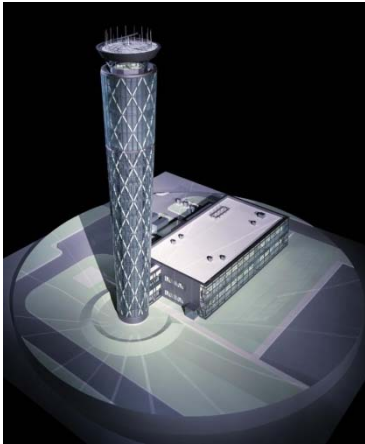
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		Proposed 2014 - 2017
Location		Terminal & Landside Facilities
Industry Guidelines		US Green Building Council
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$ (\$10,001 - 100,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	 (0-2 hours/week)

BENEFITS

Quantitative Benefits:	Return on Investment 2 -3 yrs
	Estimated Annual Energy Savings / GHG Savings \$15,000/yr (entire Terminal)
	Saves Water (no running water until water heats-up)
Qualitative Benefits:	Ecologically Friendly
	Reliable / Consistent Hot Water Temperatures
	Energy Efficiency - 95%



Utilize Guidelines & Specifications to Promote Asset Protection



Description

Utilize guidelines for the Airport's design and construction standards based on LEED requirements and the Institute for Sustainable Infrastructure (ISI) - Envision, Sustainable Infrastructure Rating System for Sustainable Civil Infrastructure. Facilitate design and construction processes that result in a net zero, or less impact, on the environment and ensure that each project integrates and aligns with the overall community needs, increases overall infrastructure efficiency and effectiveness over a life cycle, and contributes to the community quality of life.

INITIATIVE NOTES		
Lead Department	Engineering, Operations	
Supporting Department(s)	Terminal Maintenance	
Target Timeframe	In Progress 2014 - 2020	
Location	Facilities & Infrastructure	
Industry Guidelines	USGBC - LEED / ISI - Envision	
Performance Metric	Cost-Benefit Analysis	
Estimated Costs	Capital Costs	\$ (\$10,001 - 100,000)
	Ongoing Costs	\$ (\$0 - 10,001/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Return on Investment	
	Infrastructure Longer Lifespan	
	Rapid Disruption Recovery	
Qualitative Benefits:	Promotes DAY's Imagine	
	Infrastructure Resilience	
	Infrastructure Security	

Implementation Steps

- ☐ Continue developing guidelines for the Airport's design and construction standards (Incorporate Green Standards) based on the U.S. Green Building Council (USGBC) - LEED "Rating System for Sustainable Green Buildings" and the Institute for Sustainable Infrastructure (ISI) - Envision "Sustainable Infrastructure Rating System for Sustainable Civil Infrastructure".

References

- Homeland Security - Supplemental Tool: Incorporating Resilience into Critical Infrastructure Project: http://www.dhs.gov/sites/default/files/publications/NIPP%202013%20Supplement_Incorporating%20Resilience%20into%20CI%20Projects_508.pdf
- <http://www.sustainableinfrastructure.org/index.cfm>
- <http://www.usgbc.org/leed/rating-systems>

Contributes to DAY's Goals



Energy



People



Environmental
Stewardship



Sustainable
Investment



Resiliency/
Adaptation

Implementation of Biodiesel or other Alternative Fuels in Airport Operations



Description

Replace conventional Airport Owned gasoline/diesel equipment and fleet vehicles with alternatively fueled equipment / vehicles, such as bio-diesel, compressed natural gas small equipment including forklifts, dump trucks, standby generators, skid steers, tractors, etc.

Implementation Steps

- ☐ Use "AirportGEAR" as an interactive electronic tool designed to assist airport operators in learning about and prioritizing and selecting greenhouse gas emission reduction strategies that are most appropriate for their specific airport's needs.
- ☐ Convert or purchase Airport maintenance equipment and fleet vehicles to biodiesel, CNG, or other alternative fuels, where possible.
- ☐ Recommend prioritizing equipment by correlating with existing equipment replacement schedule (Age/Years of Service/Equipment Type/Operational Importance) and the CIP for the Airport.

References

- Alternative Fuel Guidelines for Alternative Transportation Systems
http://www.triptac.org/Documents/RepositoryDocuments/ATS_Alt_Fuel_Guide_v2.pdf
- AIP Improvement Handbook- FAA Order 5100.38C & FAA VALE Program Information
http://www.faa.gov/airports/environmental/vale/media/vale_techreport_v7.pdf
Also- FAA AIP Improvement Program will fund various Operational equipment needs such as Snow Removal Equipment (SRE), Fire Fighting (ARFF) Trucks, following a cost benefit analysis of similar maintenance equipment, etc.

Contributes to DAY's Goals



Energy



People



Environmental
Stewardship



Resiliency/
Adaptation

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		N/A
Target Timeframe		Proposed 2015 - 2020
Location		Airport Fleet
Industry Guidelines		FAA
Performance Metric		Cost per MPG
Estimated Costs	Capital Costs	\$\$\$ (\$100,001 +)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	👤 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment 4 - 6 yrs
		Estimated Annual Energy Savings / GHG Savings
		Operation & Maintenance Costs
		Gas Emissions Reduction
Qualitative Benefits:		Promotes DAY's Image
		Opportunities for innovation
		Enhanced implementation of sustainability initiatives



Establish Re-Claimed Water Storage & Supply System for Using Recycled Water



Description

Establish re-claimed water storage (including rainwater) and supply system for using recycled water in lieu of fresh potable water. Provide rain water catchment and storage system including reclaimed water in lieu of fresh potable water for use in washing vehicles or equipment, landscaping irrigation, airport mechanical systems (i.e. Cooling Towers) etc. Strict requirements for the design, operation and monitoring of reclaimed water system facilities ensure that reclaimed water can be safely used for landscape irrigation and other purposes.

Implementation Steps

- ☐ Harvested Rainwater is storm water that is conveyed with sub-surface HDPE drainage piping from a building roof, stored in a cistern and disinfected and filtered, before being used for landscape irrigation and other uses.
- ☐ Implement rainwater catchment and storage systems to provide recycling of water for washing, landscaping irrigation and mechanical systems etc. were appropriate.

Reference

- Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 2.5 Water Efficiency: Rain Harvesting for Non-irrigation UsageOM-47 [page 337]
- Resources, Conservation and Recycling - "Rainwater use in airports: A case study in Brazil.
- Sustainable Design Manual Dec 2003 O'Hare Modernization Program 1.6 Stormwater Management, Rate and Quantity
- EPA United States Environmental Protection Agency - 2012 Guidelines for Water Reuse
<http://nepis.epa.gov/Adobe/PDF/P100FS7K.pdf>

Contributes to DAY's Goals



Environmental
Stewardship



Sustainable
Investment

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		Proposed 2014 - 2020
Location		Airside and Landside Areas
Industry Guidelines		US Green Building Council
Performance Metric		Cost per GPD
Estimated Costs	Capital Costs	\$ (\$10,001-100,000)
	Ongoing Costs	\$ (\$0 -10,001/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Return on Investment	
	Conserves Potable Water	
	Reduced Waste Water	
Qualitative Benefits:	Restore Ecosystems	
	Opportunities for Innovation	
	Protecting Water Resources	



Replace Normal Grass/Turf Areas with Specialized Natural or Synthetic Grass



Description

Replace normal grass/turf areas with specialized natural or synthetic grass products. Utilize special natural or synthetic grass to minimize irrigation and maintenance needs. Synthetic grass products have been implemented at several east coast major airports including BWI, BOS and JFK. There are multiple products available on the market which could be implemented in strategic areas.

Implementation Steps

- ☐ Utilize the Sustainable Land Management Tool to estimate cost and GHG emissions reductions associated with reduced maintenance to plan for turf conversions effectively which then could be implemented into strategic areas to minimize irrigation and maintenance needs.

Reference

- Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 14.2 Stormwater Management: Turf AreasCT-223 [page 651]
- http://www.stma.org/sites/stma/files/STMA_Synthetic_Guide_2nd_Edition.pdf
- <http://www.flightturf.com/about-us/in-the-news/>
- <http://www.avturf.com/>

Contributes to DAY's Goals



Environmental
Stewardship



Sustainable
Investment

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	N/A	
Target Timeframe	Proposed 2014 - 2020	
Location	Airside Grass Areas	
Industry Guidelines	Sports Turf Managers Assoc.	
Performance Metric	Maintenance Costs	
Estimated Costs	Capital Costs	\$ (\$10,001-100,000)
	Ongoing Costs	\$ (\$0 -10,001/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Soil Erosion Control	
	Dust Stabilization	
	Lower Carbon Footprint	
Qualitative Benefits:	Noise Abatement	
	Opportunities for innovation	
	Surface Water Quality	



Install Low Flow Fixtures in all Future Plumbing Design Projects



Dayton International Airport new low flow lavatory sinks in the DAY restrooms in 2013.

Description

Recently DAY has been renovating their public restrooms in the Terminal and Concourses replacing the existing fixtures and installing low flow fixtures in all future plumbing design projects. Continue to require and provide specifications and standards for low flow fixtures in all future plumbing related design and construction projects. Update the specifications as necessary based on new technology and best practices.

Implementation Steps

- ☐ Provide specifications and details (standardized) for low flow fixtures on all future plumbing related design and construction projects.
- ☐ Update as necessary with newest/best technology practices.

Reference

- Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 3.2 Water Use Reduction: Low FlowDC-44 [page 126]
- Sustainable Design Manual Dec 2003 O'Hare Modernization Program 2.2 Innovative Wastewater Technologies
- Low-flow Restroom Fixtures LaGuardia Airport:
http://www.nyc.gov/html/nycwasteless/html/resources/reports_wp_wastelessbusiness_laguardialowflow.shtml

Contributes to DAY's Goals



Environmental
Stewardship



Sustainable
Investment

INITIATIVE NOTES		
Lead Department		Engineering
Supporting Department(s)		N/A
Target Timeframe		In Progress 2014 -2020
Location		Terminal & Concourses
Industry Guidelines		US Green Building Council
Performance Metric		Cost per GPD
Estimated Costs	Capital Costs	\$ (\$10,001-100,000)
	Ongoing Costs	\$ (\$0 -10,001/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment
		Reduced Water Consumption
		Reduced Waste Water
Qualitative Benefits:		Restore Ecosystems
		Opportunities for innovation
		Protecting Water Resources



Expand Recycling Program for Waste from Deplaned Aircraft



Description

Encourage airlines to implement strategies to effectively capture recyclables from aircraft after each arrival. Consider working with other airports to develop a unified recycling system. If DAY adopts recycling practices of similar sized airports to capture deplaned recyclables, flight attendants could manage waste and recycling more uniformly, which could simplify and increase participation in recycling.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations	
Target Timeframe	Proposed 2015	
Location	Concourses	
Industry Guidelines	FAA	
Performance Metric	Reduced Waste Removal Cost	
Estimated Costs	Capital Costs:	\$ (\$0-10,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-10 hours/week)
BENEFITS		
Quantitative Benefits	Lower Disposal Costs	
	Recovered Resources	
	Lower Carbon Footprint	
Qualitative Benefits	Promotes DAY's Image	
	Enhanced Passenger Engagement	
	Environmental Awareness	

Implementation Steps

- ☐ Work with airlines to develop procedures and practices to make it easier for the airlines to participate in DAY's recycling program.
- ☐ Consider providing additional recycling receptacles near gates, jetways, and airline owned GSE.

