

AIRPORT MICROGRID IMPLEMENTATION TOOLKIT USER GUIDEBOOK

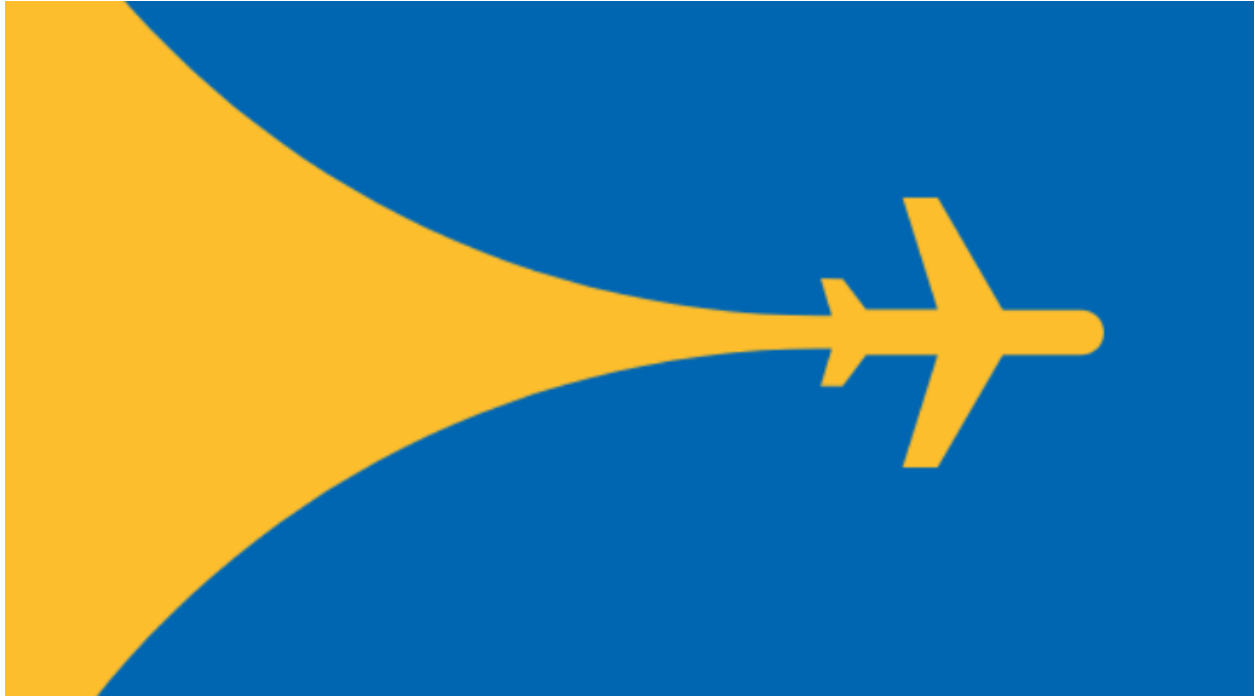


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GETTING STARTED

Create a New Account, Profile, and Airport Microgrid Project

On the toolkit homepage, select the “Get Started” button on the middle of the page.



On the Register page, enter the email and password you would like associated with your Airport Microgrid Implementation Toolkit account. Select the “Register” button to continue.

Register

If you already have an account, [login here](#)

Email

Password

Confirm password

Register

On the My Profile page, enter your information and select “save” to continue.

My Profile

First Name

Last Name

Job Title

Phone Number

Save

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Once your profile has been saved, select the “Create a New Project” button. Enter a “Project Name” (i.e. ABC Airport Microgrid) and select the “Create Project” button.

Profile Saved

Your profile has been saved.

What would you like to do next?

Update Your Profile

View My Projects

Create a New Project



Create New Project

Project Name

ABC Airport Microgrid

Create Project

You should now be on the *My Dashboard* page. On the *My Dashboard* page you can view the progress status of each module. There are eight total modules, 0-7. To begin your airport microgrid project, select the “Continue” button located on the right side of the screen within the “Module 0: Microgrid Basics and Background” section.

Module	Progress	
Module 0: Microgrid Basics & Background	 In Progress	Continue
<div> Review basics & background material</div>		

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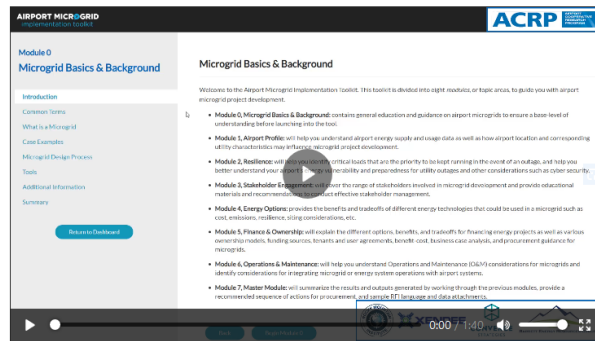
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MODULE 0 – MICROGRID BASICS AND BACKGROUND

Introduction

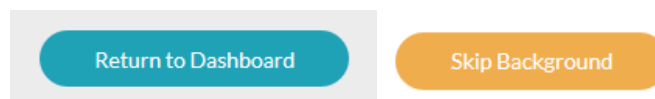
Module 0 contains general education and guidance on airport microgrids to ensure a base-level of understanding before launching into the remaining modules. On the *Introduction* page, click on the video and read through each module description to gain a sense of the toolkit contents.



