GLOBAL AIRPORT CITIES

Issue 2 Volume 4

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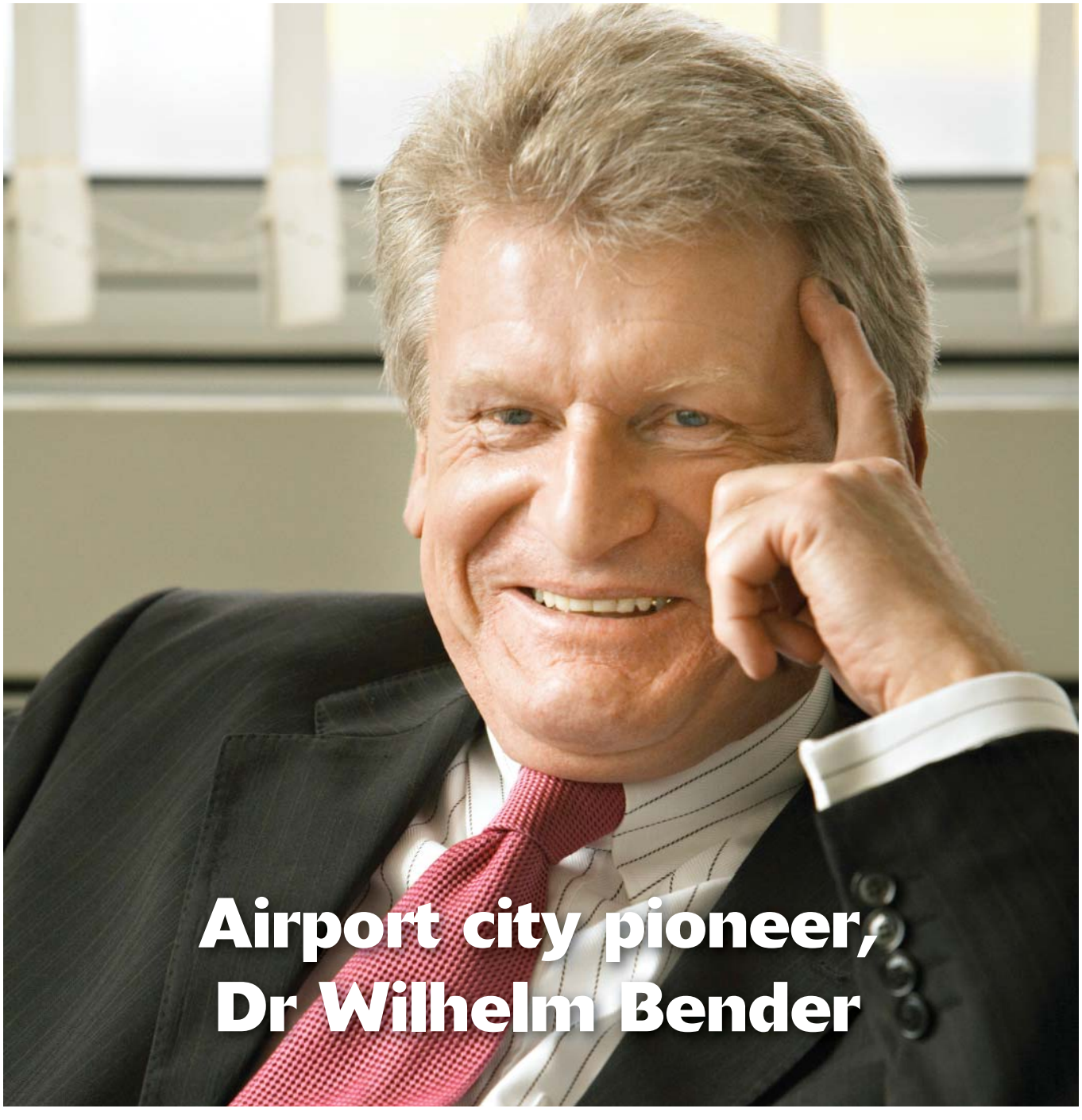

Airport city pioneer, Dr Wilhelm Bender

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Green power

Airports are fast becoming pioneers in the use of green and renewable energy solutions, write Chris LeTourneur and Andrew Fayn.

As airports evolve into airport cities, energy management is becoming a critical element of business strategies as operators look to reduce costs, generate new revenue streams, and become sustainable and more environmentally responsible.

