Photo by Werner Slocum, NREL 70838

Building a Sustainable Aviation Brain Trust: Key Insights From the 2022 NREL Partner Forum

Cross-sector collaboration is key for guiding the large, complex aviation industry over the emissions peak and quickly down the slope to net-zero—that theme was repeated regularly during the two-day 2022 NREL Partner Forum.

2022 NREL Partner Forum

200 attendees

60+ agencies, organizations, and companies

222 million tons of annual U.S. aviation CO_2*

1 vision: a sustainable aviation future.

** Airports Council International (ACI). 2021. Long-Term Carbon Goal Study for Airports. Montreal, Canada: ACI.*

With an expanding global economy, more people than ever want the convenience of air travel. That has made aviation the fastest-growing transportation sector, as well as a rising source of carbon emissions. How can the industry serve its customers while charting a course to net-zero in line with climate goals?

Interest and momentum from public and private sectors are mounting to answer that question, a backdrop for the Partner Forum. The National Renewable Energy Laboratory (NREL) brought 200 attendees to the whiteboard to find common goals, align interests, understand technologies, and discuss steps for safely and seamlessly decarbonizing aviation.

This document captures the tenor of the conversations.

Day 1: Keynotes and Panel Discussions

Across four topical panels—sustainable aviation fuels, next-generation fuels, airport infrastructure, and industry collaboration—14 panelists fielded questions on the details of decarbonizing the industry. Below are select highlights and comments:

- **Decarbonizing aviation is crosscutting,** so a variety of stakeholders need to be at the table—from technology manufacturers to fuel producers, those managing airports, and those charged with aviation safety and security.
- **More data verification on advanced aviation technologies is needed,** but predictive modeling could fill a gap for technologies only now in development.
- **Key federal offices and agencies must be engaged** and share data and resources across their various mission spaces.

Day 1 featured panel discussions among industry experts, with opportunities for questions from attendees. *Photo by Werner Slocum, NREL 70863*

- **Airports will need to determine how to balance energy needs** from sustainable aviation fuel, hydrogen, and electricity for battery-powered aircraft, and solutions developed for one are likely relevant to many.
- **Regulations, policies, definitions, and funding must be thoughtful,** as emerging energy systems and aviation technologies are nascent.
- **Applied research could "de-risk" technologies and guide investments,** especially for distributive aviation technologies that need unique infrastructure.
- **Success demands both short- and long-term solutions,** which can support immediate emissions reductions as new capabilities emerge in long-haul fuels, infrastructure, aircraft designs, and regulations.

Day 2: Sustainable Aviation Workshop

On day 2, participants divided into groups to identify challenges, strategies, and needed research related to four critical focus areas.

Liquid Fuels (Sustainable Aviation Fuels and E-Fuels)

- **Big Picture Challenges Loom**—Research and policy support is needed to make sustainable aviation fuels more affordable. Final fuels must perform in current jet engines while dramatically lowering their carbon intensity.
- **Collaboration Among Research Institutions Can Help**—NREL and other national labs and universities can help industry prioritize and focus the most promising pathways, from feedstock source, carbon intensity, process, and final product cost.

Alternate Propulsion (Hydrogen, Electric, Hybrid)

- **Hydrogen and Electricity Demand Forecasts Can Guide Investments**—Airports, utilities, and operators must understand future hydrogen and electricity use to prioritize investments in new energy assets while determining the role of existing assets (e.g., electric vehicles parking at airports).

Spread across four focus groups on day 2, participants dug into the details on realizing net-zero emissions in the aviation sector.
Photo by Werner Slocum, NREL 70890

- **Plans for Increased Electrification Must Center on Resiliency**—Abundant clean electricity is a centerpiece of e-fuels, hydrogen, and battery propulsion, as well as a core strategy for decarbonizing buildings and ground transportation. It is critical to roadmap for storage and backup power to prepare for future energy disruptions.
- **Community Engagement Is Important**—To develop meaningful and inclusive plans, it is essential to reach out to local and regional communities across the urban-rural spectrum.

Infrastructure (Airports, Bases, Vertiports, Traffic Management)

- **Collaboration Must Be Intentional**—Airports across the country must collaborate on priority actions, but regulators, agencies, service providers, and utilities must be at the table to identify and coordinate common goals for energy use and reduction.
- **Funding Is Needed for Major Upgrades**—Airport infrastructure is aging at many airports across the country. More funding is vital to enable operators to spearhead the infrastructure upgrades needed to support the energy transition. Still, critical questions remain: How will new fuel sources be funded? How can a cohesive network of fueling systems be deployed effectively?
- **Research Can Empower Airports of All Sizes**—Public tools and anonymized data can help small, medium, and large airports understand and plan around core topic areas, including microgrid design, transparent carbon accounting, energy generation and charging, hydrogen storage and distribution, and more.

Aircraft

- **Challenges Range From Technical Readiness to Safety (and Beyond)**—Although sustainable aircraft can be powered by a range of sustainable propulsion technologies, broadening their use encourages many of the same challenges: certification, market acceptance, safety, life cycle and baseline costs, technical readiness, and community issues.

Partner Forum attendees also toured NREL's world-class laboratories and facilities, including the Energy Systems Integration Facility, where NREL's supercomputer is housed. *Photo by Werner Slocum, NREL 70909*

- **Focusing on Core Technical Areas Is Crucial**—When conducting research—on batteries, more efficient and lightweight motors, fuel compatibility, recycling of materials, and analytical models—it is important to consider the bigger picture to ensure that work supports end goals.
- **Roadmapping Can Align Broad Stakeholder Goals**—To realize bold decarbonization goals, stakeholders across the aviation industry (including market competitors and government agencies) must identify common objectives for advancing the entire ecosystem. Workshops and roadmaps can help find common ground on topics as diverse as hydrogen storage, aircraft charging and fueling, motors and batteries, sustainable aviation fuel drop-in compatibility, cybersecurity, technology safety and certification, and beyond.

A Holistic, Partnering-Enabled Strategy for Decarbonizing Aviation

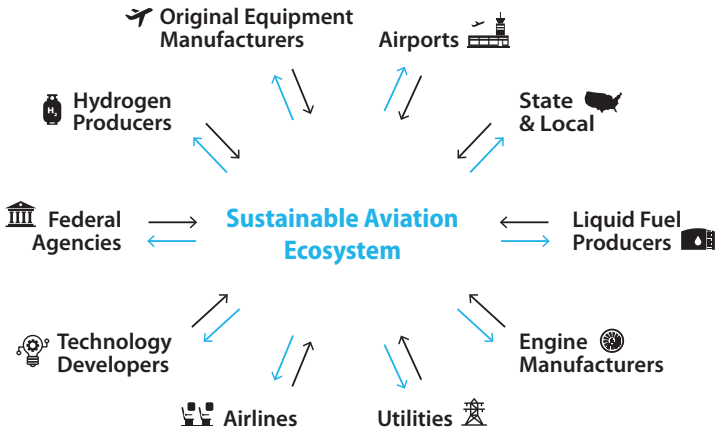

Illustration by Nicole Leon, NREL

The Skies Never Close, and Neither Does NREL

NREL is establishing public and private partnerships to accelerate the transition to net-zero aviation. Tap world-class capabilities, leading expertise, and strategic partners—and make your mark on the sustainable aviation future.

Contact NREL Strategic Partnerships Manager Brett Oakleaf at brett.oakleaf@nrel.gov. Learn more at nrel.gov/sustainable-aviation.

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