

Solar photovoltaics in airports

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Introduction

Several airport operators around the world are implementing climate initiatives at their airports, such as installing photovoltaic plants and powering aircraft on the ground with renewable energy. This article presents three examples of concrete renewable energy projects being implemented in Austria, Brazil, and Kenya. They are ready to be replicated worldwide today.

Vienna Airport's Push on photovoltaics and energy efficiency

The Austrian Federal Government has ambitious climate and energy goals, including 100% clean electricity in and from Austria by 2030. The Renewable Energy Expansion Act provides the legal framework and is part of a legislative package by the European Union, which supports our activities to combat climate change. To achieve these goals, Austria relies on investments, innovation, and cooperation.

Vienna Airport has defined an even more ambitious goal and is committed to achieve CO₂ neutrality in its operations by the year 2023 despite its future growth. In order to achieve this target, Vienna Airport, among other initiatives such as energy efficiency programs and other measurements to reduce CO₂ emissions, already obtains CO₂-free electricity from its supplier. Vienna Airport also relies on the use of photovoltaics to secure this development in the long-term.

Photovoltaics: What is it all about?

Photovoltaics is the direct conversion of light into electrical energy using semiconductor materials such as silicon. The photovoltaic effect is an important phenomenon that is being researched in physics and chemistry.

The word photovoltaic (PV) was first mentioned around 1890 and is composed of the Greek words photo, “phos” for light and “volt” for electricity. Photovoltaic technology uses semiconductors to generate electricity based on photo electricity. By harnessing the photovoltaic phenomenon, solar energy is converted into electricity and used as an alternative to conventional means of power generation. Photovoltaic systems are sometimes also referred to as solar cells. When several solar cells are electrically connected within a supporting structure, a photovoltaic module is created.

Construction of Austria's Largest Photovoltaic Plant

Since 2016, Vienna Airport has operated seven photovoltaic plants on the roofs of Hangar 7, the old winter service hall, the Air Cargo Centre, the area of the former sewage treatment plant, the new Office Park 4, on the roof of multi-storey car park 8 and, most recently, on the roof of multi-storey car park 3.

In the autumn of 2021, the ground-breaking ceremony for the construction of an eighth photovoltaic plant took place. This plant will extend over an area of 24 hectares and will provide an output of approximately 24 megawatts peak. With its around 55,000 photovoltaic panels this plant will be Austria's largest ground-mounted plant.

After commissioning in spring 2022, the photovoltaic plants at the Vienna Airport site will generate an output of around 30 million kilowatt hours of solar power per year, and thus will cover around 30 per cent of Vienna Airport's annual electricity consumption - the same amount as consumed by 7,000 households.

Further measures of the energy-efficient operation of the airport

The expansion of the photovoltaic systems is just one of many measures within the framework of energy-efficient environmental management at Vienna Airport. For example, the airport is increasingly focusing on e-mobility and operates an e-fleet with currently around 400 e-vehicles. The use of fossil fuels will be gradually reduced and, where the use of such fuels is currently still without an alternative, compensated for accordingly. The lighting systems at Vienna Airport are gradually being converted to energy-saving LED systems. The new Office Park 4, which was commissioned in 2020, uses geothermal energy and has received several awards as the most sustainable office building in Austria. A Smart City control software developed together with the Vienna University of Technology supports the energy optimisation of existing and future buildings.

District heating: 21,000 tonnes of CO₂ Savings per Year in the Airport System

The Austrian energy company OMV, will expand the existing supply of the district heating network by expanding the district heating hub at the Schwechat refinery. In doing so, OMV will use the waste heat from the desulphurisation plant. This is a diesel production plant with a vacuum distillation plant at the OMV Schwechat refinery and convert it into environmentally friendly district heating. The heat recovery plant will go into operation in the first half of 2022. One of the largest consumers of this new environmentally friendly district heating is Vienna Airport. Connected to a direct line from the OMV refinery in Schwechat, the entire airport site with approximately 150 buildings is supplied with CO₂ free heat. This will save around 21,000 tonnes of CO₂ per year in the airport system.

All this effort brings Vienna Airport a large step closer to its goal of becoming CO₂-neutral by the year 2023.

