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Sustainable Systems

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# Sustainable Final Prototype

## An Environmental-Friendly Airport for Chicago O'Hare International

## Objective

Create the popularization of environmentally friendly airports by providing solutions to reduce their use of energy and resources.

## Problem Defined

Airlines are worried about their impact, because flying is an extremely energy intensive practice. And while they may have slowly been improving air pollution to lessen their contribution of environmental harm, they are not actively seeking an entire refurbishment to become environmentally friendly within their interiors by not using sustainable opportunities.

## History and Context of the Problem

The 1950s began with 31 million passengers, with a 95-fold there has been an enormous increase in flights, passengers and cargo. “U.S. airlines and foreign airlines serving the United States carried an all-time high of 848.1 million systemwide (domestic and international) scheduled service passengers in 2014.”<sup>1</sup> At Chicago O’Hare, over 100,000 passengers traveled through the airport by February. According to the International Council on Clean Transportation (ICCT), “the cumulative climate impact of aviation to date is equivalent to about 40 percent of all surface transport modes, even though motor vehicles are far more numerous than planes. Relative to all sources of greenhouse gas emissions, the sector is responsible for about 4 percent of climate change, and its role is rising rapidly.”<sup>2</sup>

Post 9/11, “there was a very serious plot to blow up planes using liquid explosives in bombs that would have worked to bring down aircraft.”<sup>3</sup> This is what caused liquids to be reduced in size, and water bottles to be emptied and disposed before security and entering a concourse. These bottles, however don’t get recycled, but in a landfill.

The National Environmental Policy Act (NEPA) enacted in 1970 was what initiated airports to join the environmental movement, and begin with the reduction of air emissions and noise. As part of President Barack Obama’s “all of the above” energy strategy, the “Department of Energy is providing \$2.5 million to major airports for fuel cell electric towing tractors that transport passenger baggage.”<sup>4</sup>

## Target Audience

### *Chicago O’Hare International Airport*

They host a myriad of flyers in their airports, and thus have the opportunity to educate flyers, while encouraging other airports, large and quaint, to follow suit. Chicago’s O’Hare Airport is one of two large airports that compose the Chicago Department of Aviation, and actively hosts Airports Going Green alongside the American Association of Airport Executives (AAAE). “The Sustainability Review Panel (SRP), which includes LEED® accredited staff, continually tracks,

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<sup>1</sup> United States Department of Transportation

<sup>2</sup> World Watch

<sup>3</sup> TSA Blog

<sup>4</sup> Alliance to Save Energy

monitors and reports on sustainability achievements as part of SAM. Green Airplane Certifications were established to recognize those who meet or exceed contractual obligations to incorporate sustainable initiatives into projects. Since 2003, designers, contractors, consultants and construction management teams have reviewed over 58 projects.”<sup>5</sup>

### Existing Solutions in Chicago

- “Water Efficient Landscaping
- Restroom Modernization
- Single-Stream Recycling
- Battery Recycling
- Liquid Collection Stations
- Filtered Water Bottle Refill Stations
- Composting
- Solar Photovoltaic Energy System
- Energy Efficiency Upgrades
- Retro-Commissioning
- Aeroponic garden

### Their path for 2015:

- Energy – Reduce energy consumption by 15 percent
- Natural Resources – Reduce potable water consumption by 10 percent
- Waste – Divert a minimum of 50 percent of waste from landfills
- Ground Transport – Maintain a fleet of at least 20 percent green fleet vehicles
- Community – Reach the Airport Service Quality (ASQ) program’s Top 10 ranking as a means to measure and evaluate passenger experience

### Their goals for 2015:

- Implement additional airfield, parking and facility lighting retrofit projects
- Retro-commission the Heating and Refrigeration Plant at O’Hare and the terminal and concourses at Midway
- Explore rainwater collection systems
- Adopt more rigorous 'packaging and disposable item' policies for concessions to reduce non-recyclable waste, encouraging and rewarding them using the SAM Green Airplane rating system
- Develop a multi-alternative fueling station at O’Hare that offers compressed natural gas, electric vehicle charging, biodiesel and/or other alternative fuels
- Install up to 52 acres of solar panels at O'Hare
- Expand the Chicago Green Taxi Program
- Pursue development of an intermodal transportation center at O'Hare

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<sup>5</sup> Fly Chicago

### Accomplishments so far:

- Diverting 98 percent of O'Hare Modernization Program (OMP) construction waste from landfills
- Saving the equivalent water usage of 1,750 Chicago households by upgrading water fixtures
- Releasing an RFP for up to 52 acres of solar development at O'Hare
- "Retro-commissioning" O'Hare Terminal 5 and the Aviation Administration building
- Maintaining a total of eight acres of vegetated green roofs
- Enhancing and restoring wetlands at eight separate locations
- Producing over 1,000 pounds of produce at the O'Hare Aeroponic Garden to provide healthy, local food for O'Hare passengers
- Issuing an SAM Green Airplane rating to seven restaurants at O'Hare and Midway under the Concessions and Tenants rating system and the O'Hare Airport Maintenance Complex under the Operations and Maintenance rating system
- Grazing Herd"<sup>6</sup>

These accomplishments are superb because they apply to a variety of changes instead of a few (generic) ones. However, there is a chance to be innovative to other airports and educational to passengers still.