References

- ACRP Report 100 Recycling Best Practices - A Guide Book for Advancing Recycling from Aircraft Cabins (2014).
- Sustainable Airport Manual Nov 2010 CDA 12.7 Deplane Waste.
- Federal Aviation Administration - Recycling, Reuse and Waste Reduction at Airports 2013 - <http://www.faa.gov/airports/resources/publications/reports/environmental/media/RecyclingSynthesis2013.pdf>

Contributes to DAY's Goals



People



Environmental
Stewardship

Create a Multimedia Display about Sustainability & Efficiencies w/in the Terminal



Description

Provide a visual multi-media display for public awareness to be placed in public areas of the Terminal to educate the traveling public about DAY's sustainability practices, goals, projects, and airport operations. One of the most important features is specifying how an idea is to be presented on different media: on screen (video Monitors), on paper (hand-outs), with a speech synthesizer, with a Braille device, etc. Also what types of media would the display have such as visual, audio, speech or tactile including whether it is interactive with devices that allow interaction or static (no interaction).

Implementation Steps

- ☐ Display in public areas to educate traveling public about sustainability practices, goals and other operational practices.
- ☐ Sponsor an annual public awareness event on Sustainable Development in collaboration with local University.
- ☐ Educate the community, traveling passengers, employees, tenants and business partners about the benefits of improved environmental performance and sustainability initiatives.

References

- ACRP Synthesis 10 - Airport Sustainability Practices. http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_010.pdf
- SAGA, 2010 - Sustainable Aviation Resource Guide. <http://www.airportsustainability.org/>

Contributes to DAY's Goals

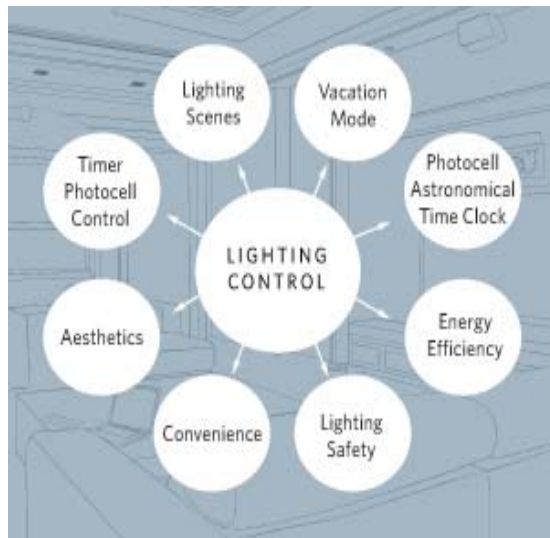


People

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	Operations	
Target Timeframe	Proposed 2015	
Location	Terminal & Concourses	
Industry Guidelines	ACRP	
Performance Metric	N/A	
Estimated Costs	Capital Costs	\$ (\$10,001 - 100,000)
	Ongoing Costs	\$ (\$0-10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Improved Environment	
Qualitative Benefits:	Promotes DAY's Image	
	Opportunities for Innovation	
	Raised Awareness	



Upgrade Interior Lighting Control Systems with Occupancy Sensors



Description

Install new lighting occupancy sensors in offices and conference rooms as well as less critical public spaces within the Terminal by providing convenient and transparent operation requiring little or no adjustment and no disruption to building occupants while operating; added convenience of automatic controls for building occupants and facility management personnel. .

These types of improvements can also be incorporated into new Building and Construction Standards and implemented with various Capital Projects as opportunities arise.

INITIATIVE NOTES		
Lead Department		Engineering
Supporting Department(s)		N/A
Target Timeframe		In Progress 2015 - 2020
Location		Terminal & Concourses
Industry Guidelines		US Green Building Council
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$\$ (\$10,001 - 100,000)
	Ongoing Costs	\$\$ (\$10,001 -100,000/year)
	Staff Level of Effort	👤 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Energy Savings up to 30%
		Estimated Annual Energy Savings / GHG Savings
		Sustainable Building Practice
Qualitative Benefits:		More Productive Employees
		Efficient Operations
		Greater Customer Satisfaction

Implementation Steps

- ☐ Install new lighting control systems including new more efficient fixtures and/or lamps including occupancy sensors in infrequently used areas.
- ☐ This may involve utilizing a set of presence sensors, with actuators, to determine when to turn on/off or dim lighting.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 3.4 Optimize Energy Performance: Lighting ControlsOM-62 [page 352]
- Innovative Workplaces: Benefits and Best Practices
http://www.gsa.gov/graphics/pbs/Innovative_Workplaces-508_R2OD26_0Z5RDZ-i34K-pR.pdf

Contributes to DAY's Goals



Energy



People



Environmental
Stewardship



Sustainable
Investment



Upgrade Interior Lighting Including Natural Light



Description

Evaluate and install better lighting in the offices and conference rooms including potential for increased natural light without affecting the comfort of the occupant. Provide opportunities for natural light (e.g. sky lights, side lights, etc.) where feasible including shading devices. These types of improvements can also be items which can be incorporated into new Building and Construction Standards and implemented with various Capital Projects as opportunities arise.

Day-lit spaces hold the potential to yield substantial benefits, including increased energy savings, increased revenue in retail applications, and improvements to human health and productivity.

INITIATIVE NOTES		
Lead Department		Engineering
Supporting Department(s)		N/A
Target Timeframe		Proposed 2015 -2020
Location		Terminal & Concourses
Industry Guidelines		US Green Building Council
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$\$ (\$10,001 - 100,000)
	Ongoing Costs	\$\$ (\$10,001 -100,000/year)
	Staff Level of Effort	👤 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:		Energy Savings up to 20 - 60%
		Estimated Annual Energy Savings / GHG Savings
		Increase Productivity
Qualitative Benefits:		Healthier Environment
		Greater Customer Satisfaction
		Reduced Absenteeism

Implementation Steps

- ☐ Install new lighting with more efficient fixtures and/or lamps in infrequently used areas.
- ☐ Provide building designs to maximize views and natural light where feasible.

References

- Sustainable Design Manual - Dec 2003, O'Hare Modernization Program; 5.0 Indoor Environmental Quality - 5.10 Daylight and Views.....Page 55 of 84
- Innovative Workplaces: Benefits and Best Practices
[http://www.gsa.gov/graphics/pbs/Innovative Workplaces-508_R2OD26_0Z5RDZ-i34K-pR.pdf](http://www.gsa.gov/graphics/pbs/Innovative%20Workplaces-508_R2OD26_0Z5RDZ-i34K-pR.pdf)

Contributes to DAY's Goals



Energy



People



Environmental
Stewardship



Sustainable
Investment

Install Electric Charging Station / Infrastructure to Support Electric (GSE)



Description

Install electric charging station infrastructure at terminal Gates to promote and support electric (GSE) equipment used by Tenants. Electric charging stations and electric GSE has been proven to be cost effective at reducing emissions at airports across the country.

Implementation Steps

- ☐ The Airport Authority must coordinate with airlines to develop plans to replace GSE with electric and/or alternative fuels. The Airport Authority needs to evaluate the infrastructure to support additional electrical demand or fueling needs.
- ☐ Install electric charging station / infrastructure to support electric Ground Service Equipment (eGSE) at the Terminal Gates.

References

- ACRP Report 78 - Airport Ground Support Equipment (GSE) Emission Reduction Strategies, Inventory, and Tutorial
- FAA VALE Program Information
http://www.faa.gov/airports/environmental/vale/media/vale_techreport_v7.pdf
- Infrastructure - Fueling & EV Charging Stations - Green Fleet:
<http://www.greenfleetmagazine.com/infrastructure/p/5>
- Sea-Tac Airport launches major ground support equipment electrification project:
<http://www.greencarcongress.com/2014/03/20140319-seatac.html>

Contributes to DAY's Goals



Energy



Environmental
Stewardship



Sustainable
Investment



Resiliency/
Adaptation

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		Terminal Maintenance
Target Timeframe		Proposed 2014 - 2017
Location		Terminal Gates
Industry Guidelines		FAA
Performance Metric		Cost per KWH
Estimated Costs	Capital Costs	\$\$ (\$10,001 - 100,000)
	Ongoing Costs	\$\$ (\$10,001 -100,000/year)
	Staff Level of Effort	👤 (0-10 hours/week)
BENEFITS		
Quantitative Benefits:		Return on Investment 6 - 8 yrs
		Estimated Annual Energy Savings / GHG Savings
		Operation & Maintenance Costs
		Gas Emissions Reduction
Qualitative Benefits:		Promotes DAY's Sustainability
		Enhanced tenant engagement
		Opportunities for innovation

Modify Irregular Operations (IROPS) Plan



Description

Mitigate consequences of disasters by good planning and preventative actions by working with Airport Operations, Emergency, and Security personnel to modify/ enhance current Irregular Operations (IROPS) including a guidebook on developing and implementing the IROPS plan to address operational demands that are outside the normal range of the airport. Such demands on aviation can result from a major sporting event, unusual weather and many other issues.

INITIATIVE NOTES		
Lead Department		Operations
Supporting Department(s)		N/A
Target Timeframe		Proposed 2015
Location		N/A
Industry Guidelines		ACRP
Performance Metric		Benefit Cost Analysis
Estimated Costs	Capital Costs	\$\$ (\$10,001 - 100,000)
	Ongoing Costs	\$\$ (\$10,001 - 100,000/year)
	Staff Level of Effort	1 (0-10 hours/week)
BENEFITS		
Quantitative Benefits:		N/A
Qualitative Benefits:		Greater Safety Awareness
		Disaster Preparedness
		Operational Preparedness

Implementation Steps

- ☐ Develop plans to ensure the Airport has the right people and equipment for disaster response.
- ☐ Modify Irregular Operations (IROPS) plan to address disaster response coordination and manage unusual events.

References

- ACRP Report 65 - Guidebook for Airport Irregular Operations (IROPS) Contingency Planning
- ACRP Synthesis 33 - Airport Climate Adaption and Resilience 2012
- DFW - Event Contingency Plan for Irregular Operations (IROPS):
https://dfwairport.com/cs/groups/public/documents/webasset/p2_080415.pdf

Contributes to DAY's Goals



People



Resiliency/
Adaptation



Utilize Local Materials and Resources



Description

Work on setting goals for usage of materials and products that are extracted and manufactured within the region of a 250 mile radius of the Airport, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	N/A	
Target Timeframe	Proposed 2014 - 2020	
Location	N/A	
Industry Guidelines	US Green Building Council	
Performance Metric	Construction Costs	
Estimated Costs	Capital Costs	\$ (\$10,001 - 100,000)
	Ongoing Costs	\$ (\$0 - 10,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Create Local Jobs	
	Reduce Imports	
	Lower Carbon Footprint	
Qualitative Benefits:	Support Local Economy	
	Opportunities for Innovation	
	Cleaner Environment	

Implementation Steps

- ☐ Implement requirements for regionally produced goods.
- ☐ Develop construction standards requiring usage of materials and products that are extracted and manufactured within the region of a 250 mile radius from the Airport.

