Appendix 12: Maximally Productive Use - "GreenPort" Development Concept

12.1 Sustainable Development and the Airport Industry

Definition

Airport Sustainability refers to a holistic management approach where key indicators of operational safety, security and efficiency, natural resource conservation, and social responsibility are measured, enforced, and reported. Green and sustainable airports establish innovative strategies and solutions for a more eco-efficient and green regional aviation industry.

Solutions for reducing the negative impacts of airports on the environment and society can be achieved through the development and adoption of new technologies and processes across the airport operations.

The table below provides examples of promising solutions structured around their respective set of application areas.

Table A12-1:
Examples of Innovative Green Technologies and Solutions for Airports

Airport Section	Application	Promising Technologies/Solutions
Terminal	Buildings, HVAC systems, lighting, baggage handling systems, water and waste management systems, electricity	▪ Building Automation solutions (BAS) (Siemens) ▪ Geothermal heat exchange ▪ Energy storage systems ▪ Solar PV electricity generation ▪ Efficient motors for baggage systems ▪ Rainwater harvesting systems ▪ On-site energy supply facilities ▪ Building envelope upgrades ▪ LED lighting systems ▪ Public EV charging ▪ Third-party verification and certification systems (LEED, etc.) ▪ Environmental Management System (EMS)

Ground Operations	Ground Support Equipment (tugs, refuelers, belt loaders, maintenance vehicles and snow removal equipment, mowers, ARFF vehicle, etc.)	▪ Electrification of GSE ▪ Automated apron services ▪ Wireless GSE and monitoring systems ▪ Green taxiing ▪ Xeriscaping and naturalization ▪ Environmental Management System (EMS)
Runways & Grounds	Runway surface materials, lighting and signage	▪ Stone mastic and recycled asphalt ▪ Recycled glass mix into engineered fill ▪ Solar/LED runway lights and signage ▪ Xeriscaping, lower maintenance plantings.
Air Traffic Control	Air traffic management (ATM) technology, approach designs, control tower…	▪ Lorads III (advanced ATM) ▪ Optimized descent profiles ▪ Holographic radar system (distinguish turbines and aircraft)
Airside Operations	Aircraft de-icing fluids, de-icing pads, supporting equipment	▪ Eco-efficient de-icing fluids ▪ Infrared de-icing technology, ▪ Enhanced collecting systems and improved procedures ▪ Environmental Management System (EMS)
Hangar & Other Facilities	HVAC systems, floor covering, power systems	▪ Diamond-polished concrete free of epoxy sealants ▪ Chemical-free fog systems that protects aircraft ▪ Green aircraft heating (compressors) and APUs ▪ BAS systems ▪ LED lighting ▪ Solar PV generation, battery storage systems and geothermal heat exchange

Key Benefits for Airports

A common misconception is that airport sustainability could only be achieved through costly and binding measures. Rather than a major redesign or overhaul of airports, airport sustainability should be seen as a set of step-change solutions to improve the environmental performance of airport operations, intermodal transport operations to and from airports, and the airport's infrastructure. Another premise is that green improvements go hand in hand with, and should even contribute to, time-efficiency and cost-effectiveness. If not, the airport would not be able to compete with other airports in

the current fierce and evolving global competition. As a result, the solutions associated with green airports are designed to reduce the impact on the environment whilst offering enhanced operations, mainly triggering the following key benefits for airports:

Lower Operating Costs

By focusing on green programs and initiatives that can be implemented within airport infrastructure, either through new construction, retrofitting or improvements, and processes, airports can achieve energy savings, water conservation, and reductions in other environmental impacts that translate into lower operating costs. According to a 2015 Airport World article[14], new systems and processes for energy savings such as LED lighting or controls and automation solutions have led to Birmingham Airport saving over $475,000 (USD) – 7% – on energy bills in the past two years. Likewise, as depicted in the following figures, the various efforts at Denver International Airport result in over $1 Million savings annually.

Table A12-2:
Annual Savings Resulting from Green Practices at Denver International Airport

	% Reduction (annually)	$ Savings (annually)
Reduction in Hazardous Waste Disposal	8%	$10,000
Reduction in Vehicle Fuel Use	5%	$162,000
Deicing Fluid Recycling	8%	$850,000
Recycling Savings	1432 Tons	$110,000
Total annual savings	n/a	$1,132,000

Increased Revenues

In addition to cost savings, the adoption of sustainable practices may also result in a revenue hike. More specifically, renewable energy development provides opportunities for incremental revenue by leasing land or by selling the surplus electricity to utilities facing state, regional, and federal environmental and energy goals. Airports have particular characteristics that enhance the potential financial viability of on-site renewable energy.

