Energetic Value: The Design and Economics of Microgrids at Airports

Wednesday, March 20, 2019
2:00-3:30 PM ET
Purpose

Discuss research from the Airport Cooperative Research Program (ACRP) Synthesis 91/Transit Cooperative Research Program (TCRP) Synthesis 137: Microgrids and Their Application for Airports and Public Transit.

Learning Objectives

At the end of this webinar, you will be able to:

• Understand microgrids and their application at airports
• Identify the steps required to evaluate a microgrid at their facility
• Understand the design and installation challenges for airports
• Describe a case study of microgrid use at an airport
ACRP Webinar

Energetic Value — The Design and Economics of Microgrids at Airports

March 20, 2019
Rima Oueid
U.S. Department of Energy

- DOE Senior Policy Advisor
- Advisor on energy infrastructure project finance, microgrids, and investment strategies
- Energy Finance Advisor on Hurricane Sandy Task Force
- Provided technical, financial, and strategy assistance for NJ TransitGrid
- Topic panel and report contributor
  - Microgrids and Their Application for Airports and Public Transit
- University Of Chicago Booth School Of Business MBA, University of Illinois Bachelor of Science
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community
2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

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Today’s Speakers

Eric Mannarino, Arup
and
Brendan Reed, San Diego International Airport

Presenting
ACRP Synthesis 91
Microgrids and Their Application
for Airports and Public Transit
Microgrids and Their Application to Airports and Public Transit

Eric Mannarino, MS, PE
Arup

March 20, 2019
Eric Mannarino, MS, PE
Co-Author

- Electrical Engineer, Arup
- DER, Microgrid, and Critical Power Design
- AC/DC Microgrid and BSS Research
- Certified Professional Engineer, CA
ACRP Synthesis 91 Oversight Panel

Joshua D. Abramson, Eastwood Airport Management, Panel Chair
Debbie K. Alke, Montana DOT
Gloria G. Bender, TransSolutions, LLC
David A. Byers, Quadrex Aviation, LLC
David N. Edwards, Jr., Greenville-Spartanburg Airport District
Brenda L. Enos, Burns & McDonnell
Linda Howard, Independent Aviation Consultant
Patrick W. Magnotta, FAA Liaison
Matthew J. Griffin, Airports Consultants Council Liaison
Liying Gu, Airports Council International – North America Liaison
Adam Williams, Aircraft Owners & Pilots Association Liaison
Christine Gerencher, TRB Liaison
Microgrids as a solution to power reliability and resiliency issues

Identifies considerations and potential difficulties in implementing microgrids

Identifies and documents the benefits for airports in adopting microgrids

Identifies key steps in the development process

Presents means for stakeholders to organize airport microgrid deployment

Presents additional case studies for the use of microgrids at various facilities

Published August 2018
Microgrids and Their Application for Airports

A Research Synthesis

- What are Microgrids?
- The Benefits to Airports and Public Transit Agencies
- Opportunities
- Barriers and Considerations
- Microgrid Costs
- Cost Savings and Monetization Strategies
- Case Studies
Drivers of Adoption

- Site resilience and reliability
- Increasing costs of fossil fuels
- Falling costs of Battery Storage Systems (BSS) and Distributed Energy Resources (DER)
- The need to balance intermittent DERs
- Climate goals and clean energy mandates
- Changing regulatory environment
- Increasing frequency of extreme weather events
An Introduction to Microgrids

Department of Energy (DoE) Microgrid Definition

- A group of interconnected loads and DERs within a clearly defined electrical boundary that act as a single controllable entity with respect to the grid
- A Microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or grid-islanded mode

What does a microgrid allow for?

- Grid modernization
- Enhanced integration of DERs
- Reliable and resilient power supply for critical loads

Advanced Microgrids

- Improving the resilience of the local grid
  - 2-way communication with the grid
  - Local compensation for the variability of Renewable Energy
  - Ancillary Services: VAr Support, Voltage Regulation, Frequency Regulation

- Dynamic dispatch algorithms
  - Response to time-of-use pricing
  - Mitigation of peak demand charges
  - Minimizes carbon cost of energy
  - Predictive dispatch
  - Outage management

- Improved Cybersecurity
  - Integrated controls
  - Advanced monitoring

Microgrids at Airports

- Improved power reliability
- Improved energy resiliency
- Energy cost savings
- Cost risk reduction
- Improved sustainability

Outages in 2017

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Barriers and Considerations for Airport Microgrids

- **Technical**
  - High energy demand
  - Operational continuity
- **Financial**
  - Low energy costs
  - Valuing resiliency
- **Regulatory/Policy**
  - FAA safety requirements
  - Security and access
- **Operational and organizational**
  - Conflicting stakeholder interests
  - Complex O&M and procurement
- **Utility interconnection**
Opportunities in Airports

Technical
- Physical space and capacity
- Dedicated site personnel
- Advantageous demand profiles
- Existing microgrid components

Financial
- Federal Tax Credit (ITC) eligible
- Access to revenue streams
- P3, PPA, etc.

Regulatory/Policy
- Organizational sustainability goals
- Internal resiliency goals
- Energy market participation
Developing a microgrid is complex

What is the project scope?

How do we design a microgrid?

What does it do?

Will a microgrid work for this site?