References

- Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 5.8 Materials and Resources: Local/Regional Materials..... DC-108 [page 190]
- Regional Materials - Airports Going Green - Specification with use and tracking requirements; www.airportsgoinggreen.org/.../01355_Local-Regional%20Materials.doc
- ACRP Report 42 - Sustainable Airport Construction Practices http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_042.pdf

Contributes to DAY's Goals



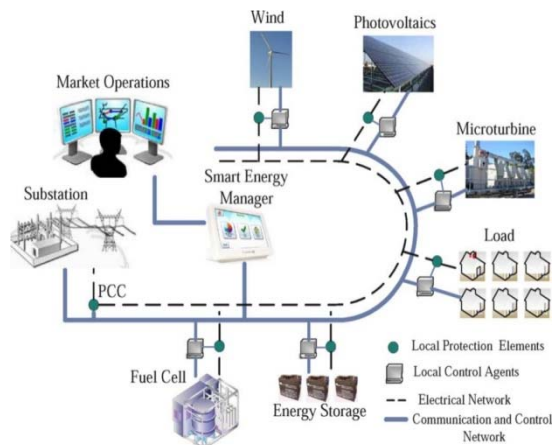
Environmental
Stewardship



Sustainable
Investment



Develop an Airport Microgrid at DAY



Description

The Center for Transportation and the Environment (CTE) requested funding to research and test the feasibility of developing an airport microgrid at DAY, which is an efficient energy-secure operation which would be independent from the local, traditional utility power grid. Microgrids allow for service to continue during utility system failure, maximum efficiency in routine operation and capability in emergencies, optimal generator load sharing and efficiency, and enhanced energy security.

INITIATIVE NOTES		
Lead Department	Engineering	
Supporting Department(s)	N/A	
Target Timeframe	Proposed 2016 - 2020	
Location	Facilities & Infrastructure	
Industry Guidelines	US Department of Energy	
Performance Metric	Cost per KWH	
Estimated Costs	Capital Costs	\$\$\$ (\$100,001 +)
	Ongoing Costs	\$\$ (\$10,001 - 100,000/year)
	Staff Level of Effort	1 (0-2 hours/week)
BENEFITS		
Quantitative Benefits:	Return on Investment	
	Estimated Annual Energy Savings / GHG Savings	
	Lower Carbon Footprint	
Qualitative Benefits:	Energy efficiency	
	Greater Reliability	
	Energy Security	

Implementation Steps

- ☐ Continue to coordinate with the CTE in order to develop an airport microgrid at DAY.

References

- Introduction to Microgrids :
http://www.securicon.com/sites/default/files/Introduction%20to%20Microgrids%20-%20Securicon%20-%202013_1.pdf
- EDSA Makes Microgrids, Energy Independence Real:
<http://www.greentechmedia.com/articles/read/edsa-makes-microgrids-work-energy-independence-possible>

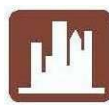
Contributes to DAY's Goals



Energy



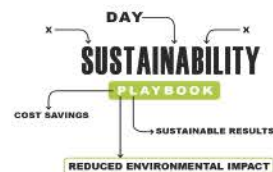
Sustainable Investment



Resiliency/
Adaptation

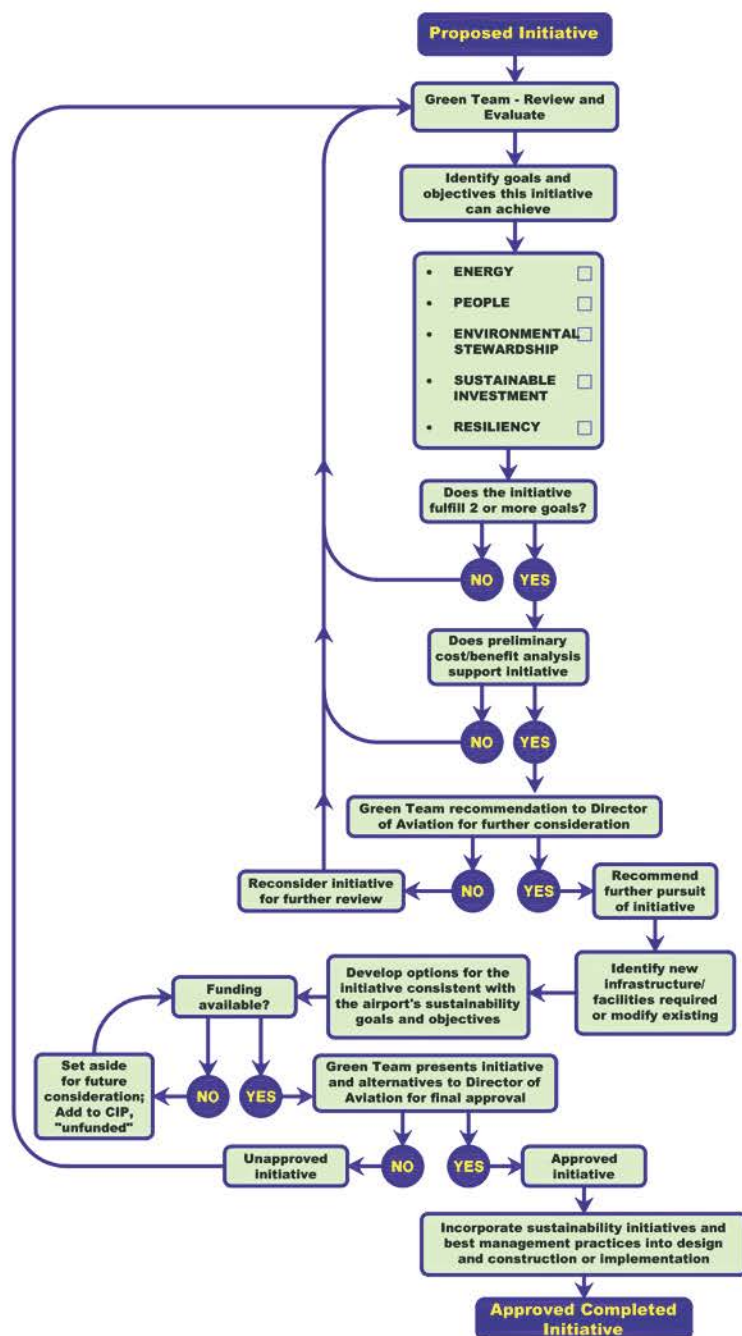


DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



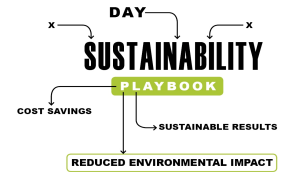
Sustainability Decision Flow Chart

To aid the Green Team in the decision making process for new initiatives that may be presented from Staff, Tenants, and others, a Sustainability Flow Chart was developed and is outlined below:



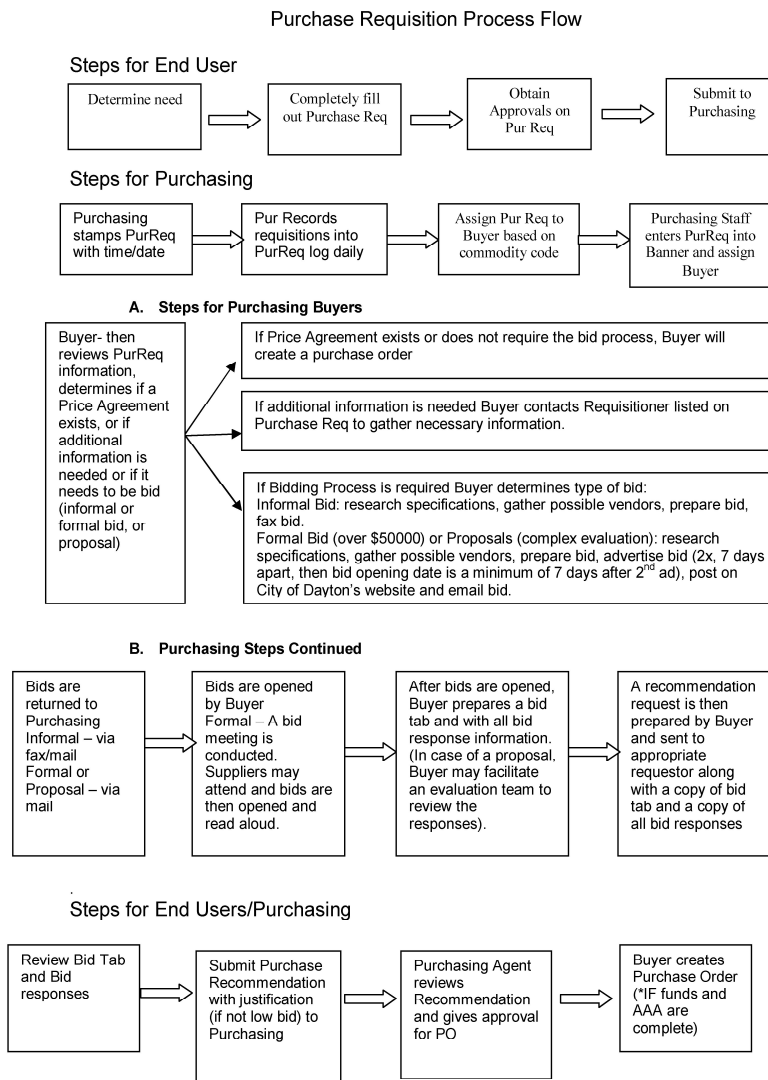


DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



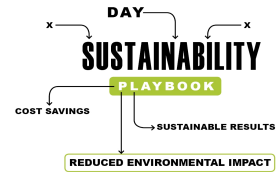
Purchasing Requisition Flow Process

Since the Airport is owned and operated by the City of Dayton, various City purchasing requirements are part of the requisitioning process. A schematic flow diagram for this process is outlined below:





DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



One recommendation for the Green Team to consider is collaborating with the City Purchasing Department to discuss potential operational practices to include options for alternative products, equipment, and services which are more sustainable and more environmentally friendly.

Suggested enhancements could be as simple as adding a paragraph regarding Sustainable Alternatives to the inter-departmental City memo, which accompanies a request, and in the “remarks” section of the current Purchasing Request form. In addition, supplemental information, including cost benefit data, potential cost savings, environmental benefits, etc. could be attached to current forms and memo for review and consideration as the process occurs.

At this time, no changes to the current City standard forms are proposed.

Capital Improvement Projects – Planning/Design/Construction Process

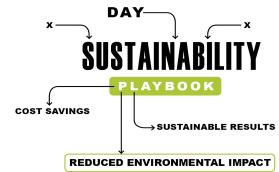
With each new Capital Improvement Project that the Airport pursues, there is a potential opportunity to identify and/or incorporate Sustainability initiatives into the process and ultimately into the completed construction of a Capital Improvements program. The typical process for each project involves the following major steps:

- Identifying the Need
- Programming the project in sequence with other projects and activities at the Airport
- Identifying available funding opportunities
- Development of Conceptual/Schematic Design and the overall Project Program (Vision)
- Conducting Cost / Benefit Analysis
- Prepare Preliminary Design
- Prepare Final Design and Bidding Documents
- Public Bidding Phase / Contract Award
- Construction
- Close out

As such, the process will need to include an opportunity to review various Sustainability Initiatives and integrate them into the design process when applicable while conforming to required standards.