Toolkit users that have a background in microgrid technologies may consider moving forward to Module 1, Airport Profile. If this is the case, select the “Return to Dashboard” button located within the table of contents on the left side of the screen. For users that may not be as familiar with microgrids, select the “Begin Module 0” button at the bottom of the *Introduction* page.

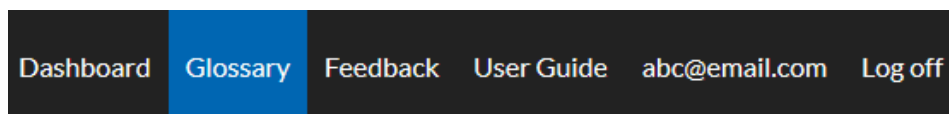


On the *Table of Contents* page, selectable links are available to navigate directly to specific Module 0 pages of interest. Select a link in any order or select the “Continue” button located at the bottom of the page if you would like to explore the Module 0 content in sequence. Again, if you would like to skip the microgrid background content of Module 0, select either the “Skip Background” button at the bottom of the page, or select the “Return to Dashboard” button located within the Module 0 table of contents on the left side of the screen.



Common Terms

Review the list of acronyms and terms that are referenced throughout the toolkit. No need to memorize everything on this page. If you come across an unfamiliar term as you work through the toolkit, refer to the Glossary which can be accessed at the top of each page.



Select the “Continue” button at the bottom of the page to move forward.

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What is a Microgrid

The *What is a Microgrid?* page provides a well-accepted microgrid definition provided by the Department of Energy:

“A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.”

Read through the definition and supporting material, including the list of microgrid benefits. Now that you have a better understanding of what a microgrid is, select the “Continue” button and proceed to the Case Examples page to see how microgrids have been put into practice at airports.

Case Examples

The *Case Examples* page includes six airport microgrid case studies; five military airbase microgrids and one civilian airport microgrid. Click on a link and read through the case study for details related to microgrid technologies, capabilities, sources of funding, project timeline, and more. At the bottom of each case study, select the “Back Button” to return to the *Case Examples* page. After reading through the case studies, select the “Continue” button to move on.

Microgrid Design Process

The *Microgrid Design Process* page details a 10-stage framework for microgrid design and implementation developed under *ACRP Synthesis 91 and TCRP Synthesis 137 - Microgrids and Their Application for Airports and Public Transit*. Explore the design process diagram and then navigate down to the “How Does This Toolkit Fit In” section. Read through each module description. At the bottom of the page, select the “Continue” button to move on.

Tools

The *Tools* page introduces the user to phases of microgrid adoption and provides information on techno-economic models and power system analysis tools that can be used during the planning and design phases. A comprehensive list of techno-economic and power system analysis tools available through a variety of providers is included. Navigate to the bottom of the page and select the “Continue” button to move on.

Additional Information

Now that you have completed the previous Module 0 sections you are ready to continue into Module 1, Airport Profile; however, if you would like to further explore additional microgrid resources prior to moving on, the *Additional Information* page includes a number of links to resources ranging from microgrid design and implementation to resiliency and monetization. Select the “Continue” button to move on.

Summary

You have completed Module 0. If you wish to continue to Module 1, Airport Profile, select “Start Module 1” button. You may also return to the *Dashboard* by selecting the “Back to Dashboard” button.

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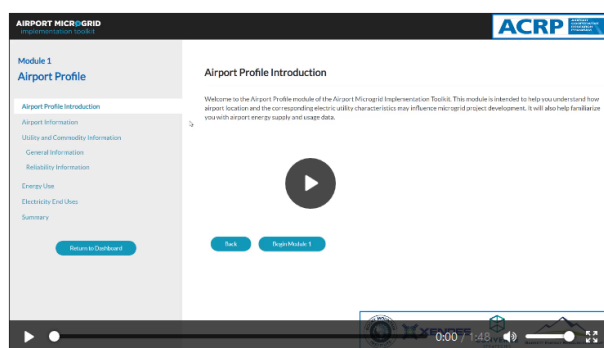
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MODULE 1 – AIRPORT PROFILE

Introduction

Module 1 is intended to help you understand how airport location and the corresponding electric utility characteristics may influence microgrid project development. It will also help familiarize you with airport energy supply and usage data. On the *Introduction* page, click on the video and read through the introduction. Then select the “Begin Module 1” button to move on.



Airport Information

Selecting the “Save and Continue” button will save the information that you have entered. If you need to exit the toolkit for any reason, you may return to where you left off with all previously input content in place.

On the Airport Information page, enter your airport’s International Air Transport Association (IATA) 3-letter identifier in the dropdown menu and select your facility from the list.*

Airport Code (IATA)

Verify your facility name and location on the associated map and then select the “Save and Continue” button at the bottom of the page to move on.