The significant physical infrastructure demanded by airports requires substantial amounts of electric energy. Regions throughout the world are struggling to meet energy requirements for growing populations, with energy production at or near capacity.

Energy solutions typically involve large scale projects that cost hundreds of millions, or even billions of dollars in funding, and energy sources have historically come from non-renewable sources such as coal, natural gas and nuclear power generation.

In response to global economic challenges and ethical objectives towards sustainability, airport managers are exploring opportunities for reducing energy consumption and operating costs to reduce landing fees and remain competitive.

According to reports, a standard regional airport handling five million passengers per year uses approximately 20% of its energy on heating, 21% on cooling, 23% on lighting and 2% on hot-water.

The remaining 34% of energy is used for a variety of operations such as baggage handling equipment, check-in computer processing, catering and security.

Introducing techniques to lower energy consumption and reduce airports' dependency on the energy grid is an on-going challenge for airport designers and managers. The evolution of green and renewable energy at airports is unfolding in the following four stages:

Reduce energy consumption

Various 'green building' techniques are being adopted by existing and new airport buildings to reduce energy consumption. Recognising the need to illuminate large, open spaces, an immediately effective energy conservation method involves installating 'Low-E-Glass' window pane/glazing.

During cool seasons, Low-E-Glass prevents heat from escaping through the glass, while transmitting short-wave solar energy through the glass, providing an additional heat source. During warm seasons, it reflects surplus sun rays away from the building, thus reducing heating, ventilating and air conditioning (HVAC) demands.

In 2008, Shenzhen International Airport, the fifth busiest airport in the People's Republic of China, installed Low-E-Glass in their new, 10-level, 30,000sqm Airport Command and Information Center. While it is too soon to assess the direct amount of energy saved at this airport, HVAC air conditioning and heating has been reported to be used infrequently, and visitors claim the internal building climate is very comfortable.

At Beijing Capital International Airport's new Terminal 3, natural light is used extensively in the building design to reduce the amount of energy required to

Solar power at Vancouver International Airport.

illuminate the terminal during daylight hours. The aesthetically pleasing arched roof is made completely of girders and glazed glass, allowing natural sunlight to flood into the terminal building from all sides, balancing the temperature and reducing the need for heating and cooling.

Investing in 'smart energy' technology is also an affective way to reduce energy consumption and expenses. At Mineta San José International Airport in California's Silicon Valley, a high-technology HVAC system controlling the climate within the terminal was installed in 2008.

Within the first five months of operation, this new system, run by intelligent software, saved more than 235,000 kilowatt hours of electricity, totalling savings of over $35,000. According to Optimum Energy LLC, the provider of the HVAC Smart Energy software systems, these energy savings equate to a reduction of almost 300,000 pounds of carbon emissions.

Also in the San Francisco Bay Area, during its recent renovation and expansion programme, Oakland International Airport used green building and smart energy methods to reduce energy consumption. As a result, energy saving light fixtures shut off or dim in response to the amount of daylight, in harmony with a Low-E-Glass window glazing system.

Additionally, skylights that allow natural light to flood in during daytime hours have been installed in interior zones that do not have windows. Also installed was a smart energy HVAC system that controls ventilation rates based on the number of people within the terminal using sensitive carbon dioxide sensors.

When there are fewer passengers in the terminal, ventilation decreases, increasing energy efficiency. These combined energy consumption reduction techniques are projected to reduce Oakland International Airport's annual energy consumption by an incredible 57%.

Reduce energy costs – generating on-site energy

The next stage of renewable energy and environmental stewardship for airports involves generating their own energy through on-site micro-utilities.

In pursuing energy solutions that are environmentally, socially and economically feasible, airports are turning to generating their own renewable energy. Popular 'green energies' introduced at airports include solar photovoltaic (pv), wind and both geothermal and resource extraction.

The increased demand for 'clean energy' sources has stimulated airports to experiment with these various technologies to reduce their need for drawing power from the larger regional grid.

Over the past decade, solar energy generation has become popular at airports due to technological advances in solar pv panels.

One of the concerns that once hampered investment in solar panels at airports was the safety risk posed by the light reflection onto aircraft. However, this effect only occurs from older-tech solar thermal panel installations. The newer solar pv panels are completely non-reflective and present no danger to pilots operating aircraft.

Two airports in the US have made significant investments by installing solar projects over the past year. Denver International Airport (DIA), the nation's fifth busiest airport in terms of passenger traffic, completed its project in the summer 2008.

