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Community energy production at airports - taking relationship to the next level?

Authors:

Ferenc Kis, MSc. Renewable Energy, Head of Environment, Budapest Airport, Ferenc.kis@gmail.com +36 30 350 7906

István Mudra (MU), ATS Expert, NCNC, ICAO coordinator, istvan.mudra@itm.gov.hu

Relation to the conference topics:

TOPIC 6: PV Applications and Integration, 6.1 PV on/in Buildings, Infrastructure, Landscape, Water and Nature

This paper addresses design, architectural and landscape aspects of utility-scale PV systems in the European Airports. We investigate environment, safety and especiall aviation safety regulatory aspects and potential of integrating PV in large transport infrastructures

We are describing how PV systems are placed on or are integrated into man-made infrastructure, but also in nature and the environment which surrounds us.

The present abstract contains new scientific work that has not been presented in another conference. Each abstract will be reviewed by at least three independent experts from the global PV community.

Aim and approach used

Creating thousands of direct and indirect jobs, boost to local logistic development and enhancing tourism activities - the presence of airports are already overwhelmed by their positive impacts over the noise and landside traffic often referred as environmental concerns. But these days there is a new phenomenon called energy community - that both airports and neighbouring districts can benefit from, environmentally and economically too.

Our paper describes what Photovoltaic energy means at European airports and what are the main aspects to consider during planning and design of such systems.

Scientific innovation and relevance

Our recommendation to any airport considering a large set of solar panels is to ensure that the boundaries of what is possible from a safety perspective is assessed prior to the drafting of plans for location, orientation and height. The safety assessment methodology we apply, containing a combination of quantitative and qualitative methods, will ensure whether or not potential locations are suitable. From there, we suggest to work with the technical design team to maximise the energy production within those areas judged to be suitable.

Our methodology in based, in part, on European and international regulations. As a whole it considers realistic and actual aviation safety concerns. As such it a method that can be integrated into the airport's SMS practices for change management.

Performing an assessment after a design has been agreed may, we stress may, lead to one or more of the following:

- reduction in the numbers of panels that be placed in a particular location, or
- a reduction in the energy generated (panel tilt and orientation is an important factor in glint and glare calculations for airside actors), or
- architectural designs having to be modified.

In our paper, we have been confronted with all of these scenarios.

What airports have: flat roofs, huge parking lots and hundreds of hectares of grasslands, a considerable portion of which goes unused. This is something that nearby cities often miss: land for massive photovoltaic (PV) installations, however both entities' electricity consumption will certainly grow in the future. Because of the need for zero-carbon electricity generation raising, airports and cities should set a new ground for cooperation: PV energy communities based on Power Purchase Agreements.

Today more than 100 airports worldwide have solar plants and the trend of airports incorporating solar panels into their energy systems is taking off. Similar to the photo above from Brno airport, Czech Republic, where 21.7 MW 3-stages PV plant has been aquired by Jufa Group in 2017, airports make a natural choice for solar electricity generation. The consumption of an international airport comparable to a 100.000 inhabitant-size city, plus the need for uninterrupted power supply is critical.

Not only does the type of land make them prime candidates for installations, but airports are linked to national grid with a visible size of cable diameter - or two. Considering the amount of local initiatives that are moving to have decentralized power by renewable energy, having an airport and city energy community cooperation can jumpstart both of their net zero goals.

In the USA there is a long-lasting history for airport solar energy projects. Because of concerns such as glint and glare, the U.S. Federal Aviation Administration (FAA) in November 2010 released a document titled Technical Guidance for Evaluating Selected Solar Technologies on Airports. The guide - backed with an on-line tool called SGHAT, which was available earlier for free, today Forgesolar is used more commonly - seeks to ensure that solar installations do not create negative effect on aviation safety.

At Indianapolis International Airport, 22.2 MW of renewable energy pumped into the region's electric grid. Denver International Airport also has an impressive facility of a 10 MW solar farm.

Jumping over Europe, Athens International's photovoltaic park produces more than 13 thousand MWh of emission-free electricity annually, corresponding to approximately 25% of the airport's own electricity needs. Their business model backed up by a 400EUR/MWh Feed-in-Tariff scheme, which is not an easy deal to replicate elsewhere in Europe. Rooftop systems should not be underestimated in the airport context either. At Terminal 2 of Dubai International Airport 5 MW system installed by Ethiad Energy Services. Interesting fact, that the glare and reflection analysis has been conducted by the same Austrian engineering company, Zehndorfer, which worked on an off-site 10 MW airport PV project in Munich too.

Kuala Lumpur Airport in Malaysia has the 19 MW plant, but in Asia, Cochin International Airport is the world's first solar power airport with the German support from Bosch Building Solutions. Its entire operations are powered by 46,150 solar modules powered by 2.500 hours of sunshine over the course of the year. Their 28.5 MW plant has recieved the prestigious UN Environmental Program Champions of

the Earth Awards in 2018. It was not much covered in the media, but since 2015 the same aiport has operated a 2.67 MW carport developed by Tata Power Solar and the biggest such PV covered parking area in India.

A study published by FAA in 2015 gives further insight on how glare actually affects aircraft aviation and compares PV glare to other common sources of glare. On performing a thorough study with pilots, it was found that the majority of pilots had encountered glare for objects other than direct sunlight or solar panels. Based on my personal discussions with European airport professionals, the local Civil Aviation Authorities often share that view, that typical sources of glare from other real-world objects like water, buildings/glass windows, other aircraft and even snow are far higher than PV panels.

PV systems could cause negative impacts on radar, NAVAIDS (navigation aids) and infrared instruments called communication, navigation, and surveillance (CNS) by causing interference. For example the UK-

based Pager Power or the Dutch To70 Aviation Consultants have numerous examples of these risk-assessments, with international exposure.

Results or preliminary results and conclusions

According to the standard methodology, interference of radar and NAVAIDS (despite passive components) occurs when objects are placed too close to a radar sail or antenna and obstruct the transmission of signals between the radar antenna and the receiver, which can be a plane or a remote monitoring location. Metal components on the PV racking may also cause reflected signals. However, due to PV systems having a low profile these risks are low as most large-scale solar farms are of low height profiles, not exceeding 2-2.5 meters. In addition, solar modules do not emit electromagnetic waves over distances that could interfere with radar signal transmissions.

Studies also suggesting that PV can both serve higher biodiversity at airport through the exclusion of using pesticides and herbicides to the soil while according a peer-reviewed research paper, bird hazard index far lower at the vicinity of PV arrays than at conventional airfield grasslands in states of Arizona, Colorado and Ohio in the US.

The Indian experience regarding side-effects of airport PV farm is even more astonishing! Over the past year, the above mentioned Cochin Airport has been busy farming organic vegetables on its campus. It has grown over 80 tonnes in a year—378 kg of pumpkin, over 2.000 kg of ash gourd, 425 kg of cucumber among others—selling those to the staff and the open market.

And turning from the airport's own consumption, Middleton Municipal Airport in Wisconsin/USA operates a community solar program, which provides residential and business customers the opportunity to power their home or business with locally generated solar energy. This might set an example and airports will be looked as ideal locations for similar initiatives.