APPENDIX E

STRATEGIES FOR GUIDING
SUSTAINABLE DEVELOPMENT
AT
BUFFALO-NIAGARA INTERNATIONAL AIRPORT

A Report to Buffalo/Niagara International Airport

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E.1 INTRODUCTION

This report is developed as a component of the Buffalo-Niagara International Airport (BNIA) Master Plan update. Its purpose is to identify opportunities for further improving environmental quality and efficiency and guiding sustainable development at BNIA. By focusing upon efficiency, BNIA can continuously shrink its environmental footprint while reducing operating costs. Achieving these simultaneous objectives is key to achieving the goal of sustainable development. It is also consistent with NFTA's environmental policy which is based upon the following principles:

- Comply with applicable environmental laws and regulations
- Make operations safe for employees, customers and the environment
- Minimize waste, prevent pollution, and incorporate recycling in all practices and operations
- Strive to eliminate releases that impact the environment
- Employ sound environmental practices to address and redevelop environmentally impacted property
- Encourage open and candid communication with employees, customers, and the public, regarding the NFTA's environmental program and any hazard that may arise from its operations
- Train employees to be aware of and responsive to environmental responsibilities
- Strive to continually improve environmental performance

To help assist BNIA in defining this pathway, McFarland Johnson (MJ) and Clean Airport Partnership (CAP) have been tasked to define opportunities that may exist to achieve these goals in four program areas:

1. Building efficiency and new building design
2. Exterior air quality
3. Waste management and recycling
4. Water use

The vast majority of candidate programs identified will be revenue neutral or provide return on investment. The inventory of prospective programs that is examined within this report is based upon a literature search conducted by CAP and its experience with and first-hand knowledge of airports that have environmental leadership both nationally and globally. Because a program has worked successfully at one airport, however, is no guarantee of its transferability to BNIA. For example, the fact that Denver International Airport uses hundreds of natural gas fueled vehicles or an expansive free-standing solar field, does not mean these strategies are easily replicable at BNIA. Therefore, the identification of "opportunities" must also consider the unique characteristics and needs of BNIA given its location, climate, and priorities.
On December 15th, CAP facilitated a charrette with senior airport managers and area leaders to examine the prospective strategies presented in this report and to augment these strategies as needed. At the close of the meeting, participants also expressed the strong sentiment that among the broad categories of strategies examined, "building efficiency" and "landside vehicles" provided the greatest potential environmental and economic benefits and deserved the most attention by airport managers. For more information on the charrette and its summary of findings, please see **Exhibit A**.

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This final report prepared by MJ and CAP is intended to assist the airport in developing the sustainability component of the Master Plan update. Through this process it is BNIA's goal to design a Master Plan and future airport that is visionary, sustainable, and that integrates the thoughts and input of both airport and area leaders.

E.2 BUILDING EFFICIENCY

The new terminal complex was completed in 1997 and with its later expansions, now accommodates 26 gates. In 2010 the building included over 480,000 square feet of space with over 27,000 square feet of glass and a 350 foot wide lobby with 50 foot ceilings.

Operating virtually around the clock, the airport consumes large volumes of electricity which is supplied by New York State Electric and Gas (NYSEG). In fiscal year ending (FYE) 2008, electrical consumption was 32,855 kW with average use of 2,737 kW per month. Between FYE 2008 and 2009, 70,000 square feet of space was added to the terminal complex which resulted in a slight increase in consumption for FYE 2009 to 34,704 kW or an average use of 2,893 kW per month; which then stabilized in FYE 2010 to 34,443 kW or an average monthly use of 2,869 kW.

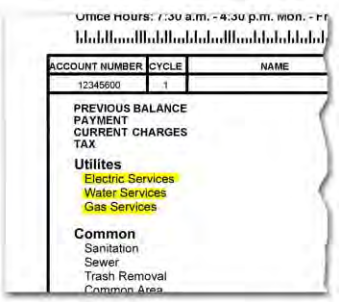
The minimal increases in consumption that occurred even with the addition of the expanded space was attributed to BNIA staff, which has focused on managing the building control system and fine-tuning of the building schedule to maximize savings. In 2008 NORESCO was retained to help NFTA improve building efficiency throughout its system. Phases I and II of NORESCO energy audit addressed lighting, building controls, and revolving doors.

E.2.1 Building Siting

While the majority of improvements at the airport involve existing buildings and infrastructure, several items, particularly the consolidated airfield maintenance facility and airport rescue and fire fighting facility will involve new construction. The location and orientation of a building can have a notable impact on the efficiency of a building. Daylight can be maximized by orienting windows to the south and east. In Buffalo, winds are overwhelmingly from the southeast direction. Minimizing the building profile, particularly opening such as garage doors can help to improve building efficiency. Orienting ramp and garage openings away from the prevailing winds will also reduce snow removal operations caused by windblown snow.

E.2.2 Energy Audit

Phase III of the NORESCO audit as currently defined for NFTA will not examine many significant opportunities that remain for improving building efficiency at BNIA. By reducing energy consumed, BNIA can further minimize pollution generated by electric utilities supplying power to BNIA. Therefore, consideration should be given to refining this scope of work to target key remaining opportunities.


Office Hours: 7:30 a.m. - 4:30 p.m. Mon. - Fr

ACCOUNT NUMBER	CYCLE	NAME
12345600	1	

PREVIOUS BALANCE
PAYMENT
CURRENT CHARGES
TAX

Utilites
Electric Services
Water Services
Gas Services

Common
Sanitation
Sewer
Trash Removal
Common Area

E.2.3 Billing Procedures

A separate but important complementary strategy for improving building efficiency involves altering the manner in which tenants are billed for utilities. Under prior agreement with its tenants, each month BNIA calculates "rates and fees" for its tenants based upon a hybrid model. Fees for terminal space which is exclusively operated

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by a tenant is calculated based upon the square footage leased. Fees for space which is used in common by airlines and other tenants is calculated based on the number of users combined with the square footage. Space which is jointly used by airlines only is weighted at 20% based on the number of users and 80% based upon the number of enplanements. The airport is "self-sustaining" and operates on its own revenue stream, without profit and without use of general revenue funds. Monthly rental rates involve a broad range of costs including: custodial, maintenance, insurance, DOA staffing, materials and supplies, personal service contracts, equipment costs, police, fire, and utilities.

To provide greater cognizance of utility costs and motivation for tenants to improve efficiency, BNIA may wish to consider separating utility costs for terminal operations as a separate line item in its monthly calculation of rates and fees. If this calculation becomes too onerous, BNIA may wish to approximate utility costs pro-rata, based upon the square footage leased and common areas shared by each tenant. With this change in the billing procedure, it may be useful to send a letter to the affected tenants explaining that the objective in changing billing procedures is to make utility costs more explicit and to heighten the awareness of tenants about how energy use in the terminal and concourses affects their bottom line. This will further motivate tenants to support conservation measures recommended in successive phases of NORESCO's energy audit.

