

TRANSPORTATION RESEARCH BOARD

Power Up! Implementing an Airport Microgrid

December 6, 2021



**@NASEMTRB
#TRBwebinar**

Learning Objectives

- Determine the feasibility of a microgrid for an airport
- Use the toolkit to gather stakeholders
- Assess financing and ownership operations as well as best practices




American Association of Airport Executives (AAAAE)

1.0 Continuing Education Units (CEUs) are available to Accredited Airport Executives (A.A.E.)

Report your CEUs: www.aaae.org/ceu



Transportation Research Board Webinar



Power up! Implementing an Airport Microgrid

December 6, 2021 | 2:00 -3:00 pm ET

Today's Presenters



Meredith Pringle

Director

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Adib Naslé

CEO and Founder

XENDEE

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Learning Objectives



MICROGRID IMPLEMENTATION TOOLKIT OVERVIEW

How to use the microgrid toolkit to understand what microgrids are, how to gather stakeholders, understand financing, and learn from best practices.



UNDERSTANDING THE MICROGRID VALUE PROPOSITION

How to determine if a microgrid or resilient energy solution is right for your airport's objectives

ACRP Research Report 228: Airport Microgrid Implementation Toolkit

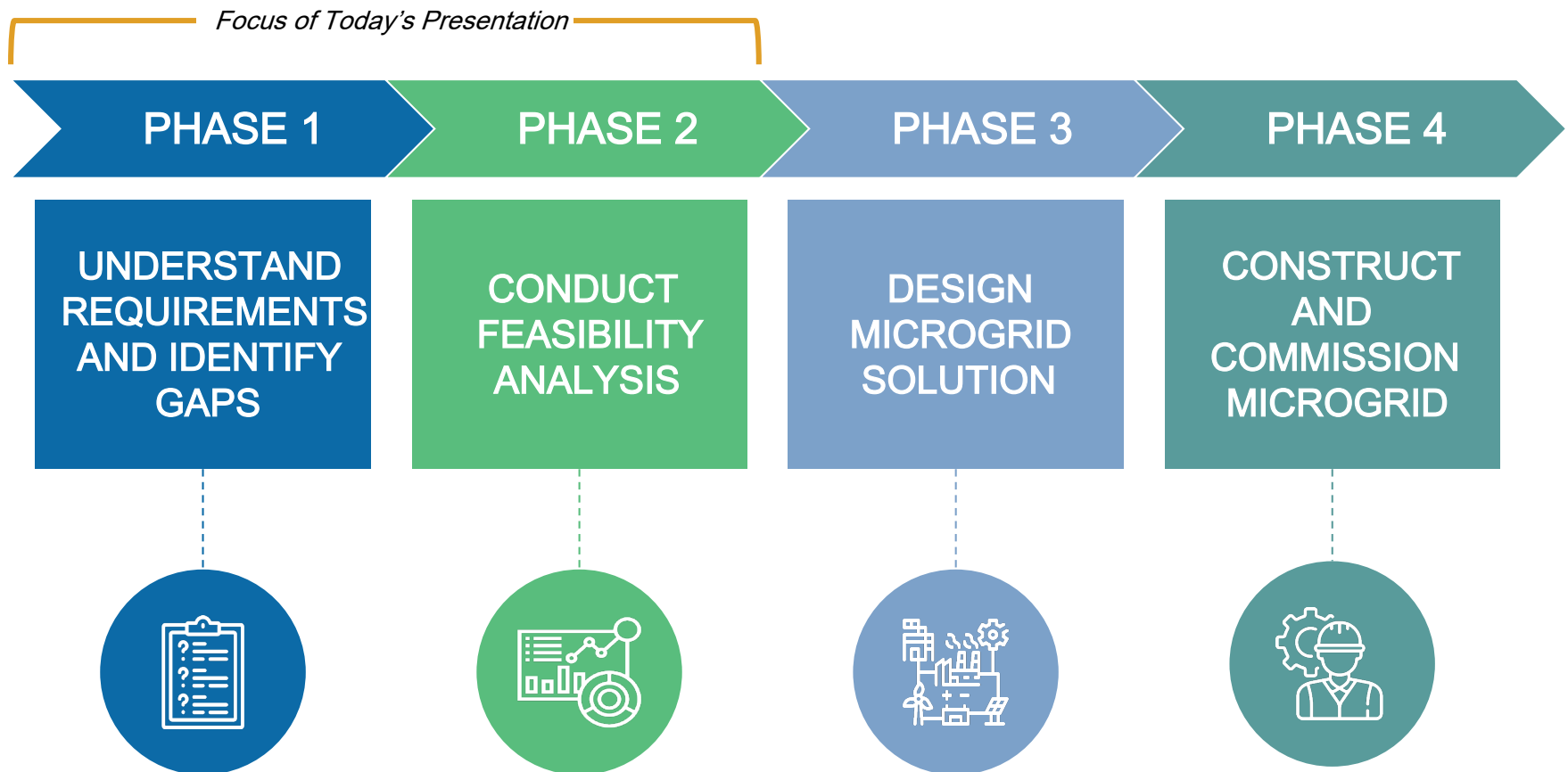
The Airport Microgrid Implementation Toolkit is a web -based resource designed to:

- ✈ Inform airport stakeholders about the capabilities of microgrids
- ✈ Provide guidance and background resources
- ✈ Collect + consolidate airport data
- ✈ Provide technology overview and options

[ACRPMicrogridToolkit.Xendee.com](https://www.acrpmicrogridtoolkit.xendee.com)



Airport Microgrid Implementation Process



Aging Infrastructure, Cyber Attacks, and Extreme Weather Events Threaten Airports



7

Airports directly serviced by the Colonial Pipeline, resulting in disruptions during cyber attack



\$40M

Total loss for Delta Airlines from the power outage at ATL in December 2017



>400

Flights suspended at EWR following Hurricane Ida in September 2021

Microgrid Toolkit Overview

AIRPORT MICROGRID implementation toolkit

ABOUT THE PROJECT

Converge Strategies and XENDEE worked with a team of partners to develop an online [microgrid implementation toolkit](#) for airport decision makers to evaluate and pursue energy resilience investments.

PROJECT TEAM

- ✈ Converge Strategies
- ✈ XENDEE
- ✈ Rocky Mountain Institute
- ✈ Barrett Energy Resources Group

MICROGRID TOOLKIT MODULES

Module 0: Microgrid Basics & Background

Module 1: Airport Profile

Module 2 : Resilience

Module 3: Stakeholder Engagement

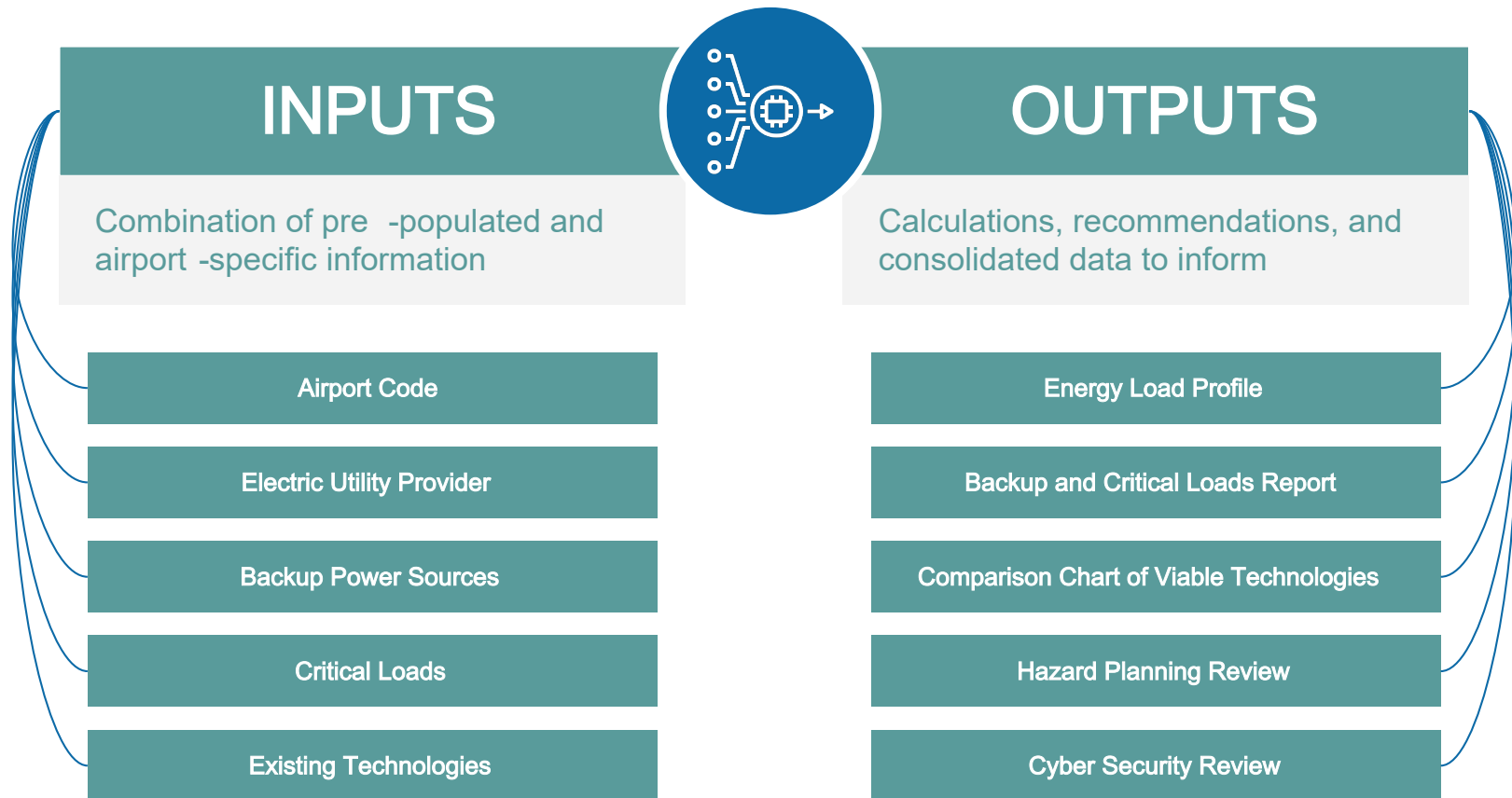
Module 4: Energy Options

Module 5: Finance & Ownership

Module 6: Operations & Maintenance

Module 7: Master Module

Microgrid Implementation Utilizes An Input/Output Approach



Airport Profile Module

Module 1

Airport Profile

Airport Profile Introduction

Airport Information

Utility and Commodity Information

Energy Use

Electricity End Uses

Summary

MODULE 1 INPUTS

Airport Code

Electric Utility Provider

Electric Utility Tariff Name

Commodity Provider Name (Optional)

Commodity Fee Schedule (Optional)

Energy Use (Choose from 3 options)

- ✈ Upload hourly energy load profile
- ✈ Enter monthly energy consumption
- ✈ Use sample load profile for airport

Electricity End Uses (based on data)

MODULE 1 OUTPUTS

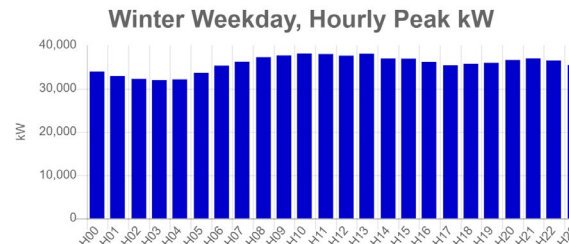
General Information

- ✈ Electric utility ownership type
- ✈ Presence of organized electricity market