Utility and Commodity Information

Now that you have entered your airport information, the next step is to enter information about your local utility provider(s). First, select your airport’s Electric Utility Provider using the dropdown list.* The dropdown list includes all of the electric utility providers registered in your state (based on your previously entered airport code).

Electric Utility Provider

Next, enter in your Electric Utility Tariff Name.** Consult your monthly utility bill to find the precise name of your utility tariff, then enter it in the text box. If you don't have access to your utility bill, or can't find the utility tariff on your bill, you can enter **Unknown** in the text box.

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Electric Utility Tariff Name

Next, if your airport generates heat or electricity from fuel such as diesel or natural gas, enter the name and fee schedule of your commodity provider in the appropriate text boxes.

Leave the Commodity Provider Name field blank if your facility does not purchase fuel to deliver heat or to generate electricity.** If your electric utility is the same company that provides these commodities, then enter **Same**.

Commodity Provider Name

Leave Commodity Fee Schedule field blank if your facility does not purchase fuel to deliver heat or to generate electricity.** Otherwise, consult your monthly commodity bill to find the precise name of your fee schedule, then enter it in the text box. If you don't have access to your commodity bill or can't find the fee schedule on your bill, you can enter **Unknown** in the text box.

Commodity Fee Schedule

Once you have made all applicable utility/commodity provider inputs, select the “Save and Continue” button to move on. In the next section you will be presented with general and reliability information about your utility provider that you should be aware of.

General Information

The “Your Utility” section includes the following information: state, utility, ownership, ISO & RTO, retail choice, and restructuring status.

Read through the “Microgrid Development Considerations Based on Utility Ownership” section. This section will be populated based on your utility provider’s ownership structure.

Microgrid Development Considerations based on Utility Ownership: Investor Owned

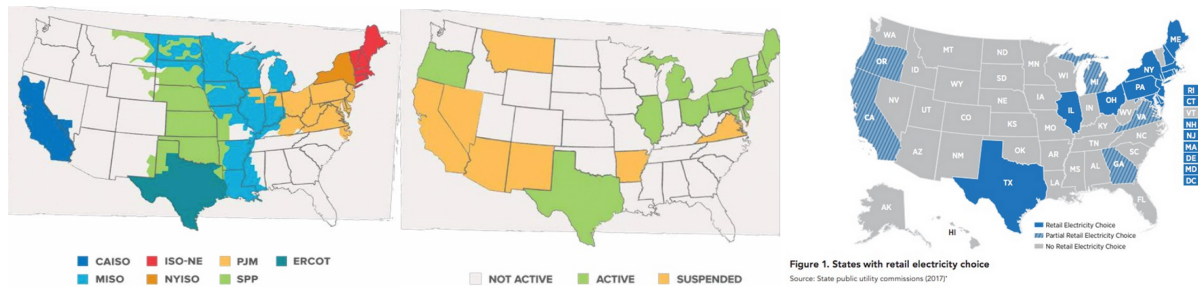
Read through the “About Utility Ownership Types, ISOs/RTOs, and Regulated/Deregulated Markets to gain a better understanding of the structure of your utility provider, which may influence how your airport chooses to move forward with microgrid development. Also, explore the ISO/RTO, Restructuring Status, and Retail Choice Maps for additional context.

About Utility Ownership Types, ISOs/RTOs, and Regulated/Deregulated Markets

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Select the “Continue” button at the bottom of the page to move on.

Reliability Information

Information about your utility provider’s reliability is presented next. View your utility’s System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) results compared to national averages. Results are presented in terms of both “With Major Event Days” and “Without Major Event Days.”*** You may also view maps detailing average SAIDI and SAIFI reporting results by state for both major event days and non-major event days using the dropdown menus at the top right corner of the page.

SAIDI	With Major Event Days	Without Major Event Days
Reporting metric:	SAIFI	Major event days: Include

For additional context, read through the “About Reliability Metrics” section to gain a better understanding of how and by whom reliability metrics are reported.

About Reliability Metrics

Select the “Continue” button to move on.

Energy Use

In this section, select how you would like to enter your airport’s energy use. You can share this information by: uploading your airport’s hourly energy load profile; entering your airport’s monthly energy use and peak demand; or by selecting an energy load profile from a sample airport. Select the option desired and click the “Continue” button.

- ☒ Upload your airport’s hourly energy load profile
- ☐ Enter your airport’s monthly energy consumption (MWh) and peak load (kW)
- ☐ Use the energy load profile data from a sample airport

Option 1: Upload Your Airport’s Hourly Energy Load Profile

Uploading your airport’s hourly energy load profile will provide the best results. To upload your airport’s hourly energy load profile, you will need to download the appropriate “Airport Load Profile Data Template” spreadsheet, open the spreadsheet and follow the instructions, save and upload the spreadsheet to the toolkit. Select the “Save and Continue” button to view and download the following

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charts: Winter Weekday, Peak kilowatt (kW), Summer Weekday, Peak kW, Peak Day, and Frequency of Daily Peak Loads.

Option 2: Enter Your Airport's Monthly Energy Consumption (MWh) and Peak Load (kW)

For less detailed, but still airport specific results, enter your airport's monthly energy consumption in megawatt hours (MWh) and peak load (kW). For this you will need monthly copies of your airport's utility bills.

