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Learnings From the 2022 NREL Partner Forum: Research Needs for Airport Ground Infrastructure and Operations

During the 2022 Partner Forum¹ at the National Renewable Energy Laboratory (NREL), stakeholders and experts from across aviation came to the whiteboard to outline common goals, align interests, understand technologies, and discuss steps for safely and seamlessly decarbonizing aviation.

Attendees identified challenges, strategies, and needed research on aviation fuels, infrastructure, and aircraft. Initial insights, strategies, and high-level suggestions from an airport ground infrastructure and operations workshop are summarized below, including potential barriers and synergies for achieving bold decarbonization goals.

Fuel Production and Delivery

Airports and airlines must collaborate to ensure infrastructure and fuel—whether delivered via truck, pipeline, or power line—are readily available for alternative propulsion aircraft.

Specific challenges to address:

- Explore carbon intensity improvements for various products, including sustainable aviation fuel (SAF) supply chains and on-site hydrogen generation.

- Evaluate current fuel infrastructure financing models, including fuel flowage fees, sales tax systems, and fixed-base operator leases.
- Consider minor reconfigurations to support both hydrogen aircraft and fuel cell trucks—which may have similar fueling needs and are often in proximity to one another.
- Analyze the role of gray hydrogen producers close to airports, which can transport it the short distance to small liquefaction facilities at the airport.
- Consider the U.S. Department of Energy’s hydrogen hubs as a model for making infrastructure and fuel available.
- Develop fuel backup plans in cases of energy scarcity (such as using e-fuels or batteries when SAF is in short supply).

Power Production and Delivery

As the United States aims to quadruple its power capacity over the next 30 years, airports must plan for increased power production and delivery, including leveraging available assets to generate power and produce fuels.

Specific challenges to address:

- For airports by the ocean, evaluate potential for offshore wind and wave generation.

¹ Discover other insights from the 2022 NREL Partner Forum: www.nrel.gov/docs/fy23osti/84111.pdf.

- Assess airports as energy assets supporting electricity demand, hydrogen electrolysis, and SAF and e-fuel production for transportation and community needs.
- Develop procurement models for power supply and generation that consider impacts on security, cost, and other factors.
- Consider alternatives to diesel generators to provide 24-hour backup power.
- Compare distributed, on-site resources to expanded transmission systems delivering energy from local power plants.
- Model energy needs—to help develop responsive energy systems—in response to fluctuations and spikes in demand, driven by changes in the number of flights, travelers, and ground vehicles per day.
- Define energy systems to help determine the benefits of delivering energy via pipeline or truck.
- Evaluate different aviation energy pathways (including electricity and hydrogen generation) to help forecast impacts on power systems to guide additional investment in transmission lines, energy storage, and other assets.

Alternative Transit Options

When planned in collaboration with aviation and regional transportation stakeholders, alternative modes of transportation can supplement or even replace regional jet service.

Specific challenges to address:

- Evaluate business cases to enable airlines and airports to benefit from diverting modes away from regional jet travel to support short-term mobility needs.
- Plan centralized generation and storage to support multiple transit modes.
- Consider the influence of capital cost on driving different transit modes in different areas (such as rail in Europe versus buses in the United States).
- Coordinate with other agencies to help people choose alternate modes.

Travel Behavior

Researchers should explore travel behavior and how it might impact investments, planning, and mode choice.

Specific challenges to address:

- Explore the impact of time on travel decision-making, including time spent going through security, passing through airports, and waiting for connecting flights.
- Determine how legislation, policy, and smart technology can promote shortened wait times at ticketing, security, boarding, and taxiing.
- Enhance models that account for people's time in the cost of business aviation. For example, could private aircraft move groups of people more quickly, efficiently, and cost effectively when factoring in time spent waiting in lines and for connections?

Connections With Electrified Ground Vehicles at Airports

Researchers should explore the influences of travel behavior and how that might impact investments, planning, and mode choice.

Specific challenges to address:

- As more consumers park electric vehicles at airports, consider how they might be utilized for energy storage as a battery buffer.
- Evaluate how vehicle-to-grid technology can help manage the grid.
- Explore electrification potential for ground vehicles like shuttles, ground service equipment, and tugs to reduce emissions and save money.