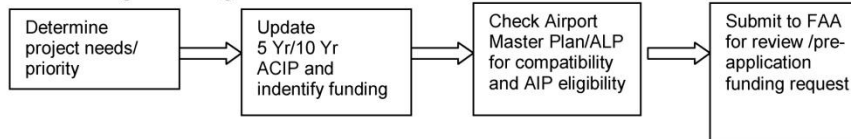


DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN

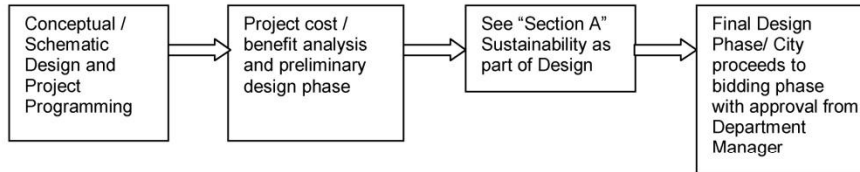


Capital Improvement Program - Process Flow

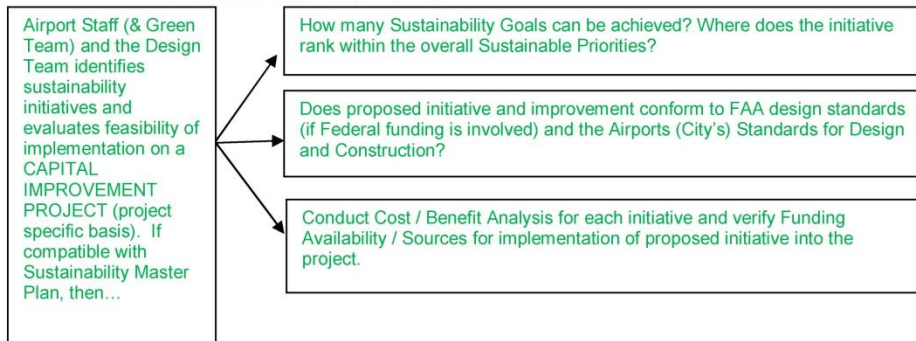
Initial Programming



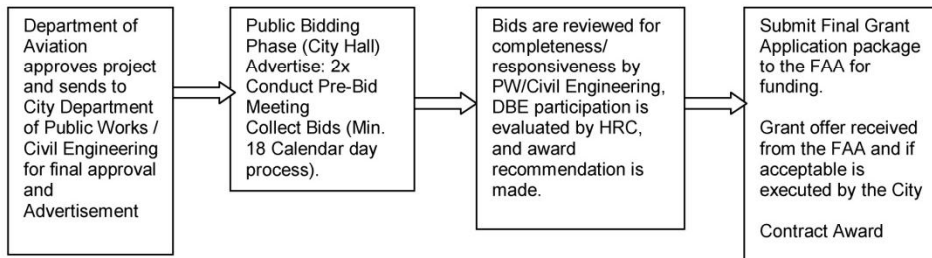
Steps for Design of Priority Capital Improvement Project(s)



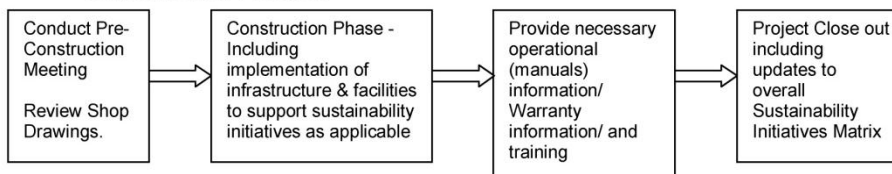
A. Sustainability as part of Design



Internal City Processes (Bidding)

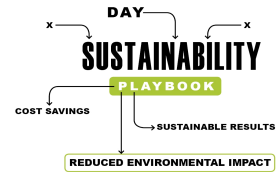


Construction Process





DAYTON INTERNATIONAL AIRPORT SUSTAINABILITY MASTER PLAN



Performance Monitoring

Performance Monitoring spreadsheets were developed for each of the primary goal categories. This information will be used in collecting data for the Annual Score Card which will be used to tabulate and present the progress to the Public each year.

The performance monitoring spreadsheets for each goal category contains the progress to date of the top ranked initiatives, responsible party (or parties), and the opportunity for the DAY-Green Team to provide remarks, self scores, or grades for the team.

Individual Spreadsheets are included on the following pages:



Sustainability Performance Monitoring

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Goal Category ENERGY	 INTERNATIONAL AIRPORT Easy to and through.												
	Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation			Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)	
Reduce Consumption of Fossil Fuels (Buildings Systems)		Year		0			100	%					
	Retrofit or replace existing light fixtures with LED style fixtures, where practicable	2014 - 2017	In Progress					25%	1	Operations & Terminal Maint.			
	Replace existing Airfield light fixtures with LED style fixtures, where practicable	2014 - 2020	In Progress					50%	2	Engineering	Included with each applicable AIP project		
	Replace water boilers and water heaters with more efficient systems	2014 - 2017	Proposed					0%	3	Operations & Terminal Maint.			
	Implement Building Management Systems	2014 - 2024	Proposed					0%	4	Operations & Terminal Maint.			

Goal Category ENERGY													
Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation					Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
Reduce Consumption of Fossil Fuels (Vehicles and Mobile Equipment)		Year		0			100	%					
	Encourage the conversion of ground support vehicles and equipment to electric or hybrid	2014 - 2017	Proposed						0%	1	Operations & Terminal Maint.		
	Convert or purchase Airport maintenance equipment and fleet vehicles to bio-diesel, CNG, or other alternative fuels, where possible	2015-2020	Proposed						0%	2	Operations		
	Install electric charging station / infrastructure to support electric Ground Service Equipment (eGSE)	2014 - 2017	Proposed						0%	3	Operations & Terminal Maint.		

Sustainability Master Plan





Sustainability Performance Monitoring

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Goal Category PEOPLE	 Easy to and through.											
	Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation			Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
Create and maintain a pleasant airport environment		Year			0		100	%				
		Continue to provide charging stations for electronics (with USB ports) throughout the Terminal	2014 - 2017	In Progress				50%	1	Operations & Terminal Maint.		
		Upgrade interior lighting control systems	2015 - 2020	In Progress				0%	2	Engineering		
		Upgrade interior lighting (including Natural light)	2015 - 2020	Proposed				0%	3	Engineering		

Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation			Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
		Year			0		100	%			
Ensure health and wellbeing of passengers, tenants, and employees	Organize a "Green Team" of Airport employees representing all functional areas	2014 - 2017	Proposed					0%	1	Engineering & Operations	
	Coordinate a food donation program and encourage tenant / vendor participation	2015	Proposed					0%	2	Operations	
	Create a multi-media display about sustainability and efficiencies within the Terminal	2015	Proposed					0%	3	Engineering & Operations	



Sustainability Performance Monitoring

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Goal Category
ENVIRON-
MENTAL
STEWARDSHIP



Easy to and through.

Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation	Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
Reduce water consumption		Year		0 100 %					
	Establish reclaimed water storage (including rain water) and supply system for using recycled water	2014 - 2020	Proposed	0%	1	Operations & Terminal Maint.			
	Replace normal grass/turf areas with specialized natural or synthetic grass products	2014 - 2020	Proposed	0%	2	Engineering			
	Install low flow fixtures in all future plumbing design projects	2014 - 2020	In Progress	50%	3	Engineering			

Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation	Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
Reduce Overall Waste Generation		Year		0 100 %					
	Reduce paper waste by increasing use of electronic documents and submittals	2014 - 2015	In Progress	25%	1	Engineering, Operations, and Admin			
	Implement a bulk recycling program	2015	Proposed	0%	2	Engineering & Operations			
	Expand recycling program for waste from deplaned aircraft	2015	Proposed	0%	3	Engineering & Operations			

Sustainability Master Plan





Sustainability Performance Monitoring

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Goal Category
**SUSTAINABLE
INVESTMENT**



Easy to and through.

Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation				Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
		Year		0			100	%				
Incorporate life cycle analysis into planning and operations	Provide life cycle and cost / benefit analysis for each new improvement or rehabilitation project	2014 -	In Progress					25%	1	Engineering & Operations		
Support local and regional economy	Utilize local materials and resources	2014 - 2020	Proposed					0%	2	Engineering		
Engagement in activities to promote Sustainability	Participate in a "Waste-to-Profit" network to identify by-product synergy and material reuse	2016 - 2020	Proposed					0%	3	Engineering		

Sustainability Master Plan





Sustainability Performance Monitoring

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Goal Category
RESILIENCY



Easy to and through.

Objective	Initiatives	Anticipated Implementation Date(s)	Performance to Date	Progress Toward Implementation				Priority	Responsible Department	Remarks	Previous Score Card(1-5)	Current Score Card(1-5)
		Year		0			100	%				
Incorporate green standards into Design & Construction	Utilize guidelines and specifications to promote asset protection in future infrastructure projects	2014 - 2016	In Progress					25%	1	Engineering , Operations & Terminal Maint.		
Develop plans to ensure right people and equipment for disaster response	Modify Irregular Operations (IROPS) plan to address disaster response coordination and manage unusual events	2015	Proposed					0%	2	Operations		
Develop microgrid	Develop an airport microgrid at DAY	2016 - 2020	Proposed					0%	3	Engineering		

Sustainability Master Plan





Appendix A

Sustainability Initiatives and Strategies Matrix (Fold Out Spread Sheet)

DAY Sustainability Master Plan -
Candidate Sustainability Initiatives Strategies Matrix