As an example, the open landscape and geographical position of airports necessary for managing air traffic arrivals and departures also facilitate the capture of natural resources from the sun, wind, water, and earth that fuel renewable energy.

Small rural airports may have surplus land available to site such facilities while larger airports often have a level of electricity demand to support power consumption that positively affects project financials. All of these attributes, combined with improved renewable energy market conditions, often make renewable energy developed at

[14] Going Green – Energy Savings, *Airport World Magazine*

airports financially viable. Below are examples of North American airports that have taken the lead on renewable energy projects by hosting ground mounted solar photovoltaic (PV) systems on their lands.

Figure A12-1:
Examples of Ground Mounted Solar Photovoltaic (PV) System Developments at Airports

Thunder Bay Airport, ON
- ✓ Over 140,000 thin film photovoltaic solar panels over 90 acres
- ✓ 8.5 MW project: enough clean energy to power 15,000 homes over a 20-year period
- ✓ Created 100 direct jobs
- ✓ The airport rents the land to SkyPower, who owns and developed the project

Indianapolis International Airport - Solar Farm, IN
- ✓ 41,000 solar panels over 75 acres
- ✓ 15 million kW per year: enough clean energy to power 24,000 average American homes over a 20-year period
- ✓ Created 142 direct jobs
- ✓ The airport rents the land: expected annual revenue is $315,000

Windsor Airport, ON
- ✓ Project recently received approval from the Ministry of the Environment and Climate Change
- ✓ Samsung is the project developer
- ✓ Maximum capacity will be 50 MW
- ✓ The company will pay the city $1 million per year for the use of the airport land, (plus $200,000 a year in property taxes)

Enhanced Image

Communication on sustainability practices can help improve the airport's image and increase community support. In fact, being transparent about environmental performance may help establish credibility and trust with all stakeholders. In some instances, sustainability reporting tends to be reactive, offsetting negative press coverage in that it exemplifies how the airport strives to contribute to the betterment of the communities in which they operate.

To a certain extent, green practices at airports may also increase market appeal, and may attract commercial airlines faced with increasing pressures to report on how they reduce their environmental impact.

Key Takeaway

Not only does the adoption of green technology and best practices help an airport to realize better operational efficiencies and reduce costs, but they also create opportunities for new revenue streams, mainly from renewable energy. In addition, a green marketing approach fosters community confidence and may create market "buzz".

These key benefits contribute to explain why so many airports willingly embrace sustainability.

12.2 The Market

Industry Initiatives

Regardless of the aforementioned key benefits, the implementation of green strategies prepares airports for an ever increasing array of environmental regulations. The increased priority on climate change leads airports to proactively go beyond requirement, and results in numerous industry-wide initiatives and commitments that are driving the demand for sustainable and greener technologies. As detailed in the next paragraphs, the International Air Transport Association (IATA) and Airport Council International (ACI) are leading the path towards the adoption of greener practices and technologies at airports.

IATA's "Carbon-Neutral Growth by 2020" Commitment

The aviation industry is united in a commitment to stabilize carbon emissions by 2020 with carbon-neutral growth; and to a 50% reduction of carbon emissions (compared to 2005 level) by 2050. To achieve these goals, a multi-faceted approach is required coupled with a strong commitment from all stakeholders to actively pursue four strategic pillars:

- Improved technology, including the deployment of sustainable low-carbon fuels;
- More efficient aircraft operations;
- Infrastructure improvements, including modernized air traffic management systems; and
- A single global market-based measure, to fill the remaining emissions gap.

While airports are representing a small percentage (i.e., 5%) of total aviation emissions, it is estimated that improvements and innovation to airports' infrastructure and processes could provide up to a 4% emissions reduction globally[15], which is why they

[15] "Aviation and Climate Change Pathway to carbon-neutral growth in 2020", IATA, 2009

participate in a number of initiatives to play their part and recognize that collaboration is needed across the entire aviation industry.