Its system consists of 9,200 panels over 7.5 acres of land flanking the highway (Pena Boulevard) that connects the City to DIA. The airport predicts that the energy generated by the solar pv panels will offset 6.3 million pounds of carbon emissions per year that otherwise would have been created by non-renewable energy sources from the regional grid.

Unlike previous solar pv projects that have utilised five-position solar panels, the DIA project uses solar pv panels that swivel from east to west to follow the sun throughout the day. This technology facilitates maximum retrieval and collection of solar energy.

Fresno Yosemite International Airport in Fresno, California has taken a different approach in the installation of its solar pv panels, which cover more than 25 acres of land.

One set of panels is installed over the top of a new rental car parking area. Accordingly, the panels serve the dual purpose of capturing solar energy while shading the parking area. The other set of panels is placed in an area of land that cannot be developed with buildings due to the airside system requirements and clearway zoning, therefore turning a potential revenue loss into a revenue opportunity.

Possibly one of the most recognised solar pv projects worldwide is found on the roof of Munich International Airport's Terminal 2 check-in concourse. This solar energy generation project produces over 500,000 kilowatt hours of electricity per year, representing enough power to service two hundred homes.

Although solar pv energy continues to grow in popularity, some discredit its use for large scale projects that require significant amounts of electrical energy due to storage limitations.

However, strengths of solar energy are that it is relatively pollution free, facility maintenance is almost non-existent and once a system has been established through initial capital funding, operating costs are low compared to that of other technologies. Furthermore, the sunlight needed to produce energy is constant and abundant in most areas of the world.

The largest obstacle preventing solar pv energy from becoming more main stream at airports is the cost of initial installation of the panels and facilities. Experts report the economic payback period on capital investment ranges from ten to twenty years depending on the size and complexity of the system.

Even though solar power may be environmentally sustainable, it is important that the renewable energy be economically sustainable for the airport as well. However, as solar power becomes more popular, it is anticipated that installation costs will be reduced, allowing for faster economic payback.

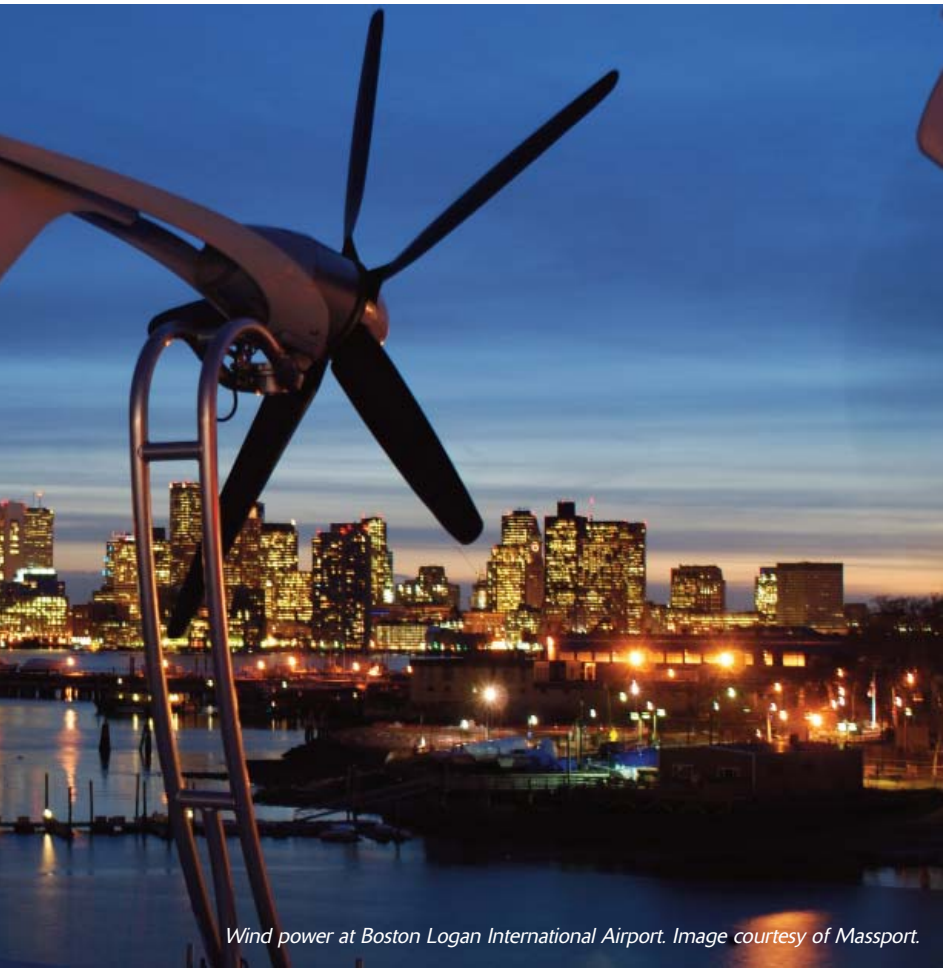
Wind power is a more established form of clean energy compared to solar energy, with over 80 countries using it to today. Large-scale commercial wind farms are found throughout Europe, particularly in Denmark, Spain, Portugal and Germany.