E.2.4 Green Building Policies and Practices

To help guide contractors in the design and retrofit of new and existing buildings, BNIA may wish to include language in its Design Intent Documents and establish new policy making explicit that "…. design shall include goals that provide the most environmentally friendly facilities". In addition, the project design should include goals supporting a proposed expansion of NFTA's policy that would include the need to '….minimize waste, prevent pollution, and incorporate recycling in all practices and operations; and to strive to continually improve environmental performance. This can best be accomplished through the implementation of sustainable practices…" This should be identified and explicitly stated by BNIA on a case-by-case basis. NFTA may also wish to consider implementation of a more explicit sustainability policy to guide future operations (see appendix B.) and to refine proposal evaluation criteria to weight the contractor's commitment to sustainability practices.

E.2.5 Practical Applications – Building Efficiency

Upgrades to the heating, ventilation, and air conditioning system (HVAC). The objective is to improve system efficiency and enable the customization of loads to demand. Examples would include lowering lighting, heating and cooling during early morning hours; adjusting thermostat set-backs; or cutting back parking garage lighting on bright days.

Wind and photo-voltaic renewable energy systems such as those authorized for the greater Rochester International Airport. Dubbed the Green Energy Initiatives Project, Rochester plans to install two dozen, 1000-watt wind turbines and 50,000 square feet of photovoltaic system solar panels. The wind turbines are projected to generate 121,000 kilowatt hours of energy per year, and the solar panels are expected to generate a projected 60,000 kilowatt hours of energy annually. Supplemental funding will come from the New York State Energy Research and Development Authority (NYSEDA), an Incentive Award from the New York State Solar-Electric Incentive Program and other programs.

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Solar wall heating technology. These systems are being used by the Greater Toronto Airport Authority, Stevens Point Wisconsin Municipal Airport, and other sites globally. The system heats the building ventilation air, offsetting heating loads and providing one of the fastest returns on investment of any commercial solar technology. One option under consideration is to “pilot” this technology on the Maintenance Garage and then expand use to the terminal complex based upon success. The return on investment is estimated at about 5 years with a 20 year life span for the equipment.

“White roofs” to reduce heat gain in the summer. Chicago O’Hare and Midway Airports use white roofs on the terminal complex and other buildings to reduce heating and cooling needs. According to the U.S. Department of Energy, white roofs can reduce electrical demands associated with cooling by up to 20%. They also reduce the "heat island" effect which can cause temperatures and ozone in the area to rise. White roofs reflect the sun's rays back into space, keeping the atmosphere cooler in the summer.

Re-design and insulation programs to minimize heat loss from the curbside baggage and conveyor system. Heat loss from the conveyor & baggage system is a significant problem at BNIA. It causes the ceiling area in the baggage claim area to be very cold, as the current heating system is unable to raise temperatures on cold days past 67 degrees Fahrenheit. Also, initiate a heat-loss study to examine opportunities for improving insulation throughout the terminal and concourses.

Reusing heat generated by the 2008-2009 baggage handling expansion and x-ray procedures. Currently, this heat is vented outside but might be better used in the winter to augment heating needs of the building for use in roof-top units. Air conditioning is also used more than desired to maintain a comfortable environment in the upstairs food court.

Re-commissioning existing buildings and establishing an authority policy for new buildings to insure that they are operating as designed. NORESCO’s phase I and II audit found evidence that some new building systems at BNIA have not operated correctly since inception.

Continuing and expanding NFTA’s load-shedding program. NFTA recently tested a load curtailment program in which they turned off about half of the roof-top HVAC units feeding the terminal complex for periods of 75 minutes. Initial tests conducted on August 2, 2010 were successful achieving load reductions of about 1300 kw with no discomfort experienced in the building environment. They are considering a further test in which the units will be turned off on a rotating basis for one hour periods to reduce heat loads.

E.3 EXTERIOR AIR QUALITY

The four dominant sources of emissions at BNIA are aircraft, landside vehicles, ground service equipment, and auxiliary power units. Ozone is the pollutant of primary concern because the Buffalo Niagara Falls area currently violates the new 8-hour ozone standard according to the US Environmental Protection Agency. This means that air emissions from sources throughout the region must be reduced to protect the health and quality of life of Buffalo area citizens. It also means that future economic growth can be seriously constrained unless air quality can be improved.

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Ozone is produced when pollutants, particularly nitrogen oxides (NO_x) and hydrocarbons (HC), released in the morning by cars, aircraft, power plants, lawnmowers, and other engines "cook" in the atmosphere. Emissions of carbon monoxide (CO) are also of concern due to potential pollutant hot spots, especially on cooler mornings. Also, emissions of carbon dioxide (CO_2), the most prevalent greenhouse gas, contribute to global climate change. It is therefore important for BNIA to reduce emissions from airport operations wherever possible to help the region preserve the health and environmental quality and achieve the national air quality standards.

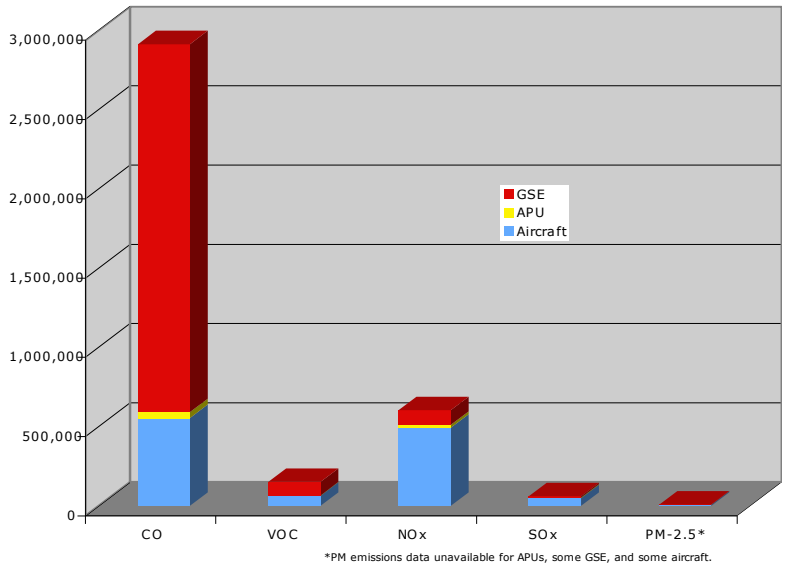
E.3.1 Aircraft Operations

Commercial aircraft are the single most significant source of ozone causing emissions at BNIA and commercial airports, nationally. The following analysis conducted for BNIA by the Clean Airport Partnership (CAP) in 2006 shows the relative contribution of the airfield emission sources. To calculate aircraft, APU, and GSE emissions at BNIA, a landing and takeoff cycle (LTO) was used as the basis for the analysis. An LTO includes the aircraft operation from the time the aircraft starts its engines, taxis to the runway, takes off, and climbs toward cruise altitude as well as the approach, landing, and taxi in to the gate where the engines are shutdown. The departures shown were used to compute emissions using FAA's Emissions and Dispersion Modeling System (EDMS). EDMS is the FAA's primary analytical tool for airport emissions inventory development and dispersion modeling and its use is required by FAA for all air quality analyses for airport projects. The calculations assumed industry standard taxi times since more specific data was unavailable.