Month	Energy Consumption (MWh)	Peak Demand (kW)
-------	--------------------------	------------------

Select the "Save and Continue" button to view and download charts summarizing your airport's monthly load profile.

Option 3: Select a Sample Airport

If you are unable to enter your airport's specific energy use using either options 1 or 2, energy load profile data has been gathered from three candidate airports: A Small Hub airport, a Medium Hub airport and a Large Hub airport. Select the sample airport energy load profile that most closely matches your airport's energy use. Note that sample airport data is not available for Nonhub Primary, Nonprimary Commercial Service, Reliever, or General Aviation airports. The Small Hub airport option would most closely match these types of airport sizes.

Select the "Save and Continue" button to view and download the following charts: Winter Weekday, Peak kW, Summer Weekday, Peak kW, Peak Day, and Frequency of Daily Peak Loads.

Electricity End Uses

Select all the Electricity End Uses associated with the terminal/building, airside, and groundside that are included in your load profile or energy consumption data.* For additional end uses that may be included in your load profile or energy consumption data, but are not listed, please select the "Other" box and input any end uses in the text box.

Select the "Save and Continue" button to move on.

Summary

You have completed Module 1. If you wish to continue to Module 2, Resilience, select the "Start Module 2" button. You may also return to the Dashboard by selecting the "Back to Dashboard" button.

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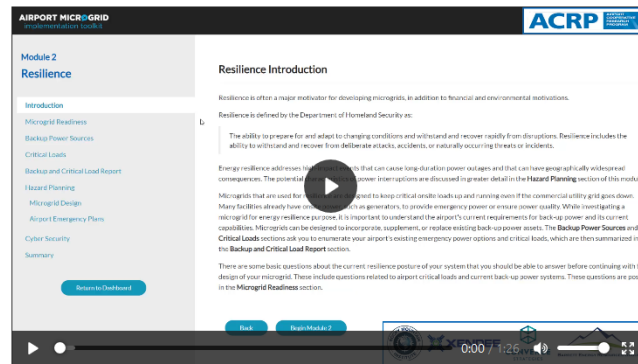
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MODULE 2 – RESILIENCE

Introduction

Optimizing resilience is often a major motivator for developing microgrids. On the *Introduction* page, read through the module content details and click on the video. When you are finished, select the “Begin Module 2” button.



Microgrid Readiness

Before continuing with the design of your microgrid, the Microgrid Readiness page presents some basic questions about the current resilience readiness of your system that you should be able to answer. These include questions related to airport critical loads and current back-up power systems.**

Critical Loads

Critical loads cannot be interrupted without compromising core airport function and/or life, health and safety.

1. Have you identified your critical loads?

Yes **No**  More Information

Each question contains a selectable “More Information” icon. If you are unsure how to answer a question, refer to the “More Information” icon for guidance. Note that the toolkit does not require the user to answer “Yes” to every question listed in order to continue through the toolkit; however, providing responses is highly recommended prior to moving on. Proceed to the next page by selecting the “Save and Continue” button.

Backup Power Sources

To begin assessing your airport's resilience to outages, enter details about your airport's backup power systems. Select the “Add a New Backup Power Source” button and complete the form on the following page. When you have finished entering the backup power source details, select the “Add Backup Power Source” button.*

Add a New Backup Power Source

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Add a Backup Power Source

Backup Power Source Name

Backup Type

Backup Size (kW) kW

[Add Backup Power Source](#) [Cancel](#)

All backup power sources will be listed on the Backup Power Sources page. Add, edit, or remove backup power sources as necessary. When you are finished entering all applicable backup power sources, select the “Continue” button to move on.

Name	Type	Capacity (kW)	
Battery 2	Battery Storage	100 kW	Edit Delete

Critical Loads

Next, enter all loads that are critical to the operation of your airport. Select the “Add a New Critical Load” button. On the right-hand side of the proceeding page, you will notice that all the electricity end uses that were input in the Electricity End Uses section of Module 1 have been transferred over. For user ease, select the “Copy” button for a given end use that you believe to be a critical load. This will automatically populate the “Critical Load Name” within the form to the left. Complete the form for the end use selected and then select the “Add Critical Load” button.

[Add a New Critical Load](#)

Add a Critical Load

Critical Load Name

Priority [More Information](#)

Peak Demand (kW) kW

Backup Power Source

[Add Critical Load](#) [Cancel](#)

Add, edit, or remove critical loads as necessary. All critical loads identified will be listed on the Critical Loads page. When you are finished, select the “Continue” button to move on.

Name	Priority	Peak Demand (kW)	Backup Power Source	
Aircraft movement related - FAA Tower – if airport circuit serves a primary power source	High	10 kW	Diesel Generator 1 (100 kW)	Edit Delete

Backup and Critical Load Report

Once you have entered in your facility’s backup power sources and critical loads, this information will be summarized within the Backup and Critical Load Report.*** The critical loads served by each backup power source are listed. If the capacity of your backup power sources is insufficient to serve your critical loads, you will receive a notification indicating that you may need additional backup power capacity to meet your airport needs.