Microgrid Design Process

Elements for microgrid realization – Anup 2017
Microgrid Design Goals

- Capabilities
- Assets
- Internal goals
- Economics
- Regulation

Microgrid variation attributes – Arup 2017
Utility negotiations

Feasibility analysis

Basis of Design (BOD)

Project scheduling

Ownership and Financing

Elements for microgrid realization – Arup 2017
Many varied factors affect the cost to implement a microgrid

Bespoke nature of current microgrid systems may lead to high costs

Limited information exists on the extended O&M costs

Developing a business case is often difficult

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<th>Component</th>
<th>Cost Ratio</th>
<th>Description</th>
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<td>Energy resources</td>
<td>30-45%</td>
<td>Energy storage; controllable loads; DG (renewable generation, CHP)</td>
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<td>Switchgear protection and transformers</td>
<td>20%</td>
<td>Switchgear utility interconnection (including low-cost switches, interconnection study, protection schemes, and protection studies)</td>
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<td>Communications and controls</td>
<td>10-20%</td>
<td>Standards and protocols; control and protection technologies; real-time signals; local supervisory control and data acquisition (SCADA) access; power electronics (smart inverters, DC bus)</td>
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<td>Site engineering and construction</td>
<td>30%</td>
<td>A&amp;E (system design and analysis); system integration, testing and validation</td>
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<tr>
<td>Operations and markets</td>
<td>5-15%</td>
<td>Operation and maintenance; market (utility) acceptance</td>
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Microgrid Ownership Models

- Single party owner
- Shared ownership
- Third party owner
- Utility ownership

Examples of capital and service exchanges in a third party ownership model – Arup 2019
Project Development: Design

- Systems Design
- Phasing
- Permitting
- Equipment specification
- Construction
Microgrid Delivery Models

- Design-bid-build (DBB)
- Design-build-finance (DBF)
- Integrated project delivery (IPD)
- Public-private partnership (P3)
- Construction manager at risk (CMAR)

Examples of capital and service exchanges using CMAR project delivery – Arup 2019
Project Development: Commissioning Operations

- Commissioning
- Operations testing
- Measurement & verification
- Retro-commissioning
- Ongoing O&M
The Benefits of Microgrids

- ISO/RTO services
  - Capacity markets & energy arbitrage
  - Frequency regulation
  - Spinning/Non-spinning reserves
  - Black start

- Utility services
  - Demand response
  - Transmission or distribution upgrade deferral
  - Emissions credit programs

- Owner/Operator goals
  - Clean energy integration
  - Business continuity

http://sustainableferc.org/iso-rto-operating-regions/
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Leveraging a (Sort of) Microgrid at a US Airport

Brendan J. Reed, CEM, LEED-AP
San Diego County Regional Airport Authority
San Diego International Airport
Brendan J. Reed  
ACRP-Synthesis 91 Panel Member 

- Director of Planning & Environmental Affairs, San Diego County Regional Airport Authority 
- 18+ Years in Environmental Policy 
- US Caucus Chair, ACI-NA Environmental Affairs Committee 
- AEE Certified Energy Manager 
- LEED Accredited Professional
Context Setting

San Diego International Airport

- 51-Gate Large Hub Airport
- Over 24 Million Annual Passengers
- Busiest Single Runway in the US
- Confined to 661 Acres (268 Hectares)
- Significant Growth Expected by 2035
“The Great Blackout of 2011”
Campus-Wide 12-kV Distribution System

- ATO Switchgears
- 5.5 MW of Solar PV Installed
- 4 MWh of BESS Design Phase
- Main Electrical Vault
- Advanced SCADA
- SDG&E INCOMING 12KV POWER

RCC
CARGO
FBO
Integrated & phased planning document

Main Goals:
- Conservation & Efficiency
- Carbon Neutrality
- Interdependence & Resiliency
- Cost Containment
- Regional & Industry Leadership

Informs capital program & operations

Available at [www.san.org/green](http://www.san.org/green)
Backbone of Sustainable Energy Plan

Contribution to SAN’s long-term energy goals:

- Allows “upstream” redundancy for grid interconnections
- Provides flexibility with siting of distributed energy resources
- Improves opportunities for direct access (commodity buying)
- Reduces electricity rates & demand charges
- Demonstrates climate, energy, & “smart airport” leadership
And if everything goes as planned...

**SAN Strategic Energy Plan - 2019 Update (DRAFT)**

*Includes Battery Energy Storage Systems (BESS)*

*Figure 10: Integrated Roadmap*
FOR ADDITIONAL INFORMATION

Brendan Reed
breed@san.org
Today’s Participants

• Rima Kasia Oueid, U.S. Department of Energy, rima.oueid@hq.doe.gov

• Eric Mannarino, Arup, Eric.mannarino@arup.com

• Brendan Reed, San Diego International Airport, breed@san.org
Panelists Presentations


After the webinar, you will receive a follow-up email containing a link to the recording
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- Seeks out the latest issues facing the airport industry.
- Conducts research to find solutions.
- Publishes and disseminates research results through free publications and webinars.
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Report 110: *Evaluating Impacts of Sustainability Practices on Airport Operations and Maintenance*

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

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

Synthesis 53: *Outcomes of Green Initiatives: Large Airport Experience*

Synthesis 93: *Sustainability's Role in Enhancing Airport Capacity*

Synthesis 77: *Airport Sustainability Practices*

Synthesis 69: *Airport Sustainability Practices—Drivers and Outcomes for Small Commercial and General Aviation Airports*

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Taking Preparedness Seriously — Emergency Exercises for Any Airport

May 8
Priming the Pump — Cleaner Approaches to Airport Ground Transportation

May 22
The Making of a Smart Airport — Preparing for the Internet of Things