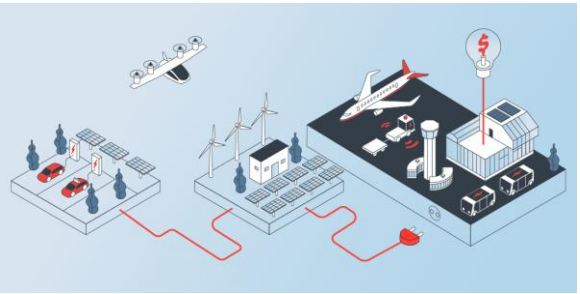
ELECTRIFICATION OF AIRPORTS FROM LANDSIDE TO AIRSIDE

Generation and storage of electricity to support infrastructure development objectives, operations and cleaner flight

May 18, 2022

The electrification of mobility will be a game changer for airports. Emerging transportation technologies are shaping the next generation of air and ground transportation, which will transform operating conditions at airports and significantly help to reduce environmental footprints.

Electrification will decrease dependency on hydrocarbon-based fuels, improve public health and accelerate progress to achieve net-zero carbon emissions by 2050.[1] Maximizing electricity's potential will lead to a future characterized by lower-emissions travel, advanced aircraft design, cleaner solutions for the first and last mile, new transportation services such as advanced air mobility (AAM), an increase of connected and automated vehicles within the airport landscape, and innovative business models to support and leverage emerging and new technologies. As current and future mobility hubs, airports will need to invest in capacity and resilience of their existing electric distribution grids.



Changing Landscape

Vehicles and Facilities

Electric powertrains are the future of automobiles as they are enabling zero-emissions at the tailpipe. Battery-electric vehicles (BEVs) and hydrogen fuel-cell-electric vehicles (FCEVs) are part of a larger movement toward connected and automated vehicles (CAVs) powered by advanced propulsion systems. These innovations will impact mobility from, to and at the airport—both airside and landside. Electric buses are increasingly populating airport landscapes; they are used to provide mass transit solutions for ground access, move passengers from the curbside to parking garages, and provide airside connectivity between terminals and serving aprons.

Ground Support Equipment (GSE) is a critical part of airline operations to enable a safe and efficient aircraft turnaround. Not only does GSE electrification save money on fuel and maintenance costs, it also contributes positively to the respiratory health of airport workers and supports efforts to enhance air quality and reduce carbon footprints. Airlines have been leading the way, but they are often constrained by existing airport electric grid infrastructure.

Electrification is progressing in passenger terminal facilities as well with, for instance, replacement of fossil-fuel-based building heating systems with fully electric solutions using

[1] Net Zero 2050, Air Transport Action Group (ATAG)

geothermal and high efficiency air source heat pumps.

The stationary battery is often referred to as the Swiss Army Knife of the electric grid—it can do almost anything. As the up-front prices come down, and markets (revenues) for battery services increase, airport grid operators will find that stationary batteries will become a key tool to support electrification efforts (outlined here). This may be done in a distributed fashion, with batteries paired with all DC fast chargers, or may be centralized near the current substation or central plant.

Change to Come

Flight

Short-haul flights performed by electric aircraft is on the horizon. These small, quieter planes are part of advanced air mobility (AAM). AAM is not only about new aerospace technologies; it is a brand-new way to travel by air within large metropolitan areas (urban air mobility) with vertical or short takeoff and landing (VTOL/STOL) aircraft, as well as between small cities and rural areas (regional air mobility) with conventional takeoff and landing (CTOL) aircraft. These vehicles will use zero-emission, low-noise electric or hybrid propulsion systems. The technologies should have lower total cost of operation due to a reduction in maintenance cost from systems that have far fewer moving parts, potentially making air travel even more accessible. AAM could become a commercial reality within the coming years, offering short-haul flights that provide point-to-point, on-demand services, which could be combined with ground mobility to form a door-to-door, smartphone-based Mobility as a Service (MaaS) offer.

AAM will provide vast potential to transform intra-regional air travel, connect more communities to air travel, and boost smaller airports with increased activity. It will not only expand variety in aviation aircraft and service concepts at commercial service airports, but also introduce a new paradigm for general aviation facilities in terms of level and type of operations.

Airports at the Center of Transformational Change

Advancing “Electrification of Everything” (EoE)

Though widespread change depends on the pace of technological progress within regulatory and policy frameworks that support electrified air travel, airports should today focus attention on a more energy-efficient path to support infrastructure development objectives to proactively and holistically address these emerging needs.[2]

Electric vehicles provide opportunity to advance airports as energy hubs and infrastructure assets for electric generation, storage, and distribution. Many airports have space for utility scale stationary batteries, solar farms, or other power generation systems that can supply the entire airport in case of an outage (micro-grid approach), increase power supply resilience for communities nearby, and generate non-aeronautical revenues by reselling the surplus. A new generation of backup systems, based on highly efficient battery powerpacks or hydrogen fuel-cells, is replacing traditional diesel generators. Moreover, electric buses and cars, already part of airport land transport, can be linked to the airport electric distribution grid to transfer power from one vehicle to another, and/or to act as a localized battery pack

[2] WSP has developed ACRP Research Report 236: *Preparing Your Airport for Electric Aircraft and hydrogen Technologies* for the U.S. Transportation Research Board (TRB). Along with the research report, an assessment tool is available, to estimate the long-term electricity demand of the entire airport ecosystem considering the “electrification of everything”—from the curbside to the runway.

providing cost savings to be shared among the airport and the vehicle owner.