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Hazard Planning

Read through the energy resilience definition provided. Take a look also at the chart depicting how additional/alternative backup sources of power can extend your airport's ability to maintain power during an outage event. After reviewing this chart, select the "Continue" button to move on.

Microgrid Design

This section includes hazard planning insight with respect to the microgrid design process. Read through the Considerations related to Power Interruption Duration and Considerations related to Hazard Impacts on Microgrid Equipment sections. Select the "Continue" button when you are ready to move on.

Airport Emergency Plans

Energy resilience considerations can be integrated into airport emergency plans (AEP). Read through this section as well as the documents on Considerations and Resources for Planning and Considerations and Resources for Emergency Exercises to learn how a long-term energy outage may be addressed by your airport's AEP and emergency exercises. Select the "Continue" button when you are ready to move on.

Cyber Security

On-site generation systems that are grid-connected rely on monitoring and control technology that is often connected to the public internet. Connections between airport power systems and the internet pose cybersecurity risks that can impact both airports and commercial grids. Read through the *Cyber Security and Airport Microgrids* memorandum for an overview of existing and emerging standards and literature that offers guidance for airport microgrid operators regarding cybersecurity. Select the "Continue" button when you are ready to move on.

Summary

You have completed Module 2. If you wish to continue to Module 3, Stakeholder Engagement, select the "Start Module 3" button. You may also return to the Dashboard by selecting the "Back to Dashboard" button.

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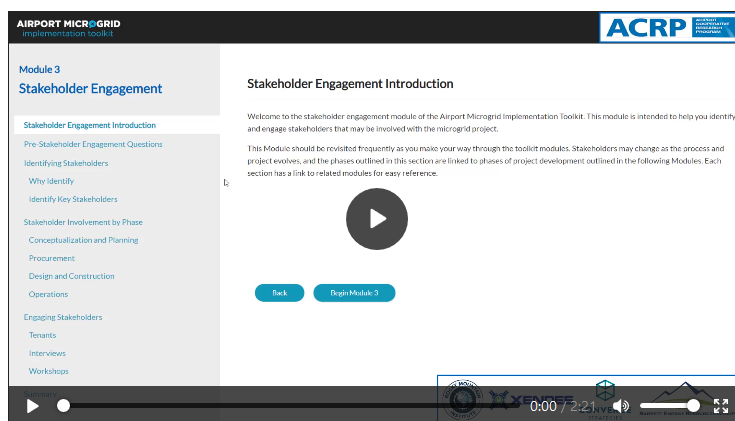
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MODULE 3 – STAKEHOLDER ENGAGEMENT

Introduction

This module is intended to help you identify and engage stakeholders that may be involved in the microgrid development process. On the Introduction page, read through the module content details and click on the video. When you are finished, select the “Begin Module 3” button.



Pre-Stakeholder Engagement Questions

Before you identify stakeholders that you will need to engage with throughout the microgrid development process, there are a number of considerations to take into account. Answer the pre-stakeholder engagement questions listed. If there are any questions that you answer “No” to, it is recommended that you first gain a better understanding of the topic prior to moving forward with Module 3. Select the “Save and Continue” button to proceed to the next section.

1. Do you understand your governance/profit structure of the airport?
☒ Yes ☐ No
2. Do you have an idea of what use and lease agreements are available to your airport?
☒ Yes ☐ No

Identifying Stakeholders

Why Identify

Stakeholders will be an integral part of the rest of the processes required for microgrid development. As you move through this toolkit, each module will require engagement with stakeholders. Read through this page for brief descriptions of how stakeholder engagement applies to each module. At the bottom of the page, select the “Additional Resource” link detailing a list of stakeholders that will need to be engaged with and their potential roles in the microgrid development process. Select the “Continue” button when you are ready to move on.

Identify Key Stakeholders

This page will introduce you to stakeholder mapping, an effective process to determine a list of key stakeholders to engage with during a project process. Read through this page to learn about the four

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steps of stakeholder mapping and the types of questions you should ask yourself when identifying stakeholders. Select the “Continue” button when you are ready to move on.

Stakeholder Involvement by Phase

Once stakeholders have been identified, they need to be engaged by the project champion throughout the microgrid development lifecycle. The next sections of this module – Conceptualization and Planning, Procurement, Design and Construction, and Operations – will help you think about which stakeholders should be involved in each phase. Select the “Continue” button when you are ready to move on after exploring stakeholder roles throughout the microgrid implementation phases.

Engaging Stakeholders

Tenants

Tenants should be engaged throughout the microgrid development lifecycle. Tenants will provide input on the microgrid design, will understand their energy requirements, and may be able to help raise funding due to their unique requirements. Take a look through the linked resources to gain a better understanding of how engaging with tenants can support the development of your microgrid. Select the “Continue” button when you are ready to move on.

Interviews

Once stakeholders are identified, they should be engaged through formal or informal interviews to capture their understanding of the project, influence the project's success, and voice any concerns. This section includes sample questions you may want to ask while engaging with airport engineering/facilities staff, airport management, utility point of contacts, federal representatives, and airline and other airport tenants. Click on each stakeholder group for details. You may also click on the “Download a PDF version of this page” button to help guide stakeholder interviews. Select the “Continue” button when you are ready to move on.