Category	CO	VOC	NOx	SOx	PM-2.5*
Aircraft	552,924	62,697	491,827	48,367	5,298
APU	37,547	2,531	17,568	3,061	0
GSE	2,320,859	85,588	93,053	8,515	2,321
Total	2,911,330	150,816	602,448	59,943	7,619

*PM-2.5 emissions data unavailable for many aircraft included in inventory.

Airfield Emission Sources



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NO_x emissions are the dominant catalyst for ozone formation in the nonattainment area and commonly the most difficult and expensive pollutant to control. For that reason NO_x is the focus of opportunities for controlling emissions. Other pollutants such as CO, VOC, SO_x, particulate matter (PM-10 and PM-2.5), and CO_2 are also generally reduced along with NO_x in proportion to any efficiency benefits. As shown below, the primary source of NO_x emissions on the airfield is aircraft. This section characterizes the air quality impact of these emission sources.
As can be seen in the figure above, aircraft were responsible for 82% of NO_x emissions on the airport airside. Airports that adopt policies to encourage airport-wide use of best management practices to minimize fuel use and reduce emissions address these emission sources indirectly. Other emission reduction opportunities can come from working with FAA to install the most modern technologies for improving air traffic management, which will reduce airport-area emissions.

Certain operational procedures are in use today by some airlines that promote fuel economy and reduce emissions from taxiing. Two of the most common and most effective are 1) single engine taxiing (also known as engine out taxiing) and 2) eliminating powerback. These strategies are examined further, below.

Taxiing
Emissions from taxiing are a small but growing component of the air emissions inventory. Aircraft taxi time includes the time it takes for an aircraft to travel from the gate to the runway, to return to the gate after arrival, and idling time on taxiways and the ramp. Since an aircraft taxis at a slow speed, which is an inefficient operating regime for jet engines, emissions of some pollutants, notably CO and HC, are relatively high. BNIA has a reasonably compact layout that results in short taxi times. Delays on the airfield, however, especially waiting on taxiways for a takeoff slot, can have a significant effect on emissions.

An operational measure that applies to taxiing is single engine taxiing, also called engine out taxiing or reduced engine taxiing. In this procedure the pilot shuts down at fuel consumption. This procedure must be left to the discretion of the pilot-in-command to ensure safe operation of the aircraft. However, one major national carrier practices it on about 75% of its flights to minimize fuel costs while simultaneously reducing its taxi NO_x emissions by about 3%. This would translate to about 1.4 tons/yr NO_x at BNIA.

Airfield Layout Improvements

While taxiing emissions from congestion are not common at BNIA due to the lack of delays, there are opportunities to reduce emissions from providing more efficient taxi routes particularly to/from the general aviation area. Taxiway improvements on the east side of Runway 14-32 and north side of 5-23 will result in more direct taxi routes to/from the runway. While the primary purpose for these improvements is safety and reducing runway incursions, a reduction in emissions is a notable byproduct of these improvements.

Power-back

Power-back is the practice of departing a gate using reverse engine power rather than being pushed back by an aircraft tow tractor. Power-back is a high power operation that generates significant NOx emissions and can pose safety concerns for both personnel and equipment in the ramp area. Many U.S. and foreign airports as well as many airlines have policies prohibiting power-back. No data was available on the prevalence of power-back at BNIA and it was not
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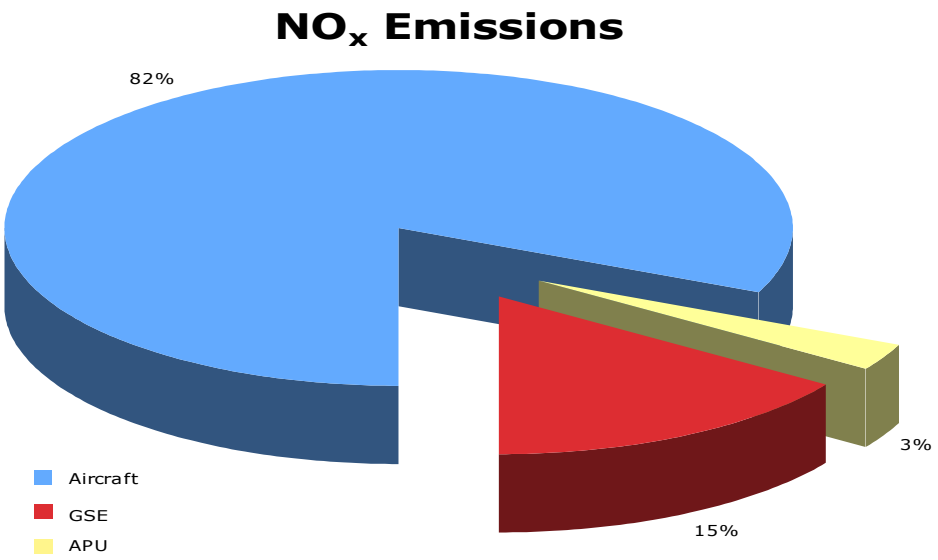
observed in use, however, some of the airlines that operate at BNIA routinely practice power-back at other airports.



E.3.2 Landside Fleets

While the impacts of landside operations were not examined in BNIA's 2006 air quality study, landside vehicles (passenger cars, airport fleets, taxis, limousines, buses, and shuttle vehicles) are likely the second greatest source of emissions, after aircraft. However, because aircraft operations are so complicated and difficult to significantly influence locally, airports wishing to improve air quality have little choice but to focus upon strategies that maximize the efficiency of landside operations. The biggest components of landside fleets are private passenger vehicles, taxis, limousines, and commercial shuttles. Because the operation of private passenger vehicles is so difficult to influence at airports like BNIA where there is ease of access, the emphasis must fall upon commercial fleets.