### **Existing Solutions In Other Airports**

- "Stansted Airport hits recycling target three years early
- Newquay Airport Solar Park to supply airport
- 300 solar panels on Geneva Airport's roof
- Greece – Athens Airport supports local communities
- Newark, JFK and BWI turn to solar power
- Cleveland recycles cooking oil into bio fuel
- Plastic banned in Bangalore"<sup>7</sup>

These are great initiatives that can reduce energy, reduce resources from going into landfills, and benefit the well being of others. However, they aren't substantial enough to make a large percentage of environmental improvement.

### Leading Airports:

Hong Kong's International Airport is currently striving to be the world's first greenest airport. "In 2012, they developed over 120 environmental initiatives covering a wide range of environmental areas including carbon reduction, energy saving, air quality, waste management and more."<sup>8</sup> They have essentially invested a lot of time to consider many aspects. However, United States significantly has more flights than China, therefore pushing the concept that the U.S. needs to compete with this environmental mindset.

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<sup>6</sup> Fly Chicago

<sup>7</sup> Centre For Aviation

<sup>8</sup> Hong Kong Airport



“Boston (Mass.) Logan International Airport became the world’s first LEED-certified airport terminal in 2006. Its energy-efficient features include roofing materials that reflect the heat of the sun; automated and/or self-dimming lights throughout the facility; and restrooms with slow-flowing faucets and waterless urinals. Logan Airport also promotes eco-friendly transportation options to and from the airport, encouraging passengers to take the T (which has a stop at every terminal); request hybrid cabs (400 of them service Logan); or share a cab through a free iPhone app. In addition, special controllers installed on moving walkways reduce the power draw of their electric motors 24 hours a day for a savings of about 60,000 kWh per year.

Dallas-Fort Worth (Texas) International Airport is so energy-efficient that the Alliance granted it the Star of Energy Efficiency Award in 2005. Just a year before that win, DFW implemented a “continuous commissioning” program, in which the building control system continuously monitors key areas and equipment for inefficiencies. The program – which senses changes in the weather and occupancy to trigger reprogramming in building automation systems – has saved over \$6 million in energy costs. DFW’s heating and cooling plant also includes a thermal energy storage system that shifts electrical loads to off-peak hours, which increases the efficiency of cooling operations and cuts costs.

Chattanooga (Tenn.) Airport’s new energy-efficient, 9,000-square-foot corporate flight center terminal facility was awarded LEED Platinum rating in February 2012, making it the first aviation terminal in the world to achieve this level of certification. The certification was based on the airport’s energy efficiency measures – including reserved parking for fuel-efficient vehicles – as well as renewable energy measures, which involve a halfway-completed 3 MW solar array that will power the entire airport. In addition, the 12,000-square-foot aircraft hangar at Chattanooga Airport is a LEED Gold-certified facility. The hangar’s energy-efficient features include an infrared heating system and a unique daylighting structure that brings windows into the hangar.

Denver International Airport is known as being efficient in all respects, holding the title of America’s Best Run Airport from Time Magazine. The LEED-Gold DIA was the first international airport in the United States to implement an ISO 14001-certified environmental management system that encompasses the entire airport. Improvements include a state-of-the-art parking “canopy” that is lit by LEDs and features geothermal heating and cooling. To save fuel in its aircraft on the ground, every mainline gate provides parked airplanes with plug-in power and pre-conditioned air so planes can turn off their on-board auxiliary power units. And to save fuel in ground transport, the airport conducted fleet vehicle retrofits that led to replacements with hybrid and electric vehicles; meanwhile, passenger pick-up and drop-off locations sport ‘no idling’ signs.”<sup>9</sup>

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<sup>9</sup> Alliance to Save Energy

These airports have made great strides toward environmental thinking, and sustainable choices. However, the flow of these changes hasn't effected the average passenger. Maybe indirectly these changes benefit, but the amount of change that benefits the environment is still minute in proportion to their entire waste.

## Final Solutions

In a infographic display the following solutions with a sampling of simulated images:

- A. Sell less plastic water bottles, and offer reusable water bottles instead. This not only brings walking promotion around to different airports, but encourages to actively seek water refill stations, and think about their reusing actions.
- B. Have water refill stations everywhere (a beginning renovation at O'Hare), but also hold a contest for drinking fountains to be redesigned.
- C. Have recycled chairs instead of newly designed ones (like Herman Miller office chairs). Also have the older chairs recycled to other programs, like Portland Airport.<sup>10</sup>
- D. Use thinner TSA bins and security detectors. This will then require less plastic (saving money and resources) and also be more cost effective in the long run.
- E. Cut back on paper tickets, by only allowing electronic passes.
- F. Only use hand dryers instead of paper towels. ("Airport restroom facilities at O'Hare by installing high-efficiency faucets, toilets and urinals to conserve water. The CDA is also incorporating more natural light to reduce the electricity demand and performing other techniques to conserve water and energy,"<sup>11</sup> but doesn't mention reducing paper).
- G. Make a digital copy of the passenger info page instead of paper (what the gate gives to the plane). This will help reduce ink and trees being cut down, by relying on the passengers to provide their information.
- H. Use solar panel architecture instead of traditional panels to generate their energy. While they may have plans to install and operate up to 52 acres of ground-mounted solar panels around O'Hare on vacant properties, they also have an opportunity for artists to combine science and art with these vacant lots.
- I. Use windmills to also generate their energy.
- J. Reduce their light energy with timers and sensors throughout the airport, similar to Boston.
- K. Use motion censored escalators. "The escalators, which use infrared motion sensors, will slow to just 15 feet per minute when no one is on them, compared with the normal full speed of 100 feet per minute. Besides the energy consumption which is saved (up to 30%), the rest the machines get when running at a slower pace also means that there is less of a strain on them. This results in less wear and tear, less breakdowns and repairs, and an extended life of 11-13%." <sup>12</sup>

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<sup>10</sup> USA Today

<sup>11</sup> Fly Chicago

<sup>12</sup> toktoktk

- L. Use the friction on the runways from the planes coming and going to use as renewable energy. This will help lower the amount of fossil fuels required to generate the airport, so that most of the fossil fuels needed are to fuel the airplane and airport cars.
- M. Advertise O'Hare's aeroponic garden (first in any airport in the world<sup>13</sup>) larger.
- N. Embrace the opportunity for green walls. This would be located after security in the terminals, when the walls funnel to each concourse. This helps improve "aesthetics, regulate temperature and reduce carbon footprint, can reduce energy costs by both providing an additional layer of insulation, improve air quality, and reduce noise."<sup>14</sup>

### Sustainable Pros and Cons

These solutions are all targeted to benefit the environment by compensating for the drastic effects on the environment, or correcting from using more energy or resources. Half of the changes encourage passengers to live with an environmental mindset, and practically educate a better lifestyle. While the other half of these solutions encourage large businesses to think and challenge themselves to be more unconventionally green. Overall, these renovations provide more employment while benefiting the overall natural-like traveling experience.

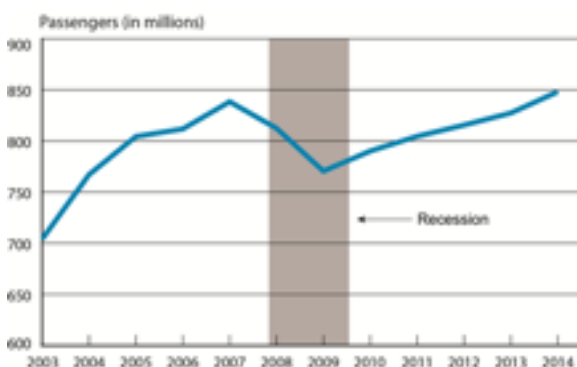
While some may reduce resources, it does require more energy:

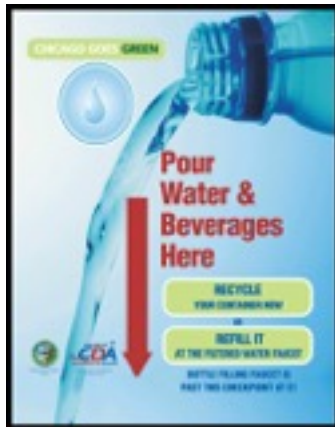
- Going to electronic-only requires more outlets for chargers.
- While using reusable water bottles may prevent less in the landfills, it takes more plastic to make a single.
- Hand Dryers may reduce paper, but requires more energy to produce the high-speed air.

### Reason Why This Plan Should Be Pursued

Airports are generally a place of layovers, and repetition of bland ideas. Chicago has the opportunity to not only embrace their artistic side, but also their green side. They have the prime location to educate, and rehabilitate travelers of all ethnicities on how to improve the earth with lifestyle changes. They demonstrate this also by leading an example for the airport industry. Granted Hong Kong is further down this sustainable path, it shouldn't discourage the innovative Chicagoans to lead the United States into a collective, depart to arrival sustainable experience.

## APPENDIX









[FROM TOP, LEFT TO RIGHT: 1) chart of passenger increase 2) Plant Wall 3) Water Refill station 4) Chicago O'Hare's solar panel 5) Chicago O'Hare's liquid disposal 6&7) Redesigned water fountains 8&9) Solar Panel Art 10) Solar Panel Architecture 11) Solar Panels at a Japan Airport 12) Windmills at Airport]

### Final Project Infographics









# SUSTAINABLE AIRPORT INITIATIVES

- 
- Advertise O'Hare's aeroponic garden (first in any airport in the world) larger.

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- Embrace the opportunity for green walls.



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integrate





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