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Learnings From the 2022 NREL Partner Forum: Research Needs for Energy Infrastructure

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 a focused infrastructure workshop are summarized below, including potential barriers and synergies for achieving bold decarbonization goals.

Sustainable Aviation Fuel (SAF)

Addressing scaling, critical supply, and operational delivery challenges can help ensure broad availability of SAF.

Specific challenges to address:

- Determine where SAF blending will take place, whether at an airport tank farm or beyond the fence at a fuel terminal.
- Address fuel blending locations in relation to existing supply chain infrastructure.
- Develop fuel storage standards for blended and unblended SAF.

- Determine the responsibility for additional infrastructure for aircraft requiring 100% SAF for higher energy density (beyond SAF blended with Jet A).
- Address supply chain challenges for small airports, such as trucking blended SAF fuels long distances where local blending would alleviate trucking.
- Understand and address community concerns on adding or changing airport fuel storage or blending capacity.
- Understand the resiliency benefits of adding fuels, but also safety, security, and supply chain vulnerabilities.
- Evaluate locations for SAF storage, blending, and earlier logistical steps.

Electricity Demand and Storage

Holistic planning, infrastructure analysis, and delivery and operational solutions can enable clean airport electrification and inform electric air mobility.

Specific challenges to address:

- Evaluate airport operational options for electrification, on-site energy generation and storage, and emergency response and resiliency, including using airports as energy hubs.
- Provide adaptable models, insights, and operational options to address possible massive and variable increases in electricity demand.
- Develop energy generation and demand best practices for small, medium, and large airports, including microgrids.

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

- Advance technical and operational options to reduce the time to reasonably charge electric aircraft and meet airline flight planning requirements.
- Evaluate options for fixed and mobile supply of power and thermal energy needs for all aircraft.

Buildings and Utility Plants

Buildings and utilities represent a readily available opportunity to lower airport emissions.

Specific challenges to address:

- Develop tools, strategies, and implementation plans to address 80% of airport Scope 1 and Scope 2 emissions reductions related to electricity, heating, and cooling.
- Advance methods to fully integrate sustainability into master plans.
- Develop tools, methods, and approaches for airport central utility plants to shift to non-fossil sources.

Hydrogen

Clean hydrogen could support a range of airport energy goals, but clearing its path to adoption by aviation requires careful regulatory, logistical, and technical planning.

Specific challenges to address:

- Evaluate implications for airports, aircraft, supply, and delivery of possible hydrogen aviation across multiple routing and sizing dimensions.
- Resolve issues surrounding hydrogen storage requirements, delivery standards and safety, and design, operation, and safety of fuel cells for aircraft.
- Understand the implications of aircraft hydrogen storage (which could influence aircraft size and dimensions) on gate or aircraft wing design.
- Conduct feasibility research on hydrogen distribution and storage at airports.

Auxiliary Power Units (APUs)

Clear strategies, tools, and best practices are needed to encourage wider adoption of ground power units (GPUs) and conditioned air over APUs (when available) to lower emissions.

Specific challenges to address:

- Develop strategies for encouraging ground power usage.
- Right-size GPU and APU resources.
- Utilize monitoring, reporting and analytics available through digital twins or smart systems to encourage best practices, including APU use.

Crosscutting and Funding

Innovative models for funding infrastructure improvements could be critical to avoid slowing or bottlenecking aviation technology deployment.

Specific challenges to address:

- Consider how to fund infrastructure improvements for both large and small airports, whether through the Federal Aviation Administration Airport Improvement Program, other federal programs, or changes to rates for airlines.
- Conduct joint studies based on airport size to help find similarities and avoid redundancy.
- Ensure research incorporates the perspective of people working on the ground.
- Evaluate annual funding for airport transformation projects and how current policies may restrict new and emerging technology projects.
- Develop strategies for funding sources outside of traditional aviation fuel taxes.
- Ensure total life cycle costs are considered to avoid excluding sustainability elements.

Collaboration and Partnerships

Collaboration among diverse aviation stakeholders can facilitate strategic planning to identify and provide solutions to energy challenges early and comprehensively.

Specific challenges to address:

- Include utility companies as key stakeholders to help ensure current regulations do not limit advancement.
- Build collaborations between airports and airlines to address the hierarchy of priority sustainability actions (such as electrifying ground fleets before electrifying aircraft).
- Encourage early collaboration with federal agencies and regulators prior to deploying emerging technologies.
- Engage early with airlines to understand business decisions and what options are most feasible for networks and routes.
- Create centers focused on data collection for research and studies (such as fuel demand at airports).
- Collaborate with state aviation agencies to expand aviation mobility to more communities.
- Cultivate cross-interest discussions between airports, airlines, original equipment manufacturers, and energy providers, as well as airport engineers, designers, and architects.