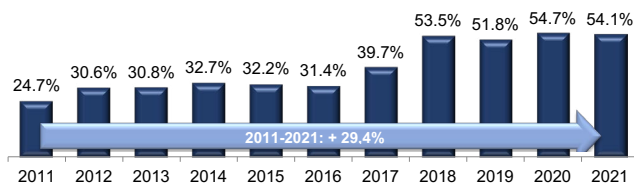


FIGURE 1: Share of renewable energy as a percentage of total energy demand FWAG



FIGURE 2: Members of the Board of Flughafen Wien AG: CFO Günther Ofner and COO Julian Jäger 24 hectares and approximately 55.000 photovoltaic panels

Renewable energy to power planes on the ground: a Brazilian international airport experience

With the goal of cooperation and to reduce the airport’s carbon footprint and assist the airlines with sustainability, Inframerica, the company that manages Brasília International Airport (BSB/SBBR), located in the capital of Brazil, together with ENGIE, a global leader in energy and solutions, entered a partnership to supply energy from renewable sources to power the electrical and air conditioning requirements of planes parked at the terminal of Brasília Airport.

This new technology replaces the diesel-powered external generators, known as GPUs (Ground Power Unit), and supplies the aircraft’s micro turbine, called APU (Auxiliary Power Unit), which normally uses kerosene from the aircraft itself. The equipment is used by the airlines to keep the aircraft connected during the time it spends on the ground in the sun, and to save on kerosene, which is expensive for airlines.

This new solution, in addition to reducing the carbon footprint and eliminating the use of generators on the airport apron also makes the operation safer, as it dispenses with the obstacles of generators filled with fuel in areas where vehicles manoeuvre, and people work. There is also a reduction in the noise level at the airport which is a bonus for the health of the employees who are exposed to high levels of noise daily. The system also significantly contributes to improving the operational efficiency of aircraft while parked on the airport apron.

The project was developed by ENGIE together with Inframerica, and the equipment was installed at 22 air bridges at the airport (Figure 3). Installation took 10 months to complete, and the work began before the pandemic, and the equipment went into operation in January 2021. Even with the reduction in air traffic caused by the effects of the second wave of pandemic restrictions, more than 22,000 aircraft have used the service over the past year.

This new technology allows for a significant reduction in airport's associated greenhouse gas emissions. The projection is that the equipment will reduce CO₂ emissions by at least 20 thousand tons per year, which is equivalent to planting more than 120 thousand trees, making the operation of Brasília Airport more economical and sustainable. This is a commitment made by Inframerica and highlights the companies' policy to reduce greenhouse gases and develop sustainable operational solutions.

The new system is part of a sustainability project that the concessionaire has been investing in to reduce CO₂

emissions from airport operations by including clean energy sources. In September 2020, the administration started using energy from a photovoltaic plant installed at the air terminal. The city of Brasília benefits from a high solar incidence, and the airport has a vast open area with no buildings nearby, all of which favour the situation of the project.

The concessionaire dedicated an area of 18,300 square meters to the project, close to the airport access area (Figure 4).

The system is operated by a Japanese start-up company, Shizen Energy, which operates in Brazil under the name of FazSol Energias Renováveis, in partnership with the Brasília real estate company Espaço Y. Solar energy is already being used to supply part of the airport's consumption. The 3,360 photovoltaic modules produce 2 million kWp of energy per year, which supplies 7% of the airport's demand, a load, that for example, would be enough to supply electricity to 1,462 average homes.

The sustainability measures adopted by Brasília Airport were recognized in the First edition of the Sustainable Airports Project by the National Civil Aviation Agency (ANAC). The terminal at Brasília was also awarded the seal of Advanced Sustainable Aerodrome, being one of only four among the 23 airports evaluated in the survey. In addition to this seal, the terminal in Brasília was also recognized, for the first time, with a gold seal by the Brazilian GHG Protocol (Greenhouse Gas Protocol) Program, which publishes inventories of greenhouse gas (GHG) emissions. The Airport



FIGURE 3: Brasília International Airport 400Hz in operation at airport's air bridges.



FIGURE 4: Photovoltaic plant near airport's main road access (Source: Google Earth Pro).

Council International (ACI) has also awarded the airport with an international certificate of carbon management, the Airport Carbon Accreditation (ACA).

Solar At The Gate Project At The Mombasa International Airport, Kenya

A pilot project was implemented in Kenya with strong support from the International Civil Aviation Organization (ICAO). It consisted of a ground-mounted photovoltaic system of 507kW solar power generation facility and mobile airport gate electric equipment. This innovative project was launched on 12th December 2018 at Moi International Airport in Mombasa, Kenya.

The facility provides pre-conditioned air (PCA) and compatible electricity that runs on solar energy to service aircraft during ground operations which eliminate carbon dioxide emissions from aircraft parked at the gate. The system has been in operation since April 2019, when the site acceptance tests were conducted, and the system commissioned.