Automated Vehicle Identification Program

Reducing emissions from passenger vehicles can be an elusive goal for airports like BNIA, where highways accommodate convenient access and congestion is manageable. Nonetheless, one of the most effective programs utilized by airports nationally to reduce emissions and congestion associated with commercial fleets is through establishment of an automated vehicle identification (AVI) program. This program would replace the current fee system in which vendors loading passengers are charged a service fee based upon airport enplanements. With an AVI program, commercial vehicles are charged each time they pass through the airport for the purpose of loading

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passengers. These systems consist of electronic transponders that are affixed to the inside corner of windshields and record, through a centralized data collection system, the number of times a commercial vehicle enters the airport. Fees are paid based upon number of trips, size, or type of vehicles. Potential participant fleets may include: door to door shuttles, hotel shuttles, limousines, taxis, and buses. Participation is required as part of the licensing agreement with fleets serving the airport. AVI programs have proven effective in reducing commercial vehicle trips by up to 40% by discouraging needless vehicle trips. They would also help to regulate commercial fleets that currently circumvent payment of fees. For example, several hotels serving BNIA are now operating park and fly shuttle services and avoiding fees paid by other parking fleets. Quotes provided to Standard Parking indicates that it would cost approximately $18,000 to install equipment to monitor traffic in BNIA's shuttle bus lane. This does not include the cost of vehicle transponders or program administration.

Hotel Shuttles

Hotel shuttles are one target for conservation strategies because many of the miles they travel are within or in close proximity to the airport and their receptivity to consolidation. Several airport models exist for encouraging the consolidation of these services. Most programs hinge on promoting to hotels the economic benefits of sharing services; or financial incentives that can be afforded by the airport through waiver of existing fees imposed by BNIA on shuttle vehicles.

Door to Door Shuttles

Door to door shuttles present another opportunity area. While data is again scarce, these vehicles often travel long distances within the regional air-shed and observations indicate that these fleets are frequently comprised of older model vehicles carrying many fewer passengers than capacity. Given current economic conditions, the best short-term recourse may be to provide economic incentives and fee waivers encouraging the use of newer model, clean technology vehicles.

Clean Taxis

The Independent Taxi Association (ITA) currently operates under an exclusive contract with NFTA which allows them to stage in the ground transportation lane while picking up or discharging passengers. The contract requires that vehicles be less than 5 years old with the contract due to expire in 2012. When the contract comes up for renewal, NFTA may wish to consider new language requiring that these vehicles comply with established clean air policy (#7 below) and participate in the airport's AVI program, if one is established.

NFTA On-Site Fleets

As part of its Clean Air Policy, NFTA/BNIA should require the purchase of dedicated natural gas or hybrid vehicles. State Executive Order 111 requires that new vehicles less than 8500 lbs purchased by State entities be alternative fueled. However, most of the vehicles obtained thus far by NFTA have been dual fueled ethanol vehicles which, once purchased, operate almost exclusively on gasoline, providing negligible fuel or air quality benefits.

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Employee Trip Reduction

While employee access to satellite parking at BNIA does not appear to be a major issue, programs that reward employees for ride-sharing or transit use have proven popular at many other airport sites. Incentive programs include:

- Creating a parking benefit cash-out option in which employees surrender their parking privileges in return for compensation which can be based upon the parking revenue that can be collected from the vacated spot. Los Angeles International Airport provides employees and tenants $50 per month per spot who accept cash in lieu of their spot.

- Imposing parking fees for employees that park on-site or in satellite locations owned or leased by the airport.

- Organizing car-pool and van-pool programs specifically designed to accommodate the commuting needs of employees and tenants. Frequently, these programs provide back-up taxi or shuttle programs to accommodate the needs of employees associated with emergencies or weather-related conditions. Some employees, however, may not be able to participate in these programs because they work on swing-shifts or at off-peak hours.

- Establishing fee discounts for employees that use transit or as a reward for those that van or car-pool.

Clean Vehicle Policy

A complementary mechanism for guiding emission reductions is for BNIA to establish a clean air policy for commercial fleets licensed by the airport. Most airports with similar policies have established criteria encouraging or requiring vehicles to meet tailpipe emissions comparable to those achieved by natural gas vehicles. This is primarily due to the lower CO2 and emission characteristics of natural gas, the lower price of the fuel (compared to gasoline and diesel), the availability of a broad range of vehicle types at competitive costs, and the ease of establishing fueling infrastructure. Since natural gas is not a staple at BNIA, the airport may first wish to undertake research to determine whether natural gas or other clean technology is most suitable to underlay BNIA's clean air policy. Once these determinations are made, this policy could supported through a AVI fee system providing discounts or fee waivers for fleets that comply or as a requisite for participation in the AVI program.

E.3.3 Ground Support Equipment

Ground support equipment (GSE) includes all of the vehicles that operate on the airside of the terminal to service aircraft. This includes services such as fueling, food services, baggage loading and unloading, cargo handling, aircraft towing, snow removal vehicles, and general services such as transporting staff, maintenance equipment, and emergency services.
At BNIA, GSE emit approximately 15% of airside NO_x emissions, about 46.5 tons/year. Since GSE generally are not licensed for on-road operation, they do not have to comply with national emission standards. However, most maintenance and service trucks used for GSE are purchased with all necessary equipment for highway operations if ever. Other equipment, like belt loaders, baggage tugs, cargo lifts, and pushback tractors, are built specifically for airport service and do not include catalytic converters and other emission control devices. The GSE in

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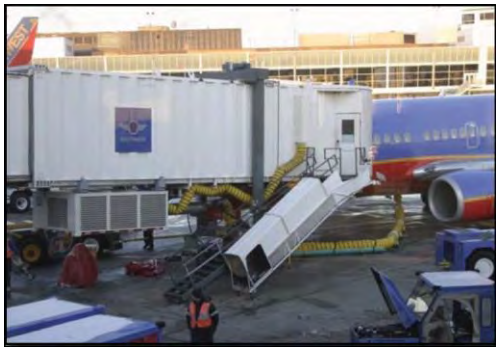
use at BNIA include equipment designed for using gasoline or diesel. Current maintenance practices are for large equipment to be serviced annually and then on an as-needed basis. Smaller vehicles like trucks and automobiles undergo basic maintenance every 3,000 miles.