- ✈ Status of deregulation in your state

Reliability Information

- ✈ SAIDI Reporting Standard for your region
- ✈ SAIFI Reporting Standard for your region
- ✈ Information about reliability metrics

Energy Load Profile



EXAMPLE OUTPUTS

- ✈ Utility provider has 60.4% better reliability for frequency of outages and 37.2% better reliability for duration of events
- ✈ Your annual airport energy usage is 1,774 MWh with a peak load of 365 kW
- ✈ \$0.10/kWh – weighted average of wholesale market price at L.G. Hanscom Field

Resilience Module

Module 2 Resilience

Introduction

Microgrid Readiness

Backup Power Sources

Critical Loads

Backup and Critical Load
Report

Hazard Planning

Microgrid Design

Airport Emergency Plans

Cyber Security

Summary

MODULE 2 INPUTS

Microgrid Readiness (General)

- ✈ Critical loads identification (Yes/No)
- ✈ Backup genset identification (Yes/No)
- ✈ Other considerations (e.g., efficiency)

Backup Power Sources (Specific)

- ✈ Backup Power Source Name
- ✈ Backup Type (e.g., diesel genset, battery)
- ✈ Backup Size (kW)

Critical Loads (Specific)

- ✈ Priority (i.e., low, medium, high)
- ✈ Peak Demand (kW)
- ✈ Backup Power Source (based on above)

MODULE 2 OUTPUTS

Backup and Critical Loads Report

- ✈ Summarizes backup and critical loads
- ✈ Highlights critical loads with insufficiently sized backup power sources

Hazard Planning Review

- ✈ Discusses the implications of "resilience scale" hazards on microgrid design and airport emergency plans

Cyber Security Review

- ✈ Provides resources for understanding the IT infrastructure that airports and its energy infrastructure depends on

Stakeholder Engagement Module

MODULE 3 INPUTS

Pre-Stakeholder Engagement Questions

- ✈ Do you understand your governance /profit structure of the airport?
- ✈ Do you have an idea of what use and lease agreements are available to your airport?
- ✈ Do you understand who funds and approves large -scale projects?
- ✈ Do you know if you have an on - site/internal procurement office?
- ✈ Do you understand how and what organization provides electricity and natural gas to the airport?