The project installed an auxiliary power unit (APU) and a ground power unit (GPU) for use by aircraft at Moi International Airport that are powered by clean energy from solar. This has helped to reduce the use of fossil fuel (diesel) by powering the APU and GPU at the airport. The system has also helped to run on-board systems and interior cooling before aircraft depart for their next flight.

The solar facility has generated 737,014.86kWh annually on average with a total power generation of 2,092,959.8 kWh as of December 2021. Thus, it has reduced on average 704.225 tonnes of CO₂ annually. In total, the amount of carbon dioxide emissions reduced equalled 1,932.422 tonnes as of December 2021. The airport gate equipment serves more than 1,497 flights per year, with both GPU & PCA consuming 75,816.96 kWh in 2021, therefore demonstrating a concrete solution to reduce aviation carbon dioxide emissions.

The Solar Pilot Project was implemented at Moi International Airport at a cost of 1,501132.22USD which was part of the € 6.5 million initiative, entitled “Capacity Building for

CO₂ Mitigation from International Aviation”. This initiative targeted 14 African and Caribbean states. Twelve States were from the African Region and two from the Caribbean Region. This project was implemented by the International Civil Aviation Organisation (ICAO), the Kenya Civil Aviation Authority (KCAA), and the Kenya Airport Authority (KAA). It was funded by the European Union and the Government of Kenya

KCAA and the Kenyan aviation industry stakeholders developed the Kenya’s Action Plan for the Reduction of Carbon Dioxide emissions from aviation in December 2015. This State Action Plan resulted into funding of the “solar-at-gate” projects in Mombasa, which was one of the mitigation measures selected. The project has further resulted into efficient operations at Moi International Airport, with savings of electricity charges at an average amount of 25,000 USD (Ksh 2.5 million) per month. Figure 5 shows the trend in power generation per month and annually.

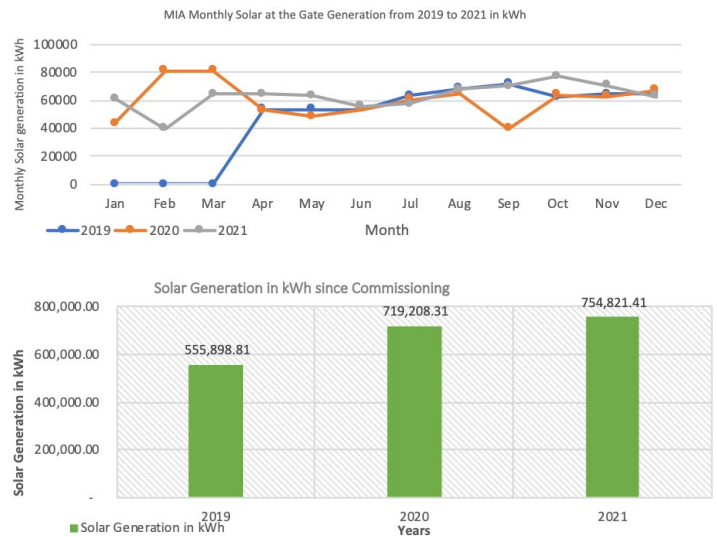


FIGURE 5: Trend in power generation per month and annually

Status on Achievements and Progress

- The project was relevant since there was a need to improve on power supply at the airport and reduce CO₂ emissions.
- The project was effective as the solar system is operational.

- The project was achieved within the contract period and budget, and the project met specified quality standards.
- The project improved on power stability at the airport.
- The system has led to the reduction of operational costs related to electricity bills and use of power generators.
- The system has reduced CO₂ emissions and noise due the clean energy use by parked aircraft and less usage of a generator.
- The project is sustainable as there are adequate measures in place to manage the system in terms of human resources, institutional arrangements, and budget.
- The formation of Project Implementation Teams was observed to have contributed enhanced the implementation of the project and reporting.

Recommendations

- There is need for further funding or provision of more financial resources to expand the solar system at Moi International Airport to provide for all the airport's power requirements, resulting in a 100% solar power during the day.
- There is need to implement similar solar projects in other airports and other installations serving the aviation industry, especially Jomo Kenyatta International Airport.
- Solar powered GPU and PCA systems should be implemented across all major international airports.



FIGURE 6: Solar Farm at Moi International Airport



FIGURE 7: Ground power unit (GPU)



FIGURE 8: Pre-conditioned air (PCA)