					Which Sustainability Goals categories does this strategy contribute to meeting? (<i>bold</i> indicates primary goal area the objective helps meet)					Overall Relative Ability of Initiative to Advance Sustainability (1-5) 1 = Low Effect 5 = High Effect	What are the costs to implement the initiative? (High, Medium, Low)	What are the annual costs to maintain the initiative? (High, Medium, Low)	What level of staff effort is required to maintain the initiative? (High, Medium, Low)	Return on Investment (if available) (years)	Overall Relative Cost/ Staff Level of Effort of Initiative (1-5) 1 = Low cost/staff effort 5 = High cost/ staff effort Short ROI reduces overall effort rating						
ID	Primary Goal Category	Primary Sustainability Objective	Initiative	Description of Initiative	Goal Category #1 (Energy)	Goal Category #2 (People)	Goal Category #3 (Env. Stewardship)	Goal Category #4 (Sustainable Investment)	Goal Category #5 (Resiliency)							Comments	Additional Resources / Tools	Source	Prioritization Matrix	Voting Priority (by Objective)	Recommended Priority (by Objective)
1	Energy	Reduce consumption of fossil fuels (building systems)	Retrofit or replace existing light fixtures with LED style fixtures, where practicable	With each new project within the Terminal or airport owned landside facilities, replace aging, less efficient light fixtures with energy efficient LED fixtures. Convert fluorescent and metal halide to LED lighting by retrofitting existing T8 fluorescent fixtures with new LED tubes which will provide additional energy savings (as the LED tubes utilize about 60% amperage draw compared to a standard T8 tube) until the fixtures are replaced in the future. It should also be noted that LED's are typically rated for 50,000 hours of operation as compared to 20,000 hour for the T8's.	X		X	X		4	Med	Low	Low	7-10 yrs	1	Recommended resource conservation measure or RCM (RCM #10 and #11 of Report).	Applied Resource Management, LLC Commercial applications including Lockeed Martin (Akron OH) and Tulsa Air and Space Museum (Tulsa, OK)	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-1	2	1
2	Energy	Reduce consumption of fossil fuels (building systems)	Replace existing Airfield light fixtures with LED style fixtures, where practicable	With each new airfield pavement/lighting project replace aging light fixtures with FAA-approved LED style fixtures. This initiative can also become part of the design and construction standards for future capital projects. Replacement of these less efficient fixtures with more energy efficient LED style fixtures will need to be accomplished for each Runway or Taxiway over the entire length of the pavement (and not phased in sections or partial lengths). Additional benefits include reduced maintenance costs, as LED style bulb life is expected to be over 100,000 hours of operation as compared to 1,000 hours for non-LED bulbs.	X		X	X		4	High	Low	Low	3-5 yrs	2	Current initiative at DAY. Opportunities available with future AIP improvement projects. Improvements to be provided along full length of Taxiway or Runway (partial sections not permitted).	• FAA AC 150/5345-53C, Airport Lighting Equipment Certification Program, Addendum, http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/08467310A914F788862570C800719ED7?OpenDocument	ACRP Synthesis 35 -Issues with Airfield LED Lighting (Trans. Research Board) 2012 and April 2011 -College of Engineering University of Missouri --Study- LED Efficiency Design for Medium Capacity Airports	4-2	3	2
3	Energy	Reduce consumption of fossil fuels (building systems)	Implement Building Management Systems	Evaluate and implement building monitoring and control systems to better manage HVAC and other systems throughout the Terminal. Installation of a site wide Direct Digital Control (DDC) system in lieu of multiple DDC and pneumatic systems. The overall DDC system will create a single point front end control for all equipment including critical and backup equipment systems. A phased implementation approach is recommended.	X	X	X	X		4	High	Med	Med	4-8 yrs	4	Recommended resource conservation measure or RCM (Recommendation #2 of Report).	Applied Resource Management, LLC	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-4	1	4
4	Energy	Reduce consumption of fossil fuels (building systems)	Implement new central chilled water plant and re-piping of the loop system	Upgrade / upsie equipment and improve the loop distribution system throughout the Terminal. This includes re-piping into a primary / secondary configuration and allow for effective use of all three (3) chillers. This effort combined with the next initiative could result in a savings over \$100,000 per year.	X		X	X		4	High	Low	Low	3-4 yrs	3	Recommended resource conservation measure or RCM (RCM #3 of Report).	Applied Resource Management, LLC	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-3	7	7
5	Energy	Reduce consumption of fossil fuels (building systems)	Convert air handler from DX to chilled water	Upgrade the central chiller plant to include chilled water coils and a control system, and converting the DX package units to chilled water system. This initiative would be tied with the previous central chilled water plant re-piping and effective use of the chilled water system.	X		X	X		4	High	Low	Low	3-4 yrs	3	Recommended resource conservation measure or RCM (RCM #4 of Report).	Applied Resource Management, LLC	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-3	6	6
6	Energy	Reduce consumption of fossil fuels (building systems)	Modify existing air handlers to outdoor air economization	Modify the central air handling system with ducting for both intake and exhaust. Accommodating Outdoor Air (OA) will allow the load to be reduced on the central chiller plant when outdoor air conditions/temperatures are appropriate to cool the facility. Anticipated savings could be as high as \$30,000 annually.	X		X	X		4	Med	Low	Low	3-4 yrs	3	Recommended resource conservation measure or RCM (RCM #5 of Report).	Applied Resource Management, LLC	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-3	5	5
7	Energy	Reduce consumption of fossil fuels (building systems)	Replace water boilers and water heaters with more efficient systems	Replace current boilers with high efficiency condensing boilers. Replace domestic water (tank) heaters with tankless (on-demand) water heaters.	X		X	X		4	Med	Low	Low	2-3 yrs	2	Recommended resource conservation measure or RCM (RCM #8 and #9 of Report).	Applied Resource Management, LLC	Energy Audit and Utility Assessment - Applied Resource Management LLC March 1, 2013	4-2	4	3
8	Energy	Reduce consumption of fossil fuels (vehicles and mobile equipment)	Convert or purchase Airport maintenance equipment and fleet vehicles to bio-diesel, CNG, or other alternative fuels, where possible	Replace conventional gasoline/diesel equipment and fleet vehicles with alternatively fueled equipment / vehicles, such as bio-diesel, compressed natural gas small equipment including fork lifts, dump trucks, standby generators, skid steers, tractors, etc.	X	X	X		X	4	High	Low	Low	4-6 yrs	2	Recommend prioritizing equipment by correlating with existing equipment replacement schedule (Age/Years of Service/Equipment Type/Operational Importance) and the Capital Improvement Program for the Airport.	Alternative Fuel Guidelines for Alternative Transportation Systems http://www.triptac.org/Documents/Repository/Documents/ATS_Alt_Fuel_Guide_v2.pdf	AIP Improvement Handbook- FAA Order 5100.38C & FAA VALE Program Information http://www.faa.gov/airports/environmental/vale/media/vale_techreport_v7.pdf Also-FAA AIP Improvement Program will fund various Operational equipment needs such as Snow Removal Equipment (SRE), Fire Fighting (ARFF) Trucks, etc.	4-2	2	2
9	Energy	Reduce consumption of fossil fuels (vehicles and mobile equipment)	Consolidate all rental car functions into one facility	A Consolidated Rental Car (CONRAC) facility will reduce consumption of fossil fuels and carbon emissions by reducing the frequency and volume of vehicle trips traveling between ready/return areas and service/ maintenance areas. Service facilities to be used by multiple rental car companies can be provided where they will clean, fuel, repair, and store vehicles. Additionally, a CONRAC facility has the potential to increase the availability of public spaces in the parking garage.	X	X	X	X	X	5	High	Med	High	10-15 yrs	5	Existing Configuration is not consolidated or efficient. Consolidation would provide for more efficient operations, better passenger experience, and reduced fossil fuel consumption/ lower carbon footprint.	Current Master Planning project	DFW - Rental Car Center Design Criteria Manual https://www.dfwairport.com/cs/groups/public/documents/webasset/p1_007837.pdf	5-5	1	4
10	Energy	Reduce consumption of fossil fuels (vehicles and mobile equipment)	Encourage the conversion of ground support vehicles / equipment to electric or hybrid	Encourage Tenants to replace conventional gasoline/diesel Ground Service Equipment (GSE) with electric or hybrid technology (GSE) equipment.	X		X	X	X	4	Low	Low	Low	5-7 yrs	1		FAA VALE Program Information http://www.faa.gov/airports/environmental/vale/media/vale_techreport_v7.pdf		4-1	4	1
11	Energy	Reduce consumption of fossil fuels (vehicles and mobile equipment)	Install electric charging station / infrastructure to support electric Ground Service Equipment (eGSE)	Install electric charging station infrastructure at terminal Gates to promote/support electric (GSE) equipment used by Tenants.	X		X	X	X	4	Med	Med	Med	6-8 yrs	3			ACRP Report 78 - Airport Ground Support Equipment (GSE) Emission Reduction Strategies, Inventory, and Tutorial	4-3	3	3
12	Energy	Increase capacity for renewable energy	Potential installation of Geothermal HVAC systems, Solar Photovoltaic, and Wind Turbines for future building expansion /development projects.	Continue to explore alternative energy sources such as geothermal, solar, and wind technology. Utilize constant deep ground temperatures to assist in heating and cooling the terminal building by installing a closed loop geothermal system. This type of system is determined to be the most resilient, reliable and efficient geothermal system. Develop solar arrays and/or wind turbine installations to provide electrical energy for airport facilities and/or re-sell back to the utility company. Recommend further study and evaluation as improvements to existing technologies and future development opportunities arise.	X		X	X	X	4	High	Med	High	15-30	5	ROI estimated to be between 15 and 30 years. Due to high cost of initial investment and also the physical geography required to implement this type of system, the Airport environment may not be the best environment for this type of system due to existing Building facilities, Aprons, Taxiways and Runways including associated infrastructure	Heapy Engineering	Renewable Energy Technology Report - Heapy Engineering, November 13, 2013	4-5	1	
13A	People	Create and Maintain pleasant airport environment	Upgrade interior lighting (including Natural light)	Provide opportunities for interior light (e.g. sky lights, side lights, etc.) where feasible. These types of improvements can also be items which can be incorporated into new Building and Construction Standards and implemented with various Capital Projects as opportunities arise.	X	X	X	X		4	Med	Med	Low	N/A	3		Sustainable Design Manual Dec 2003 O'Hare Modernization Program 5.10 Daylight and Views		4-3	3	3

DAY Sustainability Master Plan -
Candidate Sustainability Initiatives Strategies Matrix

