Pathways to a Sustainable Aviation Ecosystem

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De-Risking the Design of Decarbonized Airport and Vertiport Energy Systems

Airports need a unique set of tools and approaches to integrate low-carbon energy technologies rapidly and smoothly into existing systems and operations. Energy scenario analysis can cut through the risk and complexity of designing and managing future aviation energy systems. That way, aviation operators—from small county airfields to hub airports, urban vertiports, and remote military bases—can understand the ramifications of various energy plans on long-term business and climate goals that center sustainable aviation technologies.

Understand the Unique Challenges of Future Airport Energy Systems

Today's airports and military bases collect and distribute hundreds of megawatts of equivalent energy through various energy carriers. Petroleum-based fuels play a core role, providing energy source diversity and on-site energy storage. Increased airport building and transportation electrification—alongside adoption of hydrogen and sustainable aviation fuel—can support the experience passengers expect, but making the transition requires a different set of design considerations.

What You Need To Know

- **New Energy Assets Will Need To Be Added**—Airports may need to invest in or partner for an expanded set of energy assets. Examples include distribution system upgrades, backup power supplies, ground and aircraft charging equipment, on-site energy production, and storage systems to accommodate a wider range of fuel and energy types.
- **Emerging Aircraft "Fuels" Will Drive Changes**—Sustainable energy carriers, including sustainable aviation fuel, electricity, and hydrogen, provide pathways for lowering emissions. It is critical that aviation operators understand the regulatory requirements and pace of adoption of these emerging aviation "fuels" to help guide infrastructure upgrades to meet demand.
- **Energy Systems Must Withstand Disruptive Events**—Energy generation and storage reliability and diversity become increasingly important as power outages, natural disasters, climate urgency, and other disruptive events become more prevalent.

NREL De-Risks Future Airport Energy Systems

With its extensive vehicle and energy use data, supply and demand modeling capabilities, ARIES platform, and visualization tools, NREL can help planners discern the best energy system designs to meet the business, sustainability, and operational goals of individual airports.

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NREL's Digital Twins Predict Airport Energy Futures

NREL's Advanced Research on Integrated Energy Systems (ARIES) platform can visualize the impact and value of connecting new devices to airport energy systems, such as electric vehicles and aircraft, renewable generation, hydrogen, energy storage, and grid-interactive buildings. For example, NREL's digital twins of Dallas–Fort Worth International Airport are helping project the impact of energy investments and decisions on passenger experience, energy use, and airport revenue.

Unlock the Benefits of NREL's Integrated Energy System Modeling

1. **Design planning** across multiple energy generation, storage, and delivery technologies.
2. **Cost-benefit analyses** considering the trade-offs of various designs and procurement models.
3. **Projections of operational resilience** for future energy designs, helping airports retain and improve upon their emergency response to support emergency services, community mobility, and commerce during natural disasters.
4. **Digital twin models** for virtual scenario planning.
5. **Safety and operational criteria analysis** to support policy development.

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