Electric Tugs

BNIA has also considered requiring use of electric tugs as part of use and lease agreements with airlines. The challenge is that much GSE is designed to operate over long periods of time (often 20 to 30 years). And in this economy, airlines are hesitant to replace these vehicle before the end of their operating life. Requiring the use of electric or natural gas fueled GSE could be facilitated through vehicle and infrastructure funding available through the Federal Aviation Administration's Voluntary Airport Low Emissions Program (VALE). These grants are however, highly competitive and require matching funds. Airline participation might best be encouraged through the negotiation of use and lease agreements between NFTA and the airlines, which are up for renewal on March 31, 2013.

Gate electrification/ Pre-Conditioned Air

Of the 24 gates at BNIA, 17 have 400 Hz power and preconditioned air (PCA) available so that the airlines do not have to run their APUs while at the gate. Expanding the availability of power and PCA to all gates via VALE or other funding mechanisms would further improve air quality associated with ground service operations. These fixed facilities are much more efficient than APUs and consequently emit fewer air emissions (including emissions from the power plant supplying the electricity). APU's are small turbine engines on-board aircraft that generate 400 Hz electricity and compressed air to operate the aircraft's instruments, lights, ventilation, and other equipment. They mostly are operated when the aircraft is on the ground with its main engines shut down. APUs are relatively small emissions sources, accounting for approximately 3% of airside NO_x emissions at BNIA.



Even with 400 Hz power and preconditioned air available, some airlines do not use it. Reasons airlines often mention for running the APU during turnarounds include insufficient cooling capacity provided by the preconditioned air systems and a desire for quick turnarounds. BNIA has no policy in place regarding usage of these facilities. In the absence of an airport policy encouraging the use of gate power and PCA, it is estimated the current equipment reduces the emissions from APUs by 50%, or 1.5% of airside NO_x emissions.

The International Civil Aviation Organization (ICAO) Circular on Operational Opportunities to Minimize Fuel Use & Reduce Emissions recommends using preconditioned air (PCA) and 400 Hz power at gates and maintenance areas to "reduce or eliminate APU usage, where applicable as well as GPU (ground power units) and Air Conditioning Units, which would otherwise be used to provide electric power and air conditioning. The report also identifies minimizing reverse thrust on landing and aircraft towing as feasible and appropriate opportunities for airlines to reduce their emissions at or in the vicinity of airports. Reverse thrust is a high-power engine operation (with consequent high NO_x emissions) to slow an aircraft on landing in lieu of using the wheel brakes. NFTA may be able to adopt the ICAO-recommended measures as its policy

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or strongly recommend all tenant airlines adopt them as best management practices for operation at BNIA.

E.4 WASTE MANAGEMENT AND RECYCLING

BNIA generates a variety of solid waste. Passengers in the terminals dispose of newspapers and magazines, glass, aluminum, and plastic beverage containers, food waste, and paper towels. Food service providers dispose of food waste, paper products, packaging materials, waste cooking oil, and cleaning supplies. Vehicle maintenance shops generate used oil and oil filters, tires, and vehicle wash water. Office areas create paper waste, toner, and other office material. Airport deicing activities annually spread tons of sand and grit which becomes a waste product. Demolition and renovation projects create waste construction materials.

In addition to these generally non-hazardous wastes, maintenance shops and maintenance activities are common sources of hazardous waste. These types of waste include: paint-stripping residue, waste paint, refrigerants, solvent wastes, electronic equipment, pesticides and herbicides, used antifreeze, contaminated fuel, metal scraps, waste deicing/anti-icing fluids, fuel tank residue, absorbent clean up materials, vendor samples, and shelf-life expiration materials. BNIA recycles glass, paper, cardboard, plastic and metal. The program does not mandate airline and tenant participation, although some tenants do participate due to corporate policies. NFTA has a centralized collection and waste disposal system for BNIA and its tenants including Delaware North. Costs are charged back to the tenants through the rate base.

Comprehensive Waste Audit

BNIA may wish to consider initiating a comprehensive waste audit to obtain a clearer picture of the types and quantities of waste produced at the airport by staff, airlines, concessionaires, and tenants; and any remote operations that are not currently included in its recycling program. An audit produces a measure of waste by type (glass, plastic, paper, used oil, hazardous waste). This data can be used to help refine BNIA's current recycling program, to identify and prioritize steps for expanding the program, for assessing costs and benefits, and in establishing benchmarks for evaluating progress and establishing goals.

Minimize Non-Hazardous Waste

Currently at BNIA, recyclables are collected throughout the terminals and concourses in single stream containers. The material is then carted to a dumpster specifically designated for recycled materials. Recycling trash cans are located throughout the concourse area and emptied on all three shifts. The airlines do their own recycling and use the dumpster marked for recycling in Gate 9 area. There is also a recycling compactor located by Delaware North's loading dock which is used by BNIA and Delaware North.

Modern Disposal handles waste collection for BNIA and its tenants. Their contract is expiring and currently out to bid. The costs of waste collection are paid by BNIA and its tenants based upon "rates and fees" which are recalculated annually. This repayment structure provides little financial incentive for tenants to minimize waste generated since any cost savings attributed to waste reduction are shared by all the tenants through the rates and fee structure versus rewarding just the responsible tenant(s).

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Pay-as-you-throw

To motivate greater recycling BNIA may wish to examine implementation of a waste fee collection system for airlines and tenants that is based upon the quantity of waste generated in contrast to a rate-and-fee formula based largely on enplanements, which provides little incentive for waste minimization by individual tenants. A "pay-as-you-throw" system utilized by several major airports including Seattle-Tacoma provides tenants with access cards that register a charge against the card each time it is used to gain access to a centralized disposal bin. The bin regulates the amount of waste disposed in each throw. Recycling bins are also available which can help tenants reduce the quantity and costs of wastes disposed.

To avoid both intentional and unintentional contamination of recycling bins, SeaTac communicates the appropriate use of recycling equipment to airport tenants during monthly concession manager meetings, in Airport program brochures, and via labels affixed to equipment. They also receive feedback from the airport's recycling service provider who receives recyclables and inspects each load to evaluate contaminant (garbage) levels and determine quality of material. If contaminants are observed, the facility contacts SeaTac's recycling program managers with contamination details, and photographs that are used to identify origins of contamination (the specific tenant) and provide material specific education. This occasionally happens when a well-meaning tenant wants to recycle materials that cannot be recycled. Security cameras located near compactor areas discourage unauthorized practices. As a result, the intentional disposal of garbage in recycling compactors to avoid disposal fees is "very rarely seen". Other source reduction and recycling methods include:

Product purchase policies

Purchasing products in bulk to reduce packaging material, printing double-sided on paper, using durable utensils, cups, mugs etc. instead of disposable items, and using rechargeable batteries are all methods to minimize the amount of waste that is generated from an office or a facility. These practices can be implemented at the BNIA offices and suggested as best management practices to the FBOs.