The movement towards establishing wind turbines for energy generation at airports has faced challenges due to possible interference with aircraft and structural height limitations.

The Massachusetts Port Authority (Massport) has found a way around this challenge by installing 20 small wind turbines on the roof of the Logan Office Center at Boston Logan.

Each turbine measures approximately six feet in height and eight feet in width. Combined, these units are expected to produce enough electrical energy to offset approximately 2% of the building's monthly energy use. This is currently an experimental project that is generating a relatively small amount of power to offset power requirements.

Similarly, at Minneapolis-St Paul International Airport, wind-powered turbines were installed on top of the airport fire station, generating 10 kilowatts of electricity per hour



Wind power at Boston Logan International Airport. Image courtesy of Massport.

(3,650 kilowatt hours of electricity per year). The energy produced is sufficient to power the airports electric utility vehicle, which is used by parking operations and security staff.

This initial pilot project facilitates testing the potential of wind power at the airport to establish future goals and plans for renewable energy practices.

Although these initial projects examining the viability of wind energy generation at airports may seem small scale, the fact that wind power consumes no fuel and emits no air pollution can not be overlooked. With continued technological advances along with ingenuity, wind energy generation is projected to unfold on a much larger scale at and around airports.

Solar and wind power are not the only forms of alternative renewable energy that are making their way into airports.

Indeed, Paris Orly may be launching one of the most ambitious undertakings into the realm of sustainable green energy by investing up to €12 million on extracting and harnessing geothermal energy from a mile underground.

By drilling down almost 1,700 metres, two shafts containing returning thermal water pipes will provide access to an underground water table that is heated by the earth's core. The geothermally heated water pipes will be circulated into the airport heating system through natural pressure, and then pumped back into the ground for re-heating and circulation.

Geothermal is cost effective after initial capital installation, very reliable and environmentally sustainable. Currently, the challenge for geothermal energy is that it is geographically limited to areas in proximity to tectonic plates of seismic activity.

If an airport is not located over a geothermal 'hot spot', the chances of harnessing this type of energy are difficult. Paris Orly has a prime location for geothermal activity, and plans to meet one-third of its heating energy needs in this way after the project begins in 2011.

If successful, this project will spawn other airports to explore geothermal energy opportunities, particularly those located around the Pacific Rim in Asia and North America, where tectonic activity is strong.

Achieve self-sustainability – meeting all airport demands on-site

The question often raised regarding renewable energy at airports is whether on-site energy generation could fully meet airport energy demands, to become fully 'zero-net' and self-sustaining.

Although many airports are far from achieving this objective and are experimenting with green energy methods, San Francisco International Airport (SFO) is on the fast track to becoming energy sustainable.

SFO's Terminal 3 building features 2,800 solar pv panels, which were installed on its rooftop in 2007 and provide enough electricity for all the daytime lighting needs within the terminal.

European airports are taking the stance that becoming zero-net is a plausible feat that could become a reality sooner than we think, in an attempt to address those who view airports as significant emitters of carbon dioxide emissions.

In June 2009, 31 European airports launched a programme that looks to cut their carbon footprints to zero-net carbon neutral.

While there is no set deadline for this achievement, it displays the serious objectives airports are making to respond to environmental and renewable

energy demands. Europe's largest airports, including Schiphol, Paris CDG and Frankfurt have signed the agreement.

Methods discussed to become carbon neutral have included cutting emissions from ground transportation by using more electric vehicles, increasing the amount of renewable energy and reducing energy consumption within the terminals and hangars.