Workshops

Workshops are another effective mechanism that can be used to gather focused insight from multiple stakeholders at a single time. In this section you will be informed of steps that should be taken to conduct a successful microgrid workshop. These steps range from identifying objectives to designing an agenda to deciding on supporting materials that may be needed. Click on each step for detailed guidance. Select the “Continue” button when you are ready to move on.

Summary

You have completed Module 3. If you wish to continue to Module 4, Energy Options, select the “Start Module 4” button. You may also return to the Dashboard by selecting the “Back to Dashboard” button.

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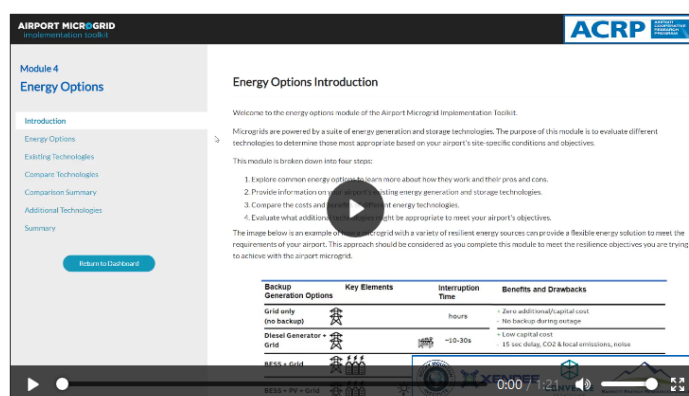
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MODULE 4 – ENERGY OPTIONS

Introduction

The purpose of this module is to evaluate different technologies to determine those most appropriate based on your airport's site-specific conditions and objectives. On the *Introduction* page, read through the module content details and click on the video. When you are finished, select the “Begin Module 4” button.



Energy Options

There are a variety of electricity and heating/cooling technologies available that you should be aware of when considering the components of your microgrid. Scroll through the list of technologies and read the brief descriptions associated with each technology. For additional information, select the link associated with each technology. Select the “Continue” button when you are ready to move on.

Existing Technologies

Your airport may already utilize various energy technologies. Select the checkbox for those technologies that your airport currently uses.** Select the “Save and Continue” button when you are ready to move on.

Compare Technologies

Costs and Benefits to Compare

- ☒ Siting
- ☒ Levelized Cost of Energy
- ☒ Resilience
- ☒ Emissions

On this page, choose the technologies that you want to compare. Click the “Select All” button if you would like to compare all technologies.* Also, choose the costs and benefits you want to evaluate: siting, levelized cost of energy, resilience, and emissions.* Select the “Save and Continue” button when you are ready to move on.

Comparison Summary

Based on your selections on the previous page, a Comparison Chart of Technologies will be generated.*** Review the chart and identify technologies that are compelling and potentially suitable for your airport. Note that monetizable services may be offered by the technologies you select to compare. For a comparison of these monetizable services, please refer to Module 5: Sources of

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Financing. When you are finished reviewing the Comparison Chart of Technologies, select the “Save and Continue” button when you are ready to move on.

Comparison Chart of Technologies

Technology	Type	Time Type	Siting	Levelized Costs (\$/MWh) ¹	Resilience Services ²	Emissions ³
Alternative Electricity Storage	Electricity		On-Site		Yes	None
Battery Storage	Electricity	Base Load	On-Site		Yes	None
Diesel Generator	Electricity	Base Load	On-Site	\$239.00	No	Yes
Electricity Efficiency	Electricity	Base Load	On-Site		Yes	Yes, reduction
Fuel Cells	Electricity	Base Load	On-Site	\$127.50	No	Yes, reduction

Additional Technologies

Now that you have identified the current technologies at your airport and have compared the costs and benefits of viable microgrid technologies, select the Electricity and Heating/Cooling generation technologies you are most interested in considering for your airport’s microgrid needs.** Select the “Save and Continue” button when you are ready to move on.

Summary

You have completed Module 4. If you wish to continue to Module 5, Financial, select the “Start Module 5” button. You may also return to the Dashboard by selecting the “Back to Dashboard” button.

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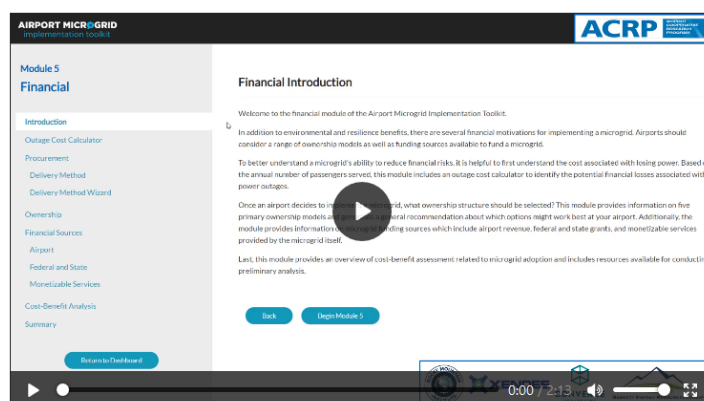
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MODULE 5 – FINANCIAL

Introduction

There are several financial motivations for implementing a microgrid. Airports should consider a range of procurement methods, ownership models, and funding sources available for microgrid development. On the *Introduction* page, read through the module content details and click on the video. When you are finished, select the “Begin Module 5” button.