ACI's Airport Carbon Accreditation

An Airport Council International-Europe (ACI Europe) initiative, the Airport Carbon Accreditation was designed as a key tool for airports to reduce their CO2 emissions and achieve best practice in carbon management, with the ultimate objective of becoming carbon-neutral. Launched in 2009, the program gradually expanded and was launched in 2014 in North America.

Airport efforts to manage their carbon emissions are recognized with four progressive levels of accreditation:

- Level 1: Mapping;
- Level 2: Reduction;
- Level 3: Optimization; and
- Level 3+: Neutrality.

By October 2015, there were 132 accredited airports representing more than 30% of world passenger traffic, including Amsterdam, Heathrow, Frankfurt, Sydney, Dubai, Hong-Kong, Dallas and Montreal airports. It is expected that Airport Carbon Accreditation will continue to grow and expand in North America at a fast rate given the increased priority on climate change, the significant interest from airports across the world and the effectiveness of the program.

Since May 2014, the Accreditation is also highly commended by OECD's International Transport Forum.

Market in Figures

A 2011 OECD report on Strategic Transport Infrastructure[16] provides information on worldwide airport capital expenditures on updates/expansion of existing airport infrastructure and the share of green investment. The report indicates that innovative green technologies will play an important role in airport construction projects, and estimates that the share will represent 8% of total investments.

[16] "Strategic Transport Infrastructure Needs to 2030", OECD, 2011

Table A12-3:
Global Infrastructure Investment Needs, 2009-2030

	Annual Average Investment*		Cumulative Investment*	
	2009-2015	2015-2030	2009-2015	2015-2030
Airport Capital Expenditure*	70	120	400	1,800
Estimated Share of Green Invest.*	5.6 (8%)	9.6 (8%)	32 (8%)	144 (8%)

*USD, Billion

According to these forecasts, over the 2015-2030 period, airport capital expenditures will amount to $120 Billion dollars a year, $9.6 Billion of which will be dedicated to greening the infrastructure through the purchase of sustainable technologies and solutions.

Further demonstrating the growing commitment to green technologies in the airport industry, Table A12-4 lists some of the major airport sustainable initiatives and plans across North America:

Table A12-4:
Major Sustainable Initiatives at North-American Airports

Airport(s)	Main focus of the Green Initiative	Budget
Hawaii Airports	• Intelligent HVAC Systems • Lighting • Energy Management (Automation Control, photovoltaic panels)	$150 million
San Diego International Airport's Green Building	• High efficiency HVAC • Baggage System (powered by 30% more efficient motors) • LEED certification	$900 million
Stewart Airport	• Aircraft Gate Power for Aircraft Use (instead of APUs) • Lighting	$10.6 million
Pittsburgh International (PIT)	• Green Lighting Project	$1.6 million

Winnipeg Richardson International Airport		

Key Takeaway

A growing number of airports are embracing sustainability principles and strive to include green technologies and practices. OECD predicts that $9.6 Billion of airport capital expenditures will be related to airport-specific green technologies. Meanwhile, most airports implement sustainable development plans and initiatives as part of industry-wide efforts to reduce the aviation environmental footprint.

All these trends create favorable market conditions for sustainable solutions with airport applications.

12.3 GreenPort Concept: Airport-Specific Technologies for Greener Airports

Concept

The proposed Concept aims to make Kingston Airport sustainable in an enterprising way by initiating, facilitating and implementing projects jointly with other parties. Branded GreenPort, the project will provide a unique facility for developing, planning, testing and improving new, sustainable and more efficient technologies/processes for the use of airports.

GreenPort will act as a driving force, an incubator, test bed and a manufacturing park dedicated to airport-specific green technologies and practices. It will provide technology developers with the environment they need to test their technologies in a real airport setting and ensure they don't jeopardize security or the efficient flow of operations. The proposed environment will also be the ideal location to demonstrate sustainable solutions without disrupting airport operations.