Generate surplus energy back on to the grid

Once airports have achieved self-sustainability, the next stage in green and renewable energy is to generate surplus energy that can be sold back to the electrical grid.

Airports would therefore have the ability to create new revenue streams to pay for the generation of energy on-airport through a micro-utility plant to serve airport needs, as well as funding for new infrastructure and terminal upgrades and expansion.

At Delhi–Indira Gandhi International Airport in India, the Cleantech Group has just this idea in mind.

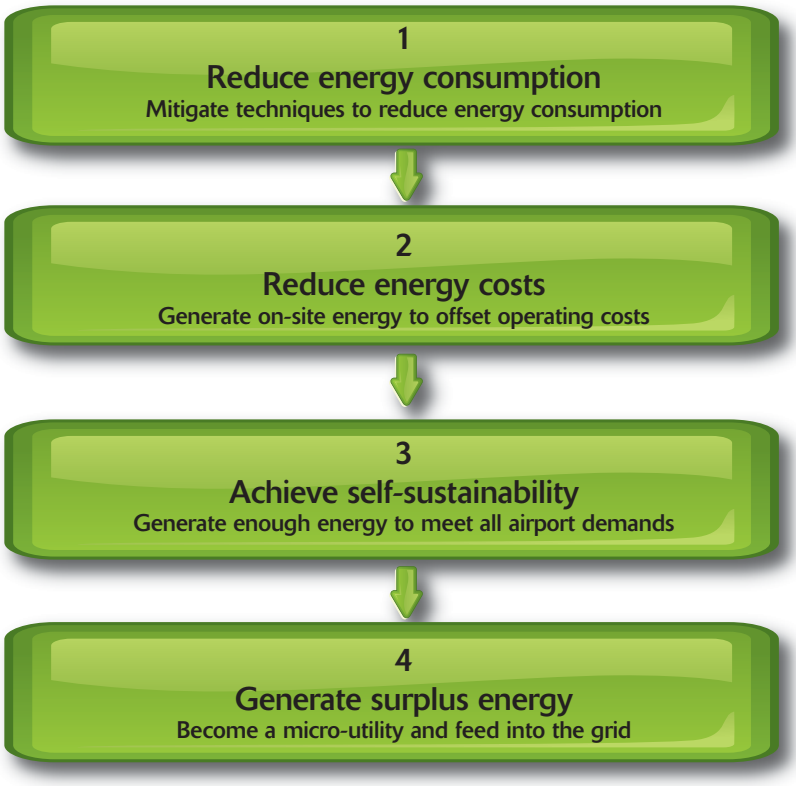
Its inspiration is the fact that the airport currently experiences electrical blackouts due to the shortage of power running on the main grid throughout Greater New Delhi.

And with a continually increasing population, the situation is only likely to worsen in the future if new energy sources are not found.

The concept that may solve this issue is a $28 million power plant that generates energy by using municipal waste. The complex would not only stop blackouts from occurring at the airport, but would generate enough power to provide 50% of the electricity created to be sold back onto the grid for Greater New Delhi to use. Cleantech is hoping this plant will be up and running by the fourth quarter of 2010.

Although this renewable energy is not as clean and carbon neutral as solar pv panels or wind turbines, it produces much more power than both techniques and reduces the amount of waste in municipal dumps that are currently overflowing.

The four stages of green and renewable energy at airports



Conclusion

There is no doubt that airports are becoming more environmentally responsible while remaining competitive and economically sustainable.

The evolving 'green' movement in building construction and operations today does not only apply to residential or commercial buildings. Airports are a major part of the urban environment and they must continue to find innovative ways to be green and become sustainable.

Whether harvesting rainwater in India or recycling hundreds of tonnes of coffee grounds at compost stations at Seattle-Tacoma International Airport, gateways around the world are taking part in the green and renewable energy revolution that is sweeping the globe.

And the outlook for renewable energy is bright. With advances in technology occurring at a pace never seen before due to globalisation and information sharing, airports have the ability to become more energy efficient through the creation of their own micro-utilities.

Economic capital costs may seem high at the moment, but these will become rationalised as demand for such approaches rises in coming years. The continued movement towards a 'zero-net energy self-sustaining airport', capable of generating its own energy as well as creating revenue through a private micro-utility to sell power back to the grid, is a goal that may not be as far off as we think.

About the author
Chris LeTourneur is president and CEO of Canada-based MXD Development Strategists.
He can be contacted at chris@MXDdevelopment.com