MODULE 3 OUTPUTS

Stakeholder List + Mapping

Next Steps for Engagement (Workshops)

Information Feeds into Other Modules

Module 3 Stakeholder Engagement

Stakeholder Engagement
Introduction

Pre-Stakeholder
Engagement Questions

Identifying Stakeholders

Why Identify

Identify Key Stakeholders

Stakeholder Involvement by
Phase

Conceptualization and
Planning

Procurement

Design and Construction

Operations

Engaging Stakeholders

Tenants

Interviews

Workshops

Summary

Energy Options Module

Module 4

Energy Options

Introduction

Energy Options

Existing Technologies

Compare Technologies

Comparison Summary

Additional Technologies

Summary

MODULE 4 INPUTS

Select Existing Technologies

- **Electricity:** Alternative Electricity Storage; Battery Storage; Diesel Generator; Electricity Efficiency; Fuel Cells; Load Control; Microturbine; Natural Gas Generator; Solar PV; Wind
- **Heating & Cooling:** Air Source Heat Pumps; Biomass; CHP; Ground Source Heat Pumps; Heating/Cooling Efficiency; Load Control; Natural and Biogas; Boiler/Chiller/Furnace; Solar Thermal; Thermal Storage

Select Cost-Benefit Technology “Levers”

- **Levers:** Siting Levelized Cost of Energy, Resilience Emissions


Select Additional On -Site Generation

- Based on options from existing tech

MODULE 4 OUTPUTS

Comparison Chart of Viable Technologies

- Based on existing technologies selected and cost-benefit levers



Technology	Type	Time Type	Siting	Levelized Costs (\$/MWh) ¹	Resilience Services ²	Emissions ³
Battery Storage	Electricity	Base Load	On-Site		Yes	None
Diesel Generator	Electricity	Base Load	On-Site	\$239.00	No	Yes
Natural Gas Generator	Electricity	Base Load	On-Site	\$87.00	No	Yes
Wind	Electricity	Intermittent	On-Site / Off-Site. FAA's Notice Criteria Tool and Surface Analysis and Visualization Tool	\$42.50	Yes/No	None
Air Source Heat Pumps	Heating	Base Load	On-Site		No	Yes, reduction
Combined Heat and Power (CHP) / Cogeneration	Heating	Base Load	On-Site		No	Yes, reduction
Ground Source Heat Pumps	Heating	Base Load	On-Site		No	Yes, reduction

Military Microgrid Case Studies Featured In Microgrid Implementation Toolkit

Otis Air National Guard Base

Cape Cod, MA



Wind + Battery Storage

Air Force 102nd IW

Marine Corps Air Station Miramar

San Diego, CA



Landfill Gas + Battery + PV

3rd Marine AW

Marine Corps Air Station Yuma

Yuma, AZ



24 MW Diesel Microgrid

Marine AWT Squadron 1

Aviation Industry Can Leverage Lessons Learned from DoD to Improve Resilience



DETERMINE MISSION CRITICALITY

Airports should identify and prioritize their critical “missions” and determine the energy requirements



INTEGRATE EXISTING RESOURCES

Airports should assess opportunities to use existing energy assets as building blocks for a microgrid



EXPLORE REVENUE GENERATION

Airports should identify the market opportunities and constraints of their utilities



INVOLVE TENANTS

Airports should work with the tenants to understand their energy resilience requirements



PARTNER WITH MILITARY

Airports should seek to engage with co -located military bases on joint energy resilience planning

Microgrid Workshop Discussed Potential for Microgrid at LG Hanscom Field



OBJECTIVE 1

Advance the state of the knowledge for a potential civilian microgrid at Hanscom Field



OBJECTIVE 2

Review the results of a site specific Hanscom microgrid feasibility study conducted using Microgrid Toolkit



OBJECTIVE 3

Develop shared understanding of requirements to support critical operations at Hanscom Field



OBJECTIVE 4

Collaborate with stakeholders to identify complementary efforts to enhance energy resilience and clean energy



OBJECTIVE 5

Identify next steps for continued collaboration and energy project development at Hanscom Field

CSL and XENDEE convened 22 participants from 15 organizations at Boston Logan International Airport in Boston, MA on Jan. 17, 2020.