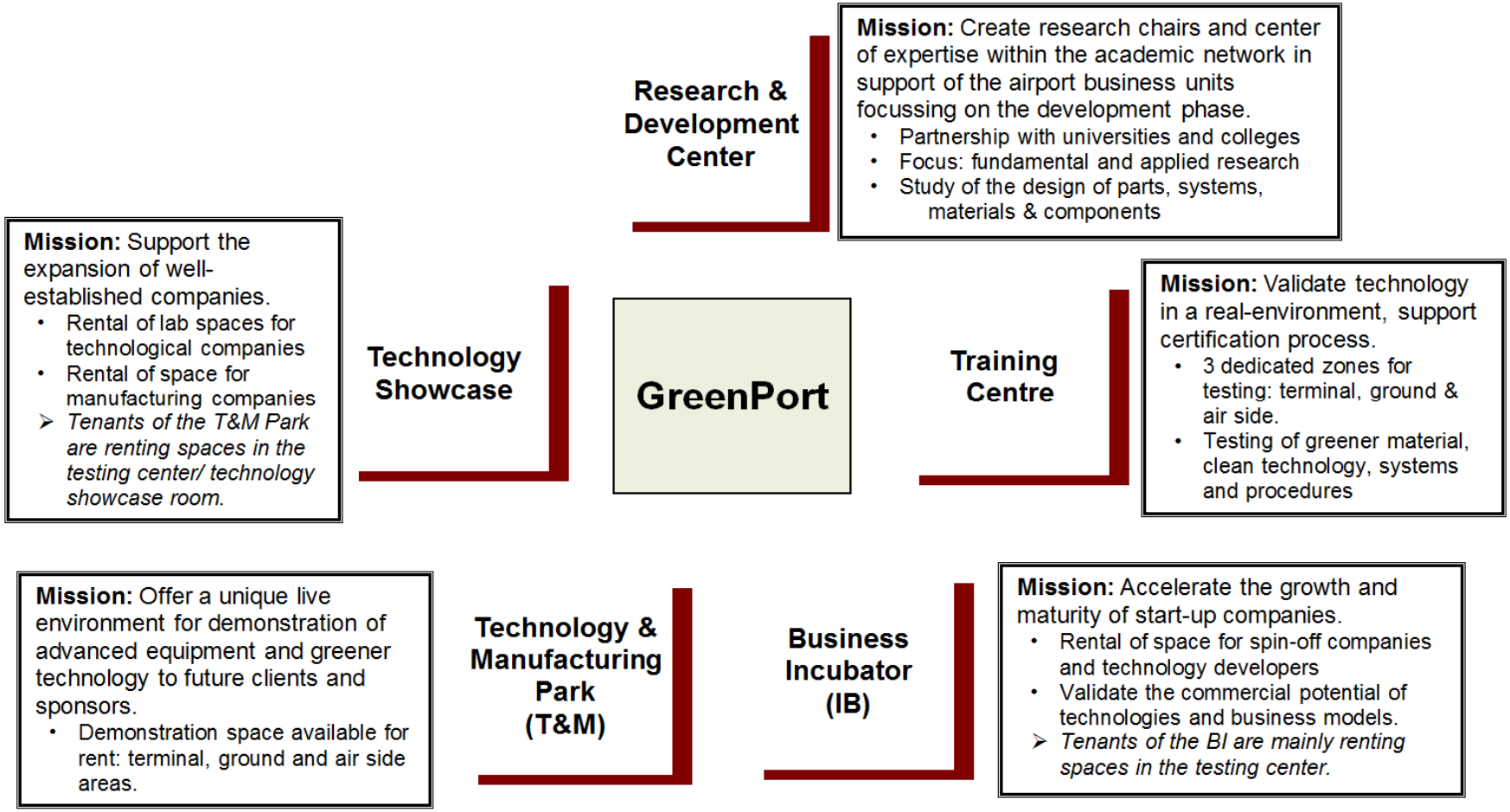
Positioning

As a growing number of airports in Canada and throughout the world plan to modernize and become greener, the GreenPort Concept aims to brand the entire Kingston Airport facility as a sustainable airport cluster. GreenPort's infrastructure will support a central location where airport operators and tenants may commercialize sustainability through

development of green technologies and where energy systems may be placed that will enable access to low carbon energy and geothermal heating and cooling and potentially less expensive on-peak electricity via large scale storage. Through GreenPort, the Kingston Airport would make a commitment to reducing the environmental footprint of their operations and the operations of Airport tenants and take on a leadership position in aerospace sustainability.

Cluster Model and Services

Figure A12-2:
GreenPort's Cluster Model and Services



Kingston Location Advantages and Resources

Local Expertise

The GreenPort Concept is in line with local, provincial and federal commitments to sustainability and climate mitigation and regional priorities and strengths. To exemplify this, Queen's University has five (5) institutes dedicated to clean and environmental technologies research whereas St Lawrence College is home to the Sustainable Energy Applied Research Centre (SEARC), which specializes in collaborative energy innovation research projects and product testing services. A number of additional Kingston-based companies are evolving in the sustainable and emerging sectors, and involved in initiatives that may be suitable for airports.