BNIA should also make every effort to expand the purchase of products that include recycled content or specifying recycled content criteria in product purchase documents. One of the biggest obstacles to recycling is expanding the market for and concomitant value of recycled goods. Examples are expansive and include: Office chairs, desks, supplies, and other office products. Rewards can be provided to departments that expand the use of recycled goods. EPA's WasteWise program (http://www.epa.gov/wastewise/) is one of many sites that provide guidance on expanding the purchase of recycled products while providing an inventory of goods available.

Terminal and Concessions

Electric Hand-dryers. Using only electric hand dryers in the restrooms in the terminal building would reduce the large amount of waste paper that is currently sent to landfills or incinerators. BNIA is moving towards this goal with restroom upgrades and high velocity hand dryers included in the capital budget over the next one to two years.

Unused Food. Donating unused cooked food from the terminal restaurants to food banks, soup kitchens, and/or shelters can eliminate perfectly good food from the waste stream while feeding

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the hungry. Seattle-Tacoma International Airport's food donation program has a success rate of 26,000 pounds of food donated annually to food banks in the area.

Coffee Grounds. Coffee grounds can be reground and used as landscaping compost. Sea-Tac currently recycles over 125 tons of coffee grounds annually instead of sending them to the landfill.

Cooking Oil. Many airports including Sea-Tac collect and recycle cooking oil from concessionaires. The oil can be used for many purposes including the production of bio-fuels.

Value Engineering. To encourage recycling of building and aggregate materials, NFTA may also wish to consider stronger language in its RFP bid documents, requiring compliance with their sustainability policy and encouraging consideration of "value engineering" or life cycle cost (versus low-bid) criteria. By applying this language to new build or retrofit projects and the demolition of structures or runways, NFTA could provide a powerful incentive for innovation in waste minimization. The Sustainable Asset Manual developed by the Chicago Department of Aviation provides extensive criteria that could be adopted by NFTA as part of its contracting requirements. Examples include:

- Recycling and/or salvage of nonhazardous construction and demolition debris
- Diversion of soils from landfills to on-airport projects
- Reuse of aggregate (sand, gravel, crushed concrete, and asphalt) from on-airport sources
- Reuse of building materials to minimize demand for virgin materials
- Preferred purchase of building products that incorporate recycled materials
- Purchase of area materials and products to reduce environmental impacts of transporting materials
- Utilizing rapidly renewable versus long-cycle renewable materials

Minimize Hazardous Waste

Hazardous wastes are defined as wastes that pose a substantial present or potential hazard to humans or other living organisms due to many different reasons. Hazardous wastes as defined here include antifreeze, diesel and jet fuel, solvents, and batteries.

The EPA does not regulate used oil that is being recycled or certain types of used oil filters as hazardous waste. Instead, used oil handlers follow a set of federal management standards that are designed to encourage the recycling of used oil. It is important to note that recycling just two gallons of used oil can generate enough electricity to run the average household for almost 24 hours. It takes 42 gallons of crude oil but only one gallon of used oil to produce 2.5 quarts of new, high-lubricating oil.

Currently, it appears that all the hazardous waste generated at BNIA is collected by licensed hazardous waste disposal companies. Therefore, BNIA's emphasis should be upon methods for reducing the generation of these wastes. The first step is to conduct an inventory of hazardous waste generated; the sources of this waste; and then to examine best management practices for reducing generation. In monthly meetings with tenants, emphasis should be placed upon the cost savings opportunities associated with reductions in hazardous waste. Typical examples of best management practices include:

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- Cleaning pipelines by hydraulically or pneumatically propelling a plastic projectile cleaner through the pipes – instead of chemicals
- Using countercurrent methods of cleaning where possible (used solvent for initial cleaning and clean solvent for the final cleaning)
- Using less toxic materials such as substituting solvent-based with aqueous based parts cleaners
- Using equipment with high transfer efficiency, such as electrostatic precipitators when painting
- Ensuring that secondary catchment is used to contain oil and solvent spills
- Establishing good housekeeping practices (repairing equipment leaks; practicing preventative maintenance; keeping waste streams separated to maximize material reuse or to simplify treatment); keeping containers covered to prevent evaporation and spills
- Recovering and reusing cooling water, used solvents, and plastic scraps

E.5 WATER USE and WASTEWATER MANAGEMENT

BNIA uses potable and non-potable water in many areas including irrigation, minimal aircraft washing, terminal building activities, fire training exercises, and chillers, as well as tenant and BNIA operations. Potable water is provided by the Erie County Water Authority. BNIA's impact on the potable water is in the form of consumption. In addition, inefficient usage can encumber valuable capacity in BNIA's consumptive use permit (CUP) and can put unnecessary strain on the water and waste water treatment plants that serve the Airport. Many of the airport tenants use potable and non-potable water for irrigation, building activities and vehicle/equipment washing. Considering ways to reduce the volume of water consumed by airport tenants can enhance the airport's commitment to water conservation.

E.5.1 Audit

What gets measured gets managed. To determine the quantity of water consumed by these uses and the projected pay-back period for improvements, BNIA may wish to consider either integrating a water use audit into the NORESCO energy audit or conducting an independent assessment of water use at BNIA.

E.5.2 Bathroom Fixtures

With tens of thousands of people traveling through BNIA daily, toilets, sinks and urinals use huge volumes of water daily. In the BNIA terminal complex there are 105 toilets which consume 1.6 gallons per flush; 37 urinals using 1 gallon per flush; and 95 sinks which use 1.5 gallons per minute with use of aerators. These units comply with Federal efficiency standards, however, new technology is now commercially available which can reduce this water use significantly while providing quick return on investment.

For example, toilets are now commercially available that use 0.8 gallons per flush, half the current volume. New technology also allows functional urinals that operate with no water. These water-free urinals use a filter system and are relatively low maintenance since there is no flushing mechanism. The filter cartridge is engineered to receive waste through drain holes. Waste passes through a layer of sealant, continues through a siphon trap system, and flows out through a baffle to prevent the loss of sealant. A discharge tube in the housing directs the flow of waste into the building drain system. The cartridge is designed as a replaceable component

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when its function has been exhausted. A retrofit would require minimal disruption of current operations and can be done in phases. This technology is currently being utilized by the Colorado Springs Airport. Water-conserving aerators could also be added to existing faucets, reducing consumption to approximately 0.3 gallons per minute, a decrease of over two-thirds from the current volume.

Portland International Airport has recently installed high efficiency toilets (@1 gallon per flush), waterless urinals, and high efficiency sink aerators with activation sensors that have decreased terminal water use from 275,000 to 100,000 gallons per day. While reducing their consumption of potable water, the airport also projects a payback on investment within eighteen months.