XENDEE Microgrid Tool Demonstration

AIRPORT MICROGRID
implementation toolkit

[About](#) [Partners](#) [User Guide](#) [Feedback](#) [Register](#) [Log in](#)



Discover how Microgrid or Distributed Energy Resources can benefit your airport.

Airport Microgrid Implementation Toolkit

Discover how Microgrid or Distributed Energy Resources can benefit your airport.

GET STARTED

Converge Strategies + XENDEE Assessed Feasibility of Developing Microgrid

FEASIBILITY STUDY FOCUS AREAS



ECONOMIC FEASIBILITY OF
SOLAR + STORAGE
MICROGRID



ENERGY RESILIENCE
THROUGH GRID OUTAGES*



NET-NEUTRAL CARBON
SOLUTION



Pictured: XENDEE technical analysis of solar generating assets designed to be connected to L.G. Hanscom Field buildings.

* Multiple data inputs provided by Massport (e.g., metered electricity demand data, electricity price), as well as proxy sources such as NREL, EIA, GTM Research or past projects (e.g., installation and O&M costs)

Today's Panelists



Moderator: Cullen Choi,
Denver International Airport



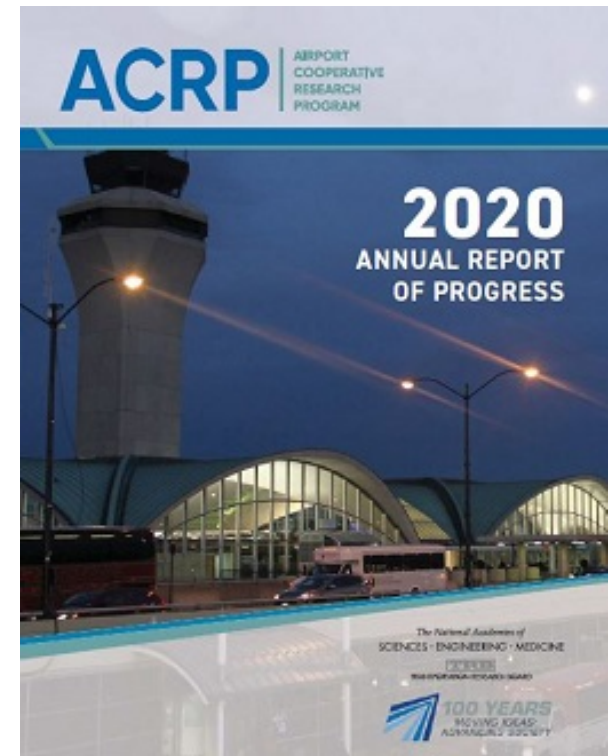
Meredith Pringle,
Converge Strategies, LLC



Adib Nasle,
XENDEE

ACRP is an Industry–Driven Program

- ➔ Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- ➔ Seeks out the latest issues facing the airport industry.
- ➔ Conducts research to find solutions.
- ➔ Publishes and disseminates research results through free publications and webinars.



Other Ways to Participate



Become an Ambassador. Ambassadors represent ACRP at events and conferences across the country!



Sponsor or become an ACRP Champion. The champion program is designed to help early- to mid-career, young professionals grow and excel within the airport industry.



Visit ACRP's Impacts on Practice webpage to submit leads on how ACRP's research is being applied at any airport.

Visit us online:
www.trb.org/ACRP

Other ACRP Research on Today's Topic

Research Report 108: *Guidebook for Energy Facilities Compatibility with Airports and Airspace*

ACRP Report 110: *Evaluating Impacts of Sustainability Practices on Airport Operations and Maintenance*

Research Report 141: *Renewable Energy as an Airport Revenue Source*

Research Report 151: *Developing a Business Case for Renewable Energy at Airports*

Research Report 220: *Guidebook for Developing a Zero- or Low-Emissions Roadmap at Airports*

Synthesis Report 91: *Microgrids and Their Application for Airports and Public Tran*

Synthesis Report 100: *Airport Greenhouse Gas Reduction Efforts*

Synthesis Report 110: *Airport Renewable Energy Products Inventory and Case Examples*

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[Register now](#) for our January meeting! *There will be no onsite registration this year.*

#TRBAM

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