Table A12-5:
List of Local Organizations with Key Expertise in Green and Sustainable Technologies/Solutions

Organization	Affiliation	Description
Advanced Ceramics and Nanomaterials	Queen's	Processing, microstructure and physical properties of advanced ceramics
Photonics for Life	Queen's	Organic opto-electronic device fabrication and investigation
Jessop Group, Department of Chemistry	Queen's	Green chemistry, switchable/smart fluids
ePOWER (Queen's Centre for Energy and Power Electronics Research)	Queen's	Power electronics research for clean technology and energy applications.
Enviro Innovate	Enviro Ambient	Cleantech accelerator that focusses on a range of clean technologies including industrial energy efficiency and sustainability, fossil fuel focused environmental solutions, metals/electrolysis cell technology, alternative fuels, hydro-electric/alternative energy transmission challenges, geo-thermal, mining and fracking solutions, land remediation and water supply/water security/water quality focused technologies.

Sustainable Energy Applied Research Centre (SEARC)	St Lawrence College	Applied research centre in Solar powered energy, Biomass Fuel Development, and Electric Vehicles.
Veolia Water & Technologies		Endetec provides state-of-the-art and innovative environmental monitoring solutions that contribute to preserving the environment. Technologies include automated microbiological water systems and multiparameters water sensors.
GreenCentre Canada		GreenCentre's mission is to work with industry and academia to advance novel green chemistry research and technologies that improve both the economy and the environment."

In addition, SWITCH Ontario, located in the Kingston Innovation Park, could become a valuable resource for the project. Since 2002, the not-for-profit organization has grown to become a networking hub and a source of technical information and business advice for those involved in alternative energy research, education, project development, policy work and entrepreneurship.

Funding and Development Tools

Government commitment to sustainable technologies translates into a number of funding opportunities from which a project like GreenPort could benefit. Below is a list of pre-identified programs that could help launch the project.

Table A12-6:
Preliminary List of Pre-Identified Funding Programs (GreenPort)

Program	Description
Infrastructure Canada	New Building Canada Fund The $10-billion Provincial-Territorial Infrastructure Component (PTIC) provides funding to support infrastructure projects of national, regional and local significance that contribute to objectives related to economic growth, a clean environment and stronger communities. Under this program, local and regional airports may qualify for funding as long as they: 1) have scheduled passenger traffic; 2) are not located in the national capital or a provincial/territorial capital; and 3) are not classified by Transport Canada as Arctic or remote airports.
ieso Connecting Today. Powering Tomorrow.	Ontario Conservation Fund Open to applications from non-profit and for-profit incorporated entities, including, local distribution companies (LDCs), technology companies, consulting firms, industry associations, educational institutions, and public sector organizations, the Conservation Fund supports projects to develop or pilot innovative conservation programs, practices and technologies. Categories of projects include: • Testing of new conservation programs; • Development of new energy management tools or approaches; • Training programs; • Strategic research; • Demonstration of emerging technologies; • Development of emerging technologies; • Improvement of energy efficiency; • Improvements in demand response and conservation behaviour; • Projects that reduce or displace load.

Green Ontario Fund An agency of the Government of Ontario	The Ontario Green Fund: Funded through proceeds from Ontario's carbon market, the Green Ontario Fund is a not-for-profit provincial agency tasked with reducing greenhouse gas pollution in buildings and industry to help meet Ontario's emission reduction targets. Through programs and rebates the Green Ontario Fund helps people and businesses take climate action into their own hands. Green Ontario Fund Programs not only reduce energy use but help Ontarians grow their savings.
NRC·CNRC Canada Industrial Research Assistance Program Programme d'aide à la recherche industrielle	Industrial Research Assistance Program (IRAP) NRC Industrial Research Assistance Program (IRAP) provides financial support to qualified small and medium-sized enterprises in Canada to help them undertake technology innovation that develops new or improves products, services, or processes in Canada. IRAP also provides companies with 500 or less employees with funding to hire interns for 12 months through the Youth Employment and Youth-Green Programs. SMEs receive a financial contribution geared towards supporting a portion of the salary costs of a youth candidate, who will work on technical opportunities within the firm and on non-technical but technology-related projects.