ID	Primary Goal Category	Primary Sustainability Objective	Initiative	Description of Initiative	Which Sustainability Goals categories does this strategy contribute to meeting? (<i>bold</i> indicates primary goal area the objective helps meet)					Overall Relative Ability of Initiative to Advance Sustainability (1-5)	What are the costs to implement the initiative? (High, Medium, Low)	What are the annual costs to maintain the initiative? (High, Medium, Low)	What level of staff effort is required to maintain the initiative? (High, Medium, Low)	Return on Investment (if available) (years)	Overall Relative Cost/ Staff Level of Effort of Initiative (1-5)	Comments	Additional Resources / Tools	Source	Prioritization Matrix	Voting Priority (by Objective)	Recommended Priority (by Objective)
					Goal Category #1 (Energy)	Goal Category #2 (People)	Goal Category #3 (Env. Stewardship)	Goal Category #4 (Sustainable Investment)	Goal Category #5 (Resiliency)	1 = Low Effect 5 = High Effect	High = \$100,000+ Med = \$100,001 - \$100,00 Low = <\$10,000	High = \$100,000+ Med = \$10,001 - \$100,00 Low = <\$10,000	High = 1+ full-time staff Med = 1 part-time staff Low = minimal effort	1 = Low cost/staff effort 5 = High cost/ staff effort Short ROI reduces overall effort rating							
138	People	Create and Maintain pleasant airport environment	Upgrade interior lighting control systems	Install new lighting occupancy sensors in offices and conference rooms as well as less critical public spaces within the Terminal. These types of improvements can also be items which can be incorporated into new Building and Construction Standards and implemented with various Capital Projects as opportunities arise.	X	X	X	X		4	Med	Med	Low	N/A	2			Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 3.4 Optimize Energy Performance: Lighting ControlsOM-62 [page 352]	4-2	3	2
14	People	Create and Maintain pleasant airport environment	Replace the Passenger Terminal Facility and concourses	Redesign and construct the Passenger Terminal Facility to enhance passenger convenience and advance sustainability efforts.	X	X	X	X	X	5	High	Med	Med	20+	5			ACRP Report 25 - Airport Passenger Terminal Planning and Design.	5-5	1	Mid to Long Term
15	People	Create and Maintain pleasant airport environment	Introduce organic vegetation to promote improved air quality within the Terminal	There are many plants that can improve indoor air quality such as Aloe, Gerber Daisy, Chrysanthemum, Azalea, English Ivy, Chinese Evergreen, Bamboo Palm, and peace lily. These plants remove Volatile Organic Compounds (VOCs) from the air.		X				3	Med	Low	Med	N/A	3	Edmonton International Airport: Living Wall http://flyeia.com/shop-dine-relax/relax/art/living-wall	Source: Mother Nature Network, "15 Houseplants for Improving Indoor Air Quality," http://www.mnn.com/health/healthy-spaces/photos/15-houseplants-for-improving-indoor-air-quality/a-breath-of-fresh-air	Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 7.4 Innovation: Green WallsCT-101 [page 529]	3-3	Mid- to Long-Term	Mid to Long Term
16	People	Provide amenities for enhancing passenger experience	Continue to provide charging stations for electronics (with USB ports) throughout the Terminal	Provide charging stations and USB ports for electronics (for passenger convenience) throughout the Terminal. Evaluate and provide in existing high-traffic passenger use areas as well as include in the future Terminal redevelopment.		X				4	Low	Low	Low	N/A	1			Airport Installing 60 Free-To-Use Charging Stations For Personal Electronics Systems https://www.mitchellairport.com/airport-information/news-releases/	4-1	2	1
17	People	Ensure health and wellbeing of passengers, tenants, and employees	Create a multi-media display about sustainability and efficiencies within the Terminal	Provide a visual multi-media display in public areas of the Terminal to educate the traveling public about DAY's sustainability practices, goals, projects, and airport operations.		X				4	Med	Low	Low	N/A	2			ACRP Synthesis 10 - Airport Sustainability Practices.	4-2	3	3
18	People	Ensure health and wellbeing of passengers, tenants, and employees	Enhance indoor air quality monitoring (while maintaining the current program).	Acquire equipment or vendor services to provide additional or enhanced indoor air quality monitoring of the passenger occupied areas, tenant areas, and employee areas.		X				3	Med	Low	Low	N/A	2	Sustainable Design Manual Dec 2003 O'Hare Modernization Program 5.5 Construction IAQ Management Plan		Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 6.1 Indoor Environmental Quality: Min. Indoor Air Quality (IAQ) Performance.....DC-117 [page 199]	3-2	4	4
19	People	Ensure health and wellbeing of passengers, tenants, and employees	Coordinate and implement program to sell/ use local farm produce and goods	Encourage tenants to hire local vendors who sell and distribute local fresh produce and goods, to sell local foods / produce at the airport to promote the local area. In addition to supporting the local economy, this provides healthier options for employees and passengers.		X		X		4	Med	Low	Med	N/A	3		Sustainable America: New Meaning for "Airport Food" http://www.sustainableamerica.org/blog/new-meaning-for-airplane-food/	Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 9.4 Responsible Procurement: Green WallsCT-133 [page 561]	4-3	1	6
20	People	Ensure health and wellbeing of passengers, tenants, and employees	Partner with the TSA, airline(s), and local organizations to hold an annual event for autistic children going on their first flight	Create a program to help families with autistic children adapt to new surroundings and the stress of flying. This would likely include taking the group of children and parents through security, waiting at a gate, boarding the aircraft, aircraft taxiing, and deplaning the aircraft. DAY can partner with local organizations such as Autism Society Dayton and Dayton Children's Hospital to assist with developing and implementing the program.		X				3	Low	Low	Low	N/A	1	Dayton Children's Hospital: http://www.childrensdayton.org/cms/special_needs_center/index.html	Massport Wings for Autism: http://www.massport.com/logan-airport/about-logan/airport-programs/wings-for-autism/ Philadelphia International Airport Guide: http://www.phl.org/passengerinfo/Accessibility/Documents/SocialStories.pdf	Jacksonville International Airport Annual Event http://members.jacksonville.com/news/health-and-fitness/2014-02-04/story/kids-autism-get-airport-test-run-next-time-anxiety-level Autism Society Dayton: http://support-autism-society.org/site/Clubs?club_id=1410&pg-main	3-1	New	5
21	People	Engage employees and stakeholders in sustainability activities of the airport	Coordinate a food donation program and encourage tenant / vendor participation	Develop and implement public food waste collection stations at TSA Checkpoints and work with vendors and tenants to implement a surplus food donation program for unused or perishable foods which were not sold. These foods could be sent to a local food bank, homeless shelter, or to other social organizations. Potential foods include pre-packed sandwiches, salads, pastries, muffins, cookies, etc. The "Good Samaritan Food Donation Act" offers protection to citizens, businesses, and nonprofit organizations that proceed in good faith to donate, recover, and distribute excess food.		X	X	X		4	Low	Low	Med	N/A	1	Observations of organic waste stream during the September 2013 Waste Audit at Rumpke Recycling, Dayton, Ohio. Many items discarded at TSA checkpoint include unopened containers, bottles, etc. of various food items.	USDA: Feeding the Hungry and Reducing Solid Waste Through Food Recovery: http://www.epa.gov/osw/consERVE/pubs/wast_not.pdf	Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 12.6 Surplus Food Sent to Local Organizations.....CT-200 [page 628]	4-1	3	2
22	People	Engage employees and stakeholders in sustainability activities of the airport	Organize a "Green Team" of Airport employees representing all functional areas	Creating a Green Team is an effective way to generate ongoing sustainability solutions. The Green Team should be comprised of airport employees and representatives from tenants, airlines, and other agencies present at the Airport, such as TSA. A Green Team meets on a consistent basis to develop and implement ongoing and new sustainability strategies. The Green Team should work together to brainstorm improving efficiency and sustainability throughout the airport as well as helping each other with ideas and suggestions.		X				4	Low	Low	Low	N/A	1	STAR: Stewards of Tomorrow's Airport Resources: http://www.msppairport.com/docs/about-msp/sustainability/Star8page.aspx		Heathrow Airport Sustainability: http://www.heathrowairport.com/about-us/community-and-environment/sustainability/heathrow-sustainability-partnership	4-1	2	1
23	Environmental Stewardship	Alternative uses of non-aeronautical airport property	Evaluate native grasses to replace agricultural land	Consider converting non-aeronautical land currently leased for agricultural use to land used for prairie grass / native plant species. Work with the local Audubon Society and other organizations to select the best native vegetation and management practices for the area.			X	X	X	4	Low	Low	Low	2+	1			ARKANSAS WILDLIFE ACTION PLAN - 2006 STATE WILDLIFE GRANT: Prairie and Grassland Bird Habitat Restoration at the Stuttgart Airport in Arkansas' Grand Prairie Region of the Mississippi Alluvial Valley	4-1	New	1
24	Environmental Stewardship	Alternative uses of non-aeronautical airport property	Provide land to establish an apiary	Provide access to surplus (non-aeronautical) land to a local bee keeper or group to establish an apiary. This provides important benefits to the region's biodiversity and local bee population.			X	X		4	Med	Med	Med	5+	3	Sea-Tac, Lambert- St. Louis and Chicago O'Hare and Midway airports among a few airports to host honeybees in Apiaries on airport property.	Flight Path: The Art + Science of Bees at Sea-Tac Airport: https://www.kickstarter.com/projects/com-monacre/flight-path-the-art-science-of-bees-at-sea-tac-air	Sea-Tac Among Airports Encouraging Honey Bee Apiaries on Airport Property: http://www.aviationpros.com/news/11182933/beekeepers-are-moving-millions-of-honeybees-into-apiaries-at-airports	4-3	Long-Term	Long-Term
25	Environmental Stewardship	Reduce water consumption	Replace normal grass/turf areas with specialized natural or synthetic grass products	Utilize special natural or synthetic grass to minimize irrigation and maintenance needs. There are multiple products available on the market which could be implemented in strategic areas.			X			4	Med	Low	Low	4+	2	Implemented at several east coast major airports including BWI, BOS, JFK.	http://www.avturf.com/ http://www.flightturf.com/about-us/in-the-news/	Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 14.2 Stormwater Management: Turf AreasCT-223 [page 651]	4-2	3	2
26	Environmental Stewardship	Reduce water consumption	Install low flow fixtures in all future plumbing design projects	Require and provide specifications and standards for low flow fixtures in all future plumbing related design and construction projects. Update the specifications as necessary based on new technology and best practices.			X			4	Med	Low	Low	3+	2	Sustainable Design Manual Dec 2003 O'Hare Modernization Program 2.2 Innovative Wastewater Technologies	Low-flow Restroom Fixtures LaGuardia Airport: http://www.nyc.gov/html/nycwasteless/html/resources/reports_wp_wastelessbusiness/aguardialowflow.shtml	Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 3.2 Water Use Reduction: Low FlowDC-44 [page 126]	4-2	4	3
27	Environmental Stewardship	Reduce water consumption	Establish reclaimed water storage (including rain water) and supply system for using recycled water	Implement rain water catchment and storage system to provide recycling of water for irrigation and landscaping as appropriate. Provide reclaimed water in lieu of fresh potable water for use in washing vehicles or equipment, landscaping irrigation, airport mechanical systems (i.e. Cooling Towers) etc.			X			4	Med	Low	Low	3+	2	Resources, Conservation and Recycling - "Rainwater use in airports: A case study in Brazil	Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 2.5 Water Efficiency: Rain Harvesting for Non-irrigation UsageOM-47 [page 337]	Sustainable Design Manual Dec 2003 O'Hare Modernization Program 1.6 Stormwater Management, Rate and Quantity	4-2	2	2