Outage Cost Calculator

To better formalize the benefits of microgrids, it can be helpful to analyze the cost of an electricity outage. The Outage Cost Calculator computes the estimated cost for an outage of a specific duration based on your airport's annual volume and includes losses for: domestic and international ticket sales, aircraft belly freight, dedicated cargo, transport revenue, and concession revenue.

Data Field	Value
Annual number of passengers	<input type="text"/>
Domestic flights	<input type="text"/> %
International flights	<input type="text"/> %
Average outage duration	<input type="text"/> hour(s)
Outages per year	<input type="text"/>
Airport	-- Enter Custom Annual Cargo Tonnage --
Annual cargo tonnage	<input type="text"/>
Annual cargo revenue	\$0

To calculate your airport’s potential annual financial losses due to power outages, enter the following: annual number of passenger enplanements, the percentage of domestic flights at your airport, the percentage of international flights at your airport, the average outage duration at your airport and the number of outages per year (if these figures are not readily available, refer to your utility provider’s SAIDI/SAIFI results detailed in Module 1: Reliability Information). * If your airport has dedicated cargo services, select

your airport from the dropdown list of dedicated cargo airports to populate annual dedicated cargo tonnage (if your airport is not on the list included, select “Enter Custom Annual Cargo Tonnage” and enter the appropriate amount in the text box). * Select the “Compute Outage Costs” button. ***

For details regarding the assumptions of the Outage Cost Calculator, select the “Cost Calculator Assumptions” button. Select the “Continue” button when you are ready to move on.

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Procurement

Selecting the appropriate procurement method for your airport is an important step in the microgrid development process. On this page, read through the procurement steps. A number of airport microgrid procurement documents including RFPs, RFIs, RFQs, as well as feasibility assessments have been included for your reference. When you have finished reviewing these materials, select the “Continue” button when you are ready to move on.

Delivery Method

There are various procurement methods that can be taken to deliver a project. On this page explore the following delivery methods: Design Bid Build (DBB), Design Build (DB), Construction Manager-at-Risk (CMAR), Integrated Project Delivery (IDP), and Performance Contracting. Select each method for a description of each method. Select the “Continue” button when you are ready to move on.

Delivery Method Wizard

To make it easier for your airport procurement team, the Master Module includes a way to rank the project delivery choices based on your airport’s priorities. Based on the rankings you select in this screen and the next, the toolkit will make a recommendation as to what delivery methods may best suit your airport's needs.

Place the five project delivery choices in order of importance based on your own priorities. The item at the top should be the most important, the second item from the top the second most important, and so on. Drag and drop each project delivery choice as needed to place them in the desired order and then click the “Save and Continue” button.

Secure lowest “first cost”
Minimize the need for capital investment funding
Delegating project management decisions to trusted 3rd party
Maximize collaborative ideas between airport, designer and builder
Limit the number of procurement actions

Next, place the five project delivery choices in order of importance based on your own priorities. The item at the top should be the most important, the second item from the top the second most important, and so on. Drag and drop each project delivery choice as needed to get them in the desired order and then click the “Save and Continue” button.

Focus exclusively on project performance outcomes
Accelerate project schedule
Generate expedited internal approval via familiar procurement
Obtain high level of cost control from start
Pursue airport innovation at leading edge despite potential risks

Review the Delivery Method Wizard results and then select the “Continue” button when you are ready to move on.

* This input impacts other inputs/outputs in the toolkit.

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Ownership

There are several different ownership models that can be used in the development of microgrids. Microgrid system ownership determines who will operate and maintain the system and who owns any value and revenue streams created by it. Review the *Ownership Introduction* page and then select the “Continue” button when you are ready to move on.

On the next page review the three ownership model options: third-party ownership, airport ownership, and hybrid airport and third party-ownership. Select the “Additional Resource” link for a more detailed analysis of microgrid ownership and service models. Select the “Continue” button when you are ready to move on.

Financial Sources

The various ownership structures provide pathways to funding and financing based on the respective owners' authorities, expertise, and access to capital. Eligible microgrid projects can also apply for grant funding or financing from federal or state energy finance initiatives. A description of various sources of financing is provided on the following pages. Select the “Continue” button to move on to review airport, federal and state, and monetizable services available for microgrid funding.

Cost-Benefit Analysis

Conducting a cost-benefit analysis is an important step for an airport considering implementing a microgrid. You can begin the process using an existing microgrid cost-benefit model developed by NYSERDA and Industrial Economics, Inc. You can download and access the model user guide and spreadsheet free of charge from NYSERDA. Note that the use of this tool is for preliminary analysis purposes and that a comprehensive cost-benefit analysis should be included in a feasibility study conducted by third party consultants or internal experts.