Summary of Potential Upgrades to Improve Efficiency

Current Facilities	Current Rate	Proposed Rate	Efficiency Gain
37 urinals	1.0 gallons per flush	0 gallons per flush	100%
105 toilets	1.6 gallons per flush	0.8 gallons per flush	50%
95 hand sinks	1.5 gallons per minute	0.33 gallons per minute	80%

E.5.3 Irrigation

The landscape irrigation system at BNIA uses three Weathermatic controllers: The first feeds 87 zones; the second supplies six zones; and the third utilizes fourteen zones. The Weathermatic company offers a flow-meter system with detectors for monitoring water use which cost about $275 per unit. Four units would be required since there are four points connection (POC). BNIA's landscape manager, Steve Krumm has recommended the purchase of water meters and direct water meter registers for each POC. Weathermatic estimates that these flow-meter systems (4) with detectors would cost about $1100 total. The investment would be paid off quickly through water and energy savings. To minimize water use absent these conservation units, Mr. Krumm has relied upon seven guiding principles:

1. Planning and design
2. Selecting and zoning drought tolerant landscape plants appropriately
3. Selecting drought tolerant turf grass cultivars
4. Improving the soil, enabling the soil to better absorb water and nutrients
5. Irrigating efficiently
6. Using appropriate mulches in planting beds
7. Sustaining the landscape through best plant health care and integrated pest management practices

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STRATEGIES FOR GUIDING SUSTAINABLE DEVELOPMENT AT BNIA

	Implementation difficulty	Environmental benefits	Payback	Recommended priorities (H:High; M:Medium; L:Low)
I. Building Efficiency				
A. Energy Audit				
1. HVAC Upgrades				
2. Renewables				
3. White Roofs				
4. Conservation/Curbside Baggage				
5. Heat reuse				
6. Re-commissioning				
7. Load Shedding				
B. Billing Procedures				
C. Green Building Policies				
II. Exterior Air Quality				
A. Aircraft Operations				
1. Taxiing				
2. Powerback				
B. Landside Fleets				
1. AVI Program				
2. Hotel Shuttles				
3. Door to door shuttles				
4. Clean Taxis				
5. NFTA Onsite fleets				
6. Employee Trip Reduction				
7. Clean Vehicle Policy				
C. Ground Support Equipment				
1. Electric Tugs				
2. Gate Electrification/ Pre-Conditioned Air				

STRATEGIES FOR GUIDING SUSTAINABLE DEVELOPMENT AT BNIA (cont.)

	Implementation difficulty	Environmental benefits	Payback	Recommended priorities (H:High; M:Medium; L:Low)
III. Waste Management and Recycling				
A. Comprehensive Waste Audit				
1. Pay-As-You-Throw				
2. Recycling Building Materials				
B. Minimize Non-Hazardous Waste				
1. Pay-As-You-Throw				
2. Product Purchase Policies				
3. Electric Hand Dryers				
4. Unused Food				
5. Cooking Oil				
6. Value Engineering				
C. Minimize Hazardous Waste				
IV. Water Use				
A. Audit				
B. Bathroom Fixtures				
C. Irrigation/Flow Meters				

Exhibit A

PRIORITIZATION OF STRATEGIES FOR GUIDING SUSTAINABLE DEVELOPMENT AT BNIA AS IDENTIFIED BY STAKEHOLDERS AT THE 12/15/2010 CHARRETTE

Based upon the prioritization criteria defined by stakeholders, votes were cast to determine the most important sector strategies for achieving the agreed objective of "…. Identify(ing) programs and policies BNIA can cost-effectively implement short and long-term to maximize the environmental quality of operations".

First and foremost, "what gets measured gets managed". Therefore, stakeholders agreed that conducting an audit of building efficiency/energy use, exterior air quality/pollution sources, solid waste/ recycling sources and types, and potable water use sources and quantities is key to designing targeted programs for guiding sustainable development at BNIA.

Within this context, there was strong sentiment (12 high priority votes) that the Phase III NFTA/ NORESCO Energy Audit provided an excellent vehicle for exploring a variety of building efficiency strategies identified by stakeholders. Along these lines, the Stakeholder Group (the "Group") recommended that the NFTA Purchasing Department and NORESCO meet to examine how the Phase III audit might be expanded to examine building efficiency opportunities that were identified. The Group also emphasized the need to look at all airport buildings and not only the terminal complex.

On the issue of exterior air quality, the Group expressed the clear sentiment (11 high priority votes) that landside strategies and more specifically, programs focusing on vehicle trip reduction and improving the circulatory road system to expedite traffic flow presented the best opportunities for improving air quality. Aircraft operations (5 high priority votes) came next, with recognition that aircraft operations are difficult and costly to influence. Advanced technology vehicles and ground service equipment were not ranked as high priorities, due primarily to the cost, limited environmental benefits (compared to other strategies) and the challenges of implementation.

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There was strong support for strategies further expanding waste management and recycling (8 high priority votes). The emphasis was on strategies that both minimize the quantity of waste generated and maximize the amount of waste recycled versus land-filled.

In the water quality arena, priorities were lower (2 high priority votes for improving the efficiency of bathroom fixtures and 1 vote for irrigation flow metering).

Notes recorded from the flip chart paper and taken at the meeting follow for review by Stakeholders.

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CHARRETTE FRAMEWORK AND STRATEGY OPTIONS FOR GUIDING SUSTAINABLE DEVELOPMENT AT BNIA
December 15, 2010

Meeting Agenda:

- Review practicable strategies sector by sector
- Augment/revise strategies
- Review/refine criteria for prioritizing strategies
- Prioritize strategies
- Evaluate meeting

Desired Outcomes:

"To identify programs and policies BNIA can cost-effectively implement short and long-term to maximize the environmental quality of operations".