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28	Environmental Stewardship	Reduce water consumption	Install gray water system for washing vehicles and equipment	Collect and recycle gray water from sinks. Gray water can be used to wash vehicles and equipment and landscape irrigation.												Car, Truck And Bus Washing Reclaim Systems http://www.hydroblaster.com/CarwashReclaim.htm	Hong Kong Airport's Triple Water System http://chinawaterrisk.org/opinions/hong-kong-airports-triple-water-system/	ACRP Report 80 - Guidebook for Incorporating Sustainability into Traditional Airport Projects	-	5	
29	Environmental Stewardship	Minimize negative impacts to local water quality	Implement and install bioswales as part of future projects in an effort to improve surface stormwater quality	Evaluate and include landscaping design features for bioswales in future site development and rehabilitation projects.			X	X		4	High	Med	Med	8+	4	EcoRain Systems: Economical EcoRain Tank Applications at LAX International Airport: http://www.ecorain.com/ecorain-underground-water-tanks.html	Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 3.2 Water Use Reduction: Low FlowDC-44 [page 126]	Sustainable Design Manual Dec 2003 O'Hare Modernization Program 1.6 Stormwater Management, Rate and Quantity	4-4	5	5
30	Environmental Stewardship	Minimize negative impacts to local water quality	Encourage airlines or other tenants to implement the use of Forced Air / Hybrid or other alternative Deicing Systems	Encourage use of Forced Air/ Hybrid deicing systems to combine pressurized air mixed with ADF to assist in breaking loose ice and removing heavy snow accumulations during deicing. These systems reduce the amount of ADF required to deice an aircraft.			X	X		4	High	Med	Med	7+	4	ACRP Fact Sheets: Deicing Practices	Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 1.4 Hardscape Grounds Management: Forced Air/Hybrid DeicingOM-16 [page 306]	Sustainable Design Manual Dec 2003 O'Hare Modernization Program 1.6 Stormwater Management, Treatment	4-4	3	4
31	Environmental Stewardship	Minimize negative impacts to local water quality	Provide anti- icing fluids to reduce the use of deicing fluid	Provide anti-icing / de-icing fluids before the start of a major precipitation event in order to prevent bonding to the aircraft surfaces which reduces the overall amount of ADF used.			X	X		4	Med	Med	Med	5+	3		Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 1.4 Hardscape Grounds Management: Use anti-icing/deicingOM-16 [page 306]	ACRP Report 45- Optimizing the Use of Aircraft Deicing and Anti-icing Fluids (2011) ACRP Fact Sheets: Deicing Practices	4-3	Mid- to Long-Term	Mid-to Long -Term
32	Environmental Stewardship	Reduce overall Waste Generation	Implement a bulk recycling program	Organize annual or bi-annual events to recycle bulk non-hazardous materials and products such as furniture, carpets, etc. Provide the opportunity to participate to airport departments, tenants, and vendors.		X	X			4	Low	Low	Low	2+	1		EPA - Developing and Implementing an Airport Recycling Program: http://www.epa.gov/osw/conserve/tools/rogo/documents/airport-recycling-guide.pdf	Chicago Department of Aviation - Sustainable Airport Manual; Operations/Maintenance - 4.0 Materials & Resources: Waste Reduction..... OM-85 [page 375]	4-1	5	2
33	Environmental Stewardship	Reduce overall Waste Generation	Implement and locate a composting program on Airport-owned agricultural land	Establish incentives and procedures to divert food waste such as coffee grounds, flour, spices, expired foods, vegetables, etc. by collecting this waste and diverting to a composting facility. Enhance DAY's sustainability by designating an area on Airport property and create a composting facility to recycle organic materials.		X	X	X		4	High	Med	High	10+	4	Charlotte-Douglas International Airport Recycling Center: http://www.airportsgoinggreen.org/Presentations/2012-Presentations/Closing%20the%20Loop%20-%20Toward%20a%20NetZero%20Airport/Lucas_AGG%202012.pdf	http://www.airportsgoinggreen.org/ http://www.epa.ohio.gov/portals/34/document/general/iw_food_compost_map.pdf	Sustainable Airport Manual Nov 2010 CDA 12.5.1 & 2 Organic Byproduct Recycling: Fats, Oils and Grease. United States Environmental Protection Agency (EPA): Developing and Implementing an Airport Recycling Program	4-4	4	5
34	Environmental Stewardship	Reduce overall Waste Generation	Increase the number of recycling receptacles	Purchase / install additional recycling receptacles for to improve the rate of recycling. Clearly label recycling receptacles and locate in distinct visible locations near service counters, dining areas, and kitchens to make it easier to recycle. In the tenant areas, ensure there is an area for recycling that is located in a convenient location and that receptacles are sized according to use and primary waste stream(s) of the tenant.		X	X			4	Low	Low	Low	1+	1	This is the continuation of the existing recycling program. The increase in recycling receptacles shall help get more waste into the commingled recycling stream.	EPA - Developing and Implementing an Airport Recycling Program: http://www.epa.gov/osw/conserve/tools/rogo/documents/airport-recycling-guide.pdf	Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 4.1 Materials & Resources: Prerequisite 1 - Storage & Collection of RecyclablesCT-41 [page 469]	4-1	Long-Term	Long-Term
35	Environmental Stewardship	Reduce overall Waste Generation	Encourage vendors to reduce plastic and cardboard packaging	Work with vendors to reduce packaging on service items and products purchased by the Airport and tenants.		X	X			4	Med	Low	Low	2+	1		Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 12.4 Waste Stream Management: Source Reduction..... CT-192 [page 620]	Sustainable Airport Manual Nov 2010 CDA 12.9.1 & 2 Reduction of Plastic Waste: Plastic Bottles and Elimination of Petroleum Based Plastic Bags	4-1	Long-Term	Long-Term
36	Environmental Stewardship	Reduce overall Waste Generation	Continue to promote or require the use of biodegradable products for food concessionaires	Work with vendors and tenants to provide biodegradable products such as plates, cutlery, cups, etc. used by food concessionaires. Additionally, these products can be composted.		X	X			4	Low	Low	Low	1+	1			Chicago Department of Aviation - Sustainable Airport Manual; Concessions & Tenants - Design & Construction - 9.3.2 Responsible Procurement: Consumer Disposable Products: Bio-Based Content CT-125 [page 553]	4-1	Long-Term	Long-Term
37	Environmental Stewardship	Reduce overall Waste Generation	Reduce paper waste by increasing use of electronic documents and submittals	Utilize an electronic document management system to manage submittals, documents, plans, specifications, reports, etc. Convert to an online / electronic system for all bidding and construction documents.		X	X			4	Low	Low	Low	1+	1	Example Airports include City of Atlanta, Jackson Hartfield (ATL), Monroe County- Greater Rochester International Airport (ROC), and many others throughout the US.		http://www.atlanta-airport.com/business/DoingBusiness/	4-1	1	1
38	Environmental Stewardship	Reduce overall Waste Generation	Expand recycling program for waste from deplaned aircraft	Encourage airlines to implement strategies to effectively capture recyclables from aircraft after each arrival, in effort to divert these materials from the landfill. Work with airlines to develop procedures and practices to make it easier for the airlines to participate in DAY's recycling program. Consider working with other airports to develop a unified recycling system. If DAY adopts recycling practices of similar sized airports to capture deplaned recyclables, flight attendants could manage waste and recycling more uniformly, which could simplify and increase participation in recycling. Consider providing additional recycling receptacles near gates, jetways, and airline owned GSE.		X	X			4	Med	Low	Med	3+	2		Sustainable Airport Manual Nov 2010 CDA 12.7 Deplane Waste.	ACRP Report 100 Recycling Best Practices - A Guide Book for Advancing Recycling from Aircraft Cabins (2014).	4-2	3	3
39	Environmental Stewardship	Reduce overall Waste Generation	Install additional liquid disposal stations	Provide additional liquid collection stations for passengers with current recyclable and waste receptacles. Liquid collection stations could be located near concessions and in the concourses where beverages and other liquids are being disposed of, to reduce the amount of liquids from entering into the waste stream. The liquid collection stations could be designed to be easily rolled over a floor drain for quick disposal of liquids.		X	X			4	Low	Low	Low	2+	2		Portland International Airport; Liquid Collection Station Program http://www.airportsgoinggreen.org/Presentations/2009-Presentations/PDX%20Waste%20Management_Ralston.pdf http://www.portofportland.com/publications/PortCurrents/?tag=liquid-collection+stations	FAA April 2013 - Recycling, Reuse and Waste Reduction at Airports - A Synthesis Document.	4-2	Long-Term	Long-Term
40	Environmental Stewardship	Reduce overall Waste Generation	Install additional water bottle refilling stations	Increase the availability of hydration stations by providing them at each administration level for use by staff and visitors to reduce plastic bottle usage. Purchase stations that provide information about how much plastic is kept out of the landfill by refilling water bottles at the hydration station.		X	X			4	Med	Low	Low	3+	2		Sustainable Airport Manual Nov 2010 CDA 12.9.1 Reduction of Plastic Waste: Plastic Bottles		4-2	Long-Term	Long-Term
41	Environmental Stewardship	Reduce overall Waste Generation	Develop and implement new construction waste management standards	Develop standardized construction waste management standards to enhance recycling initiatives during construction projects. In construction contracts, include recycling standards and minimum requirements for recyclables (e.g., asphalt, concrete, steel rebar, trees) removed during construction projects.		X	X	X	X	4	Med	Low	Low	2+	1			Sustainable Design Manual Dec 2003 O'Hare Modernization Program 4.3 Construction Waste Management / Sustainable Airport Manual Nov 2010 CDA 5.3 Construction Waste Management	4-1	3	4

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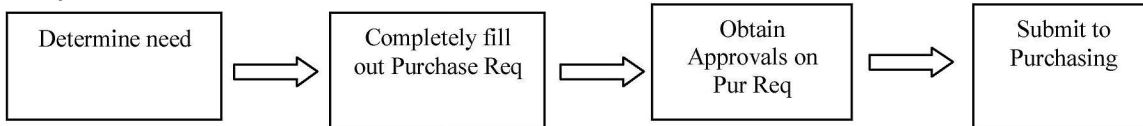
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42	Environmental Stewardship	Natural Resource Conservation	Offer voluntary carbon offsets for passengers	An airport operator may educate passengers about programs available for purchasing of carbon credits to offset the greenhouse gas (GHG) emissions associated with a passenger's air travel, and provide the opportunity to purchase offsets through an airport-sponsored program. Coordination with airline and travel agent offset purchasing programs is recommended to avoid confusion for the passenger and to optimize participation. An airport operator may set up a program either online through the airport's web page or at the airport via kiosks. The airport operator may enter into a contract with preferred offset providers such as Atmosfair, Climate Friendly, myclimate, and Native Energy.		X	X			2	Med	Low	Med	10+	3		Carbon Offsets Take Flight - http://www.businessweek.com/stories/2008-03-24/carbon-offsets-take-flight?businessweek-business-news-stock-market-and-financial-advice Voluntary Airline Carbon Offset Programs - http://www.uncsd2012.org/content/documents/743presentationschneider.pdf	ACRP Report 56 - Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports	2-3	Mid- to Long-Term	N/A
43	Environmental Stewardship	Natural Resource Conservation	Provide priority vehicle parking for emissions-friendly vehicles	An airport operator may provide preferential or discounted parking for alternative-fueled vehicles (AFVs), such as hybrid electric vehicles or vehicles fueled by compressed natural gas (CNG), for both airport employees and airport patrons. This incentive may increase the use of AFVs at the airport and reduce greenhouse gas (GHG) emissions associated with gasoline and diesel combustion in vehicles. The reserved parking could be located in the most desirable locations for airport users (e.g., close to elevators/stairs) to encourage transport to and from the airport via an AFV. Discounts for passengers may also be used as an incentive to encourage the use of AFVs.			X	X		2	Low	Low	Low	10+	2		Design of a Carbon Neutral Airport - http://catsr.ite.gmu.edu/SYST490/495_2012_CNA/CNGA_Final_Presentation.pdf	ACRP Report 56 - Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports	2-2	2	
44	Environmental Stewardship	Natural Resource Conservation	Provide preferential car/vanpool parking for employees	By encouraging and incentivizing carpooling and vanpooling, single occupancy vehicle usage by employees will decrease, thus reducing greenhouse gas (GHG) emissions associated with commuting. An airport operator may provide preferential or discounted parking for employees who carpool or participate in a vanpool. Reserved parking spots should be located in the most desirable locations for carpoolers. To enhance a carpooling program, the airport operator may include an information hotline and emergency ride home service to ensure that carpoolers would not be stranded in the case of a personal emergency.			X	X		2	Low	Low	Low	10+	1		Carpool Incentive Programs - http://www.bestworkplaces.org/wp-content/uploads/2010/10/carpool_incentives_brief.pdf	Sustainable Design Manual Dec 2003 O'Hare Modernization Program Alternative Transportation – 1.5 Alternative Fuel Vehicles & Parking Capacity - http://www.acec.org/advocacy/committees/pdf/eec0808_omp_manual.pdf	2-1	4	
45	Environmental Stewardship	Natural Resource Conservation	Promote alternatively fueled vehicles for rental cars and commercial vehicles	An airport operator may reduce GHG emissions from this source by promoting the purchase and use of Alternatively Fueled Vehicles (AFVs) in rental fleets, such as CNG for cabs/shuttles. Commercial vehicles, such as those making deliveries to an airport, also account for a portion of GHG emissions, and represent another opportunity for an operator to promote the use of AFVs. One immediate step an operator may take is to provide incentives to passengers renting AFVs, such as designated parking spaces or parking discounts. In order to promote the purchase of AFVs by companies for their rental or commercial fleets, an operator may provide incentives such as a discount on airport rental fees if a certain portion of the company's fleet consists of AFVs. An operator may include provisions in contracts for planning and design phases of an improvement project requiring life cycle and cost / benefit analyses. This effort would be integrated into the design and construction standards and can be used to help prioritize the sequence of each new improvement project as well as a tool to maximize grant funding opportunities.	X	X	X			2	Low	Low	Low	10+	1	San Francisco International Airport - http://www.flysfo.com/sites/default/download/about/reports/pdf/2008eshighlights.pdf	Going Greener Minimizing Airport Environmental Impacts - http://www.acl-na.org/sites/default/files/going_greener_brochure.pdf Oakland International Airport - http://oaklandairport.com/pdf/airport_rules_regs_Final.pdf	ACRP Report 56 - Handbook for Considering Practical Greenhouse Gas Emission Reduction Strategies for Airports	2-1	3	
46	Sustainable Investment	Incorporate life cycle analysis into all Airport planning and operations	Provide life cycle and cost / benefit analysis for each new improvement or rehabilitation project	Include provisions in contracts for planning and design phases of an improvement project requiring life cycle and cost / benefit analyses. This effort would be integrated into the design and construction standards and can be used to help prioritize the sequence of each new improvement project as well as a tool to maximize grant funding opportunities.			X	X		4	Med	Low	Low	4+	2			Chicago Department of Aviation - Sustainable Airport Manual; Planning - PL-3 Prerequisite 3: Sustainability Baseline Assessment and Cost/Benefit..... PL-14 [page 66]	4-2	2	1
47	Sustainable Investment	Support local and regional economy	Utilize local materials and resources	Implement requirements for regionally produced goods. Use materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation. Require usage of materials and products that are extracted and manufactured within a 250 mile radius from the Airport.				X	X	3	Med	Low	Low	3+	2			Chicago Department of Aviation - Sustainable Airport Manual; Design & Construction - 5.8 Materials and Resources: Local/Regional Materials..... DC-108 [page 190]	3-2	4	2
48	Sustainable Investment	Engagement in activities to promote environmental sustainability.	Participate in a "Waste-to-Profit" network to identify by-product synergy and material reuse opportunities	The Center for Resilience at The Ohio State University is launching a new By-Product Synergy (BPS) network in Central Ohio. The Ohio BPS network is bringing together large and small companies interested in converting waste by identifying by-products for reuse. BPS will facilitate meetings and analysis of opportunities to reduce supply chain materials management costs, increase manufacturing productivity, and enhance environmental leadership with those involved in the network.	X		X	X		4	Low	Low	Low	1+	1	http://www.wastetoprofit.org/	http://www.sustainable-ohio.org/documents/EcoFlowNews.pdf	Ohio By-Product Synergy Network: http://www.sustainableohio.org/index.php?option=com_content&view=frontpage&Itemid=1	4-1	Mid- to Long-Term	3
49	Resiliency	Update infrastructure to withstand extreme weather events	Conduct an evaluation of existing infrastructure and assess opportunities to improve hardening / resiliency of existing and future infrastructure	Identify the risks from climate change that will affect the Airport in multiple and diverse ways. Impacts may include physical infrastructure, business cost and opportunities, new financial considerations, and increased security challenges.			X	X	X	4	Med	Low	Low	2+	2			ACRP Synthesis 33 Airport Climate Adaption and Resilience 2012	4-2	Mid- to Long-Term	N/A
50	Resiliency	Update infrastructure to withstand extreme weather events	Replace the aging Terminal Building and concourses with a new LEED-certified facility	Utilize U.S. Green Building Council's LEED <i>Rating System for Sustainable Green Buildings</i> to develop a plan to demolish the existing terminal and concourses and design and build a new LEED-certified facility, which will improve operations and enhance the passenger experience.	X	X	X	X	X	5	High	High	High	20+	5	ACRP Report 10 - Innovation for Airport Terminal Facilities ACRP Report 25 - Airport Passenger Terminal Planning and Design	http://www.usgbc.org/leed/rating-systems	The Potential Impacts of Climate Change on Dayton, Ohio ; GLISA GLAA-C www.graham.umich.edu/glac	5-5	Long-Term	N/A
51	Resiliency	Update infrastructure to withstand extreme weather events	Integrate climate change impact assessments for planning in stormwater, flood risk and flood plain management, and other infrastructure assessments	Review the existing stormwater design and the potential impacts of climate change based on climate change model projections assessing rainfall intensity, duration, and frequency. Evaluate infrastructure options to reduce impacts from inland flooding which may result from more intense and frequent storms, and also consider the need for water retention infrastructure for irrigation during droughts.		X	X	X	X	5	High	Med	Med	15+	4		Homeland Security - Supplemental Tool: Incorporating Resilience into Critical Infrastructure Project: http://www.dhs.gov/sites/default/files/publications/NIPP%202013%20Supplement_Incorporating%20Resilience%20into%20CIR%20Projects_508.pdf	The Potential Impacts of Climate Change on Dayton, Ohio ; GLISA GLAA-C www.graham.umich.edu/glac	5-4	Mid- to Long-Term	N/A
52	Resiliency	Incorporate green infrastructure standards into the Airport's Design and Construction Standards	Utilize guidelines and specifications to promote asset protection in future infrastructure projects	Utilize guidelines for the Airport's design and construction standards based on LEED requirements and the Institute for Sustainable Infrastructure (ISI) - Envision, <i>Sustainable Infrastructure Rating System for Sustainable Civil Infrastructure</i> . Facilitate design and construction processes that result in a net zero, or less impact, on the environment and ensure that each project integrates and aligns with the overall community needs, increases overall infrastructure efficiency and effectiveness over a life cycle, and contributes to the community quality of life.	X	X	X	X	X	4	Med	Low	Low	3+	2		Homeland Security - Supplemental Tool: Incorporating Resilience into Critical Infrastructure Project: http://www.dhs.gov/sites/default/files/publications/NIPP%202013%20Supplement_Incorporating%20Resilience%20into%20CIR%20Projects_508.pdf	http://www.sustainableinfrastructure.org/index.cfm http://www.usgbc.org/leed/rating-systems	4-2	2	1

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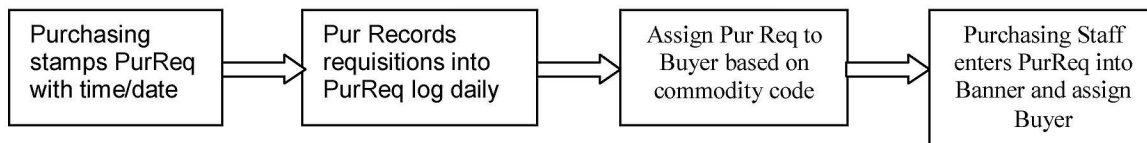
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53	Resiliency	Develop plans to ensure the Airport has the right people and equipment for disaster response	Modify Irregular Operations (IROPS) plan to address disaster response coordination and manage unusual events	Mitigate consequences of disasters by good planning and preventative actions by working with Airport Operations, Emergency, and Security personnel to modify/ enhance current Irregular Operations (IROPS) including a guidebook on developing and implementing the IROPS plan to address operational demands that are outside the normal range of the airport. Such demands on aviation can result from a major sporting event, unusual weather and many other issues.		X			X	4	Med	Med	Med	4+	3		ACRP Report 65 - Guidebook for Airport Irregular Operations (IROPS) Contingency Planning	ACRP Synthesis 33 Airport Climate Adaption and Resilience 2012	4-3	3	2
54	Resiliency	Emergency Preparedness	Develop an airport microgrid at DAY	The Center for Transportation and the Environment requested funding to research and test the feasibility of developing an airport microgrid at DAY, which is an efficient energy-secure operation which would be independent from the local, traditional utility power grid. Microgrids allow for service to continue during utility system failure, optimal generator load sharing and efficiency, and enhanced energy security.	X			X	X	4	High	Med	Med	10-15	3		Introduction to Microgrids - http://www.securicon.com/sites/default/files/introduction%20to%20Microgrids%20-%20Securicon%20-%202013_1.pdf	EDSA Makes Microgrids, Energy Independence Real - http://www.greentechmedia.com/articles/read/edsa-makes-microgrids-work-energy-independence-possible	4-3	1	3

Purchase Requisition Process Flow

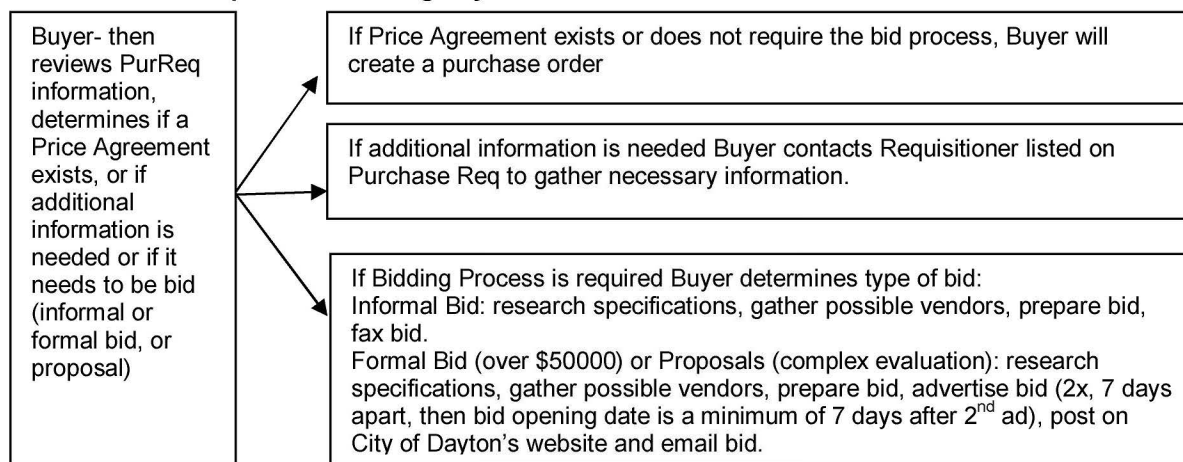
Steps for End User



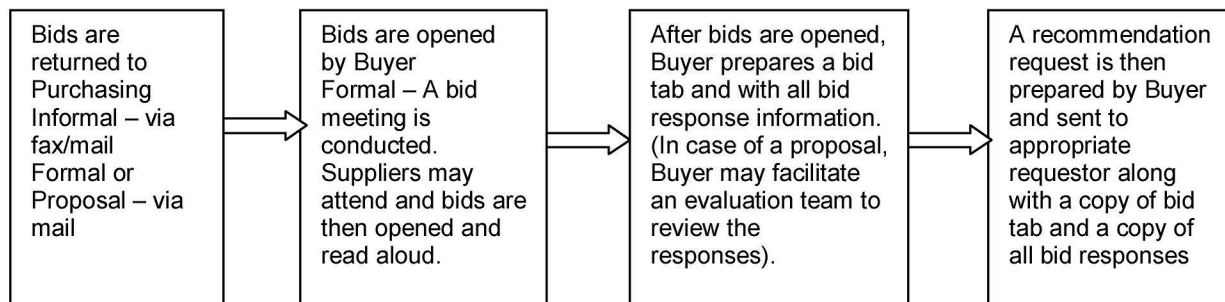
Steps for Purchasing



A. Steps for Purchasing Buyers



B. Purchasing Steps Continued



Steps for End Users/Purchasing