When you are ready, select the “Continue” button to move on.

Summary

You have completed Module 5. If you wish to continue to Module 6, Operations and Maintenance, select the “Start Module 6” button. You may also return to the Dashboard by selecting the “Back to Dashboard” button.

* This input impacts other inputs/outputs in the toolkit.

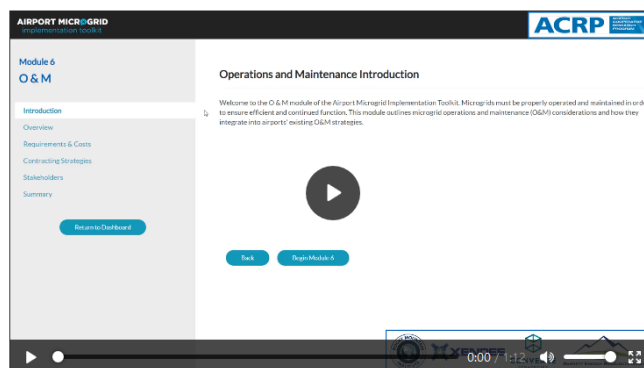
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MODULE 6 – OPERATIONS AND MAINTENANCE

Introduction

This module outlines microgrid operations and maintenance (O&M) considerations and how they integrate into existing airport O&M strategies. Read through the module content details and click on the video. When you are finished, select the “Begin Module 6” button.



Overview

Airport operations and maintenance is complex and dynamic, with a focus on the facilities, utilities, infrastructure, and equipment to support the movement of people and material in both secure and public spaces. To navigate through the complexity of O&M, this section refers the user to two ACRP reports: *ACRP Web-Only Document 37 – Research Roadmap in the Area of Airport Operations and Maintenance* and *ACRP Report 110 – Evaluating Impacts of Sustainability Practices on Airport Operations and Maintenance*. Read through this section and refer to the linked sources for additional O&M guidance.

Select the “Continue” button when you are ready to move on.

Requirements and Costs

The O&M requirements may vary widely depending on the technologies included, the microgrid size, and the geographic scope covered by the microgrid. This section identifies the typical costs associated with microgrid O&M. Read through the guidance included on this page.

When you are ready, select the “Continue” button to move on.

Contracting Strategies

Airports can take different approaches to operating and maintaining microgrids, depending on factors such as airport staff capabilities, O&M budgets, and airport appetite for operational risk. Broadly, these models can include: third-party ownership and operation, O&M contracts, and in-house O&M. Read through the details of each of these contracting strategies.

Select the “Continue” button when you are ready to move on.

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Stakeholders

The stakeholder engagement process, as covered in Module 3, includes stakeholders that should be involved to help identify O&M costs, limitations, and requirements. Recommended stakeholders to engage with regards to O&M include: utility provider(s), tenants, state public utility commission (PUC), airport staff and current O&M providers. Refer to Module 3 for further guidance related to O&M stakeholder engagement. Select the “Continue” button when you are ready to move on.

Summary

You have completed Module 6. If you wish to continue to Module 7, Master Module, select the “Start Module 7” button. You may also return to the Dashboard by selecting the “Back to Dashboard” button.

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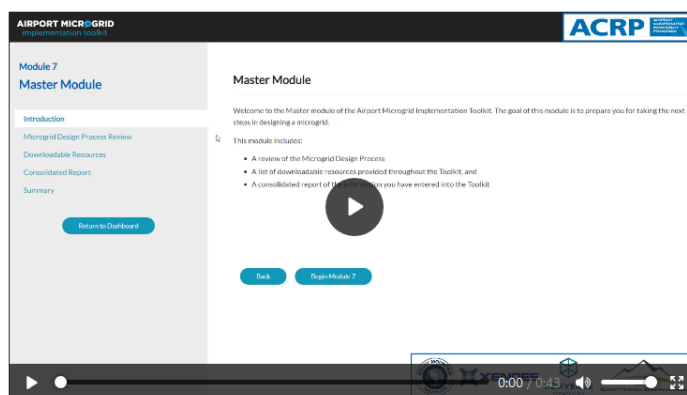
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MODULE 7 – MASTER MODULE

Introduction

This module provides a summary of the key toolkit outputs for a microgrid at your airport. Read through the module content details and click on the video. When you are finished, select the “Begin Module 7” button.



Microgrid Design Process

As first seen in Module 0, the “Elements for Microgrid Realization” diagram is included again here for your review and to help track your progress relative to the complete microgrid implementation process.

Downloadable Resources

This component of Module 7 allows users to access documents in one central location. Review this section if you are looking for additional guidance on a range of topics covered throughout the toolkit, including cyber security and stakeholder engagement.

Consolidated Report

This page consolidates the user inputs and toolkit outputs from each Module. Use this report to take informed next steps in your pursuit to develop an airport microgrid.

Summary

Congratulations on completing the toolkit.

The toolkit is designed as a dynamic support source that can be useful throughout the microgrid development process, so you may want to return to the content in the future. If you have specific suggestions for improving or adding new toolkit functionality, please use the “Feedback” feature that can be accessed on the top ribbon of the toolkit website