Though the benefits are clear, airports often have limited spare electric capacity and find it cost-prohibitive to upgrade their electric services. This is especially true at smaller and remote airports. This is where a carefully crafted energy-efficient and smart power-management strategy can make a strong positive impact. Airports are known to be large consumers of electric power for airfield operations and terminal needs, including heating systems, flight information displays, escalators, baggage handling and conveyer belts, service/visitor lifts, shops, and restaurants. Targeted energy-efficiency measures applied to nearby circuits can free up the capacity needed for these new electric loads. Smart charge management systems can ensure that most charging is completed when electricity is least costly, usually overnight, as other airport electric loads are low during this time. Smart power management can also reduce peak load at existing facilities with power sharing—for instance, between jet bridges and electric GSE chargers.

Movement toward electric and autonomous vehicles will influence land use at airports and impact traditional parking requirements. With less need for on-site parking, land and facilities can be freed up for other purposes, including energy production, stationary battery electric storage, and recharging of new mobility[3] vehicles—thus creating new sources for revenue enhancement. Vehicles in shared mobility networks could plug into these electric charging stations, and hotel and city transit buses passing through airports could also access recharging points located in former parking facilities.

Similarly, traditional taxis and transportation network companies (TNCs) can connect for a recharge while wait for their next pick-up cycle to begin. Some airports, recognizing that electric will play a vital role in fostering better traffic flow, are already providing ultra-fast charging stations for TNC vehicles to get topped up. The emergence of CAVs might adversely impact airport parking garage revenues, but it will also create further opportunities to optimize these processes as well as accommodate the CAV hubs at airport parking garages.

State-of-the-art technological impacts are wide-ranging in the airport infrastructure ecosystem. New mobility pilot programs are increasingly being conducted, including the use of robots to provide passenger information and autonomous vehicles to carry baggage in terminals and serve as airfield shuttles for employees. Smartphone connectivity, digital wayfinding and biometric scanners are already transforming today's passenger experience. As the whole airport-scape evolves with the application of environmentally-oriented solutions such as solar panel use, the outlook and plans regarding electric power at airports should progress in tandem. Whether developing as mini-cities themselves, aka the aerotropolis, or as smaller upgraded structures offering air travel and diverse terminal amenities, each airport should assess current energy use and generation potential as an integral step in its future-ready planning.

Supporting Expansion and Sustainability

Electrification can align expansion efforts meant to support increased passenger levels with initiatives to reduce carbon footprints—seemingly opposing challenges that can become compatible. With greater capacity needs, airports worldwide must now effectively address how to progress on a more environmentally-conscious and energy-efficient path to reach

[3] New mobility refers to transport changes from electric and autonomous technologies, connectivity, and shared use.

development objectives. This effort requires taking a closer look at current energy management practices—to assess how to better manage electric use and production through existing or potential on-site generation. Now is the time for airports to prioritize electric power as central to a long-term carbon- and cost-reduction strategy and determine how to leverage current and future new mobility electric assets to bring about greater efficiency—to meet sustainability goals and to generate new sources of revenue.

Today, aviation accounts for about 2 percent of carbon emissions and 3.5 percent of the drivers of climate change.[4] The goal is to continue taking steps to reduce emissions and achieve carbon neutrality by 2050,[5] with individual airports and air carriers taking a pledge to reach net-zero emissions as soon as 2030. A focus on sustainable energy practices, with an increasing emphasis on renewables, can be integrated into airports' overall energy-planning efforts to help reach this goal.

Authors

Mattias Frithiof
Director, Advisory
Sweden
Mattias.Frithiof@wsp.com

Philip Jonat
Senior Energy Engineer
United States
Philip.Jonat@wsp.com

Gaël Le Bris, C.M., P.E.
Senior Aviation Planner &
Senior Technical Principal
United States
gael.lebris@wsp.com

About WSP

WSP is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, architects, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transportation & Infrastructure, Property & Buildings, Environment, Power & Energy, Resources and Industry sectors, as well as offering strategic advisory services. Our talented people around the globe engineer projects that will help societies grow for lifetimes to come. wsp.com

[4] Intergovernmental Panel on Climate Change, World Meteorological Organization, United Nations Environment Programme; in addition, according to a Manchester Metropolitan University-led international study: when the non-CO_2 impacts were factored in, aviation's part was calculated to be 3.5 per cent of all human activities that drive climate change.

[5] Net Zero 2050, Air Transport Action Group (ATAG)