Ground Rules:

- One person speaks at a time
- No dog and pony shows
- No personal attacks
- No bad ideas
- CAP will enforce ground rules
- BNIA will make final decisions

Criteria for Prioritizing Strategies:

- Technological advances
- Ease of implementation
- Availability of funds
- Environmental benefits
- Funding eligibility
- Pay-back period
- Regulation driven
- Employee buy-in
- Public relations benefits

BUILDING EFFICIENCY OPPORTUNITIES:

- NORESCO Phase III Energy Audit / Meet with Procurement Department and NORESCO to brainstorm Phase III scope **(12 high priority votes)**

    1. Revolving terminal doors
    2. Jet bridge doors

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3. Heat/cool jet bridges
4. Green roofs/white roofs
5. Revamp parking garage structure to save heat
6. Include all airport buildings not just terminal and concourses
7. Radiant heating for new floors
8. Retrofit escalators and people movers to save energy
9. Room light activation sensors
10. Eliminate lighting redundancy
11. Harness heat gain from windows/deflect heat gain in summer

- Billing procedures **(2 high priority votes)**

- Green building practices/ life-cycle costs as part of new-building and redesign RFPs

AIRCRAFT OPERATIONS (5 high priority votes):

- Single engine taxiing
- Prohibit power-back at gates
- Continuous descent approach
- Taxiway expansion and improved infrastructure
- Use of bio-fuels

GROUND SUPPORT EQUIPMENT:

- Electrification of tugs and installation of photo-voltaic chargers
- Gate electrification and pre-conditioned air for all gates
- Hydrant fueling system

LANDSIDE VEHICLES:

- Trip reductions/Improve circulatory road system **(11 high priority votes)**
  1. Automated vehicle identification program
  2. Consolidate/cleaner hotel shuttles
  3. Consolidate/cleaner door-to-door shuttles
  4. Employee trip reduction programs (expand “Good Going” participation)
  5. Light rail and improve bus service
  6. Move employee parking closer to terminal
  7. Traffic signalization
  8. Cell phone lot: Promote 2 hours of free parking in garage/lots
  9. People movers versus parking buses
  10. Promote no-idling
  11. Improve road/traffic patterns and BNIA circulatory road system (4)
  12. More trees/shrubs to clean the air

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13. Use snow-melters versus trucking snow off-site
14. Valet parking
15. Parking availability/signalization for garages
16. Provide quicker turn-around for rental car vehicles

- Clean Technology/Clean Fuels
  1. Establish clean vehicle policy for NFTA and commercial fleets
  2. Clean technology taxis
  3. Clean technology NFTA on-site fleets
  4. Install electric vehicle charging stations
  5. Parking discounts for clean technology vehicles
  6. Replace electric golf carts with pedal carts in concourses
  7. Incentives for clean technology rental cars

WASTE MANAGEMENT/RECYCLING (8 high priority votes):

Waste minimization and recycling

- Pay-as-you-throw
- Product purchase policies
- Hand dryers in restrooms
- Donate unused food from concessionaires
- Recycle coffee grounds for compost
- Compost concessionaire food waste
- Recycle cooking oil
- Recycle light bulbs
- Integrate waste collection/recycling programs with airlines and tenants
- Donate unclaimed items confiscated to TSA and donate to needy

WATER QUALITY:

- Use gray-water for irrigation and toilets/urinals
- Upgrade bathroom fixtures **(2 high priority votes)**
- Install irrigation flow-meters and readers **(1 high priority vote)**

Meeting evaluation:

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Good to sequence meetings
Good open discussion and brainstorming
Great stakeholder diversity

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Should have budgeted more time
Should have allocated more time for prioritization phase

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Exhibit B

DFW INTERNATIONAL AIRPORT
ADMINISTRATIVE POLICY AND PROCEDURE

DFW

Title: Sustainability		Code Number: AA.012.00
Functional Category: Airport Administration	Issuing Department: Energy and Transportation Mgt.	Effective Date: 08/01/2008

1.0 PURPOSE

1.1 To establish policy and procedure designed to:
- 1.1.1 Guide the Board's activities in demonstrated commitment to economic growth, environmental stewardship, and social responsibility; and
- 1.1.2 Improve the Board's sustainability performance by aligning activities throughout the organization.

2.0 DEPARTMENTS / PERSONS AFFECTED

2.1 All employees.

3.0 POLICY

3.1 The Board will strive to continually improve its performance in economic, environmental, and social stewardship by supporting the tenants of sustainability as defined by the Bruntland Commission and Triple Bottom Line concepts.

3.2 In furtherance of this policy, the Board shall:
- 3.2.1 Make sustainability a top down priority.
- 3.2.2 Utilize systems thinking as a critical discipline for sustainable development.
- 3.2.3 Apply integrated management through collaboration, communication, and coordination.
- 3.2.4 Pursue continuous improvement through education and outreach.
- 3.2.5 Utilize life-cycle cost analysis to demonstrate full economic benefits.
- 3.2.6 Practice resource stewardship to achieve environmental benefits.
- 3.2.7 Pursue community partnerships for social benefit.

4.0 PROCEDURE

4.1 The sustainability policy and principles herein will guide best practices for the Airport community.

4.2 The Board's sustainability program will consist of the following minimum elements:
- 4.2.1 Comprehensive sustainability standards and metrics incorporated into business processes.
- 4.2.2 Sustainability standards and practices integrated into management, planning, design, construction, development, operation and maintenance criteria, guidelines, systems, and processes.
- 4.2.3 Internal and external communication and outreach programs to educate and involve employees, business partners, and other stakeholders.

DFW INTERNATIONAL AIRPORT ADMINISTRATIVE POLICY AND PROCEDURE

4.3 Oversight mechanisms will review the status of each element of this policy to ensure its implementation with a goal of integrating sustainable practices throughout the organization.

5.0 RESPONSIBILITIES

5.1 **Vice President, Energy and Transportation Management**. Responsible for serving as the Board's Sustainability Officer providing oversight and support to other departments to ensure effective response to the provisions of this policy and to track performance.

5.2 **Departmental Heads**. Responsible for ensuring that sustainability goals, objectives, requirements, and practices are integrated into operational and business planning, development, and management.

5.3 **Internal Communications**. Responsible for promoting understanding and awareness of sustainability among employees.

5.4 **Public Affairs**. Responsible for promoting understanding and awareness of sustainability among external stakeholders and communicating the Board's sustainability efforts.

5.5 **Employees**. Responsible for:
- 5.5.1 Reducing or eliminating unnecessary use of supplies and other resources;
- 5.5.2 Complying with internal procedures as developed within each department that support the sustainability goals of the Board; and
- 5.5.3 Complying with this policy.

6.0 DEFINITIONS

6.1 **Bruntland Commission.** Author of a 1987 report to the United Nations World Commission on Environment and Development widely credited with offering the first comprehensive definition of sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

6.2 **Department Head.** Vice president of a department or assistant vice president in those cases where the department is led by an assistant vice president.

6.3 **Sustainability.** Business operations and development that meets the needs of the present without compromising the ability of future generations to meet their own needs by considering long-term economic, environmental, and social impact of current activities.

6.4 **Triple Bottom Line (TBL).** The addition of social and environmental values to the traditional economic measures of an organization's success. The TBL concept provides an expanded set of values and criteria to describe an organization's activities and to make evaluations of business activities more in-depth.

7.0 APPROVAL / REVISION HISTORY

7.1 08/01/2008 AA.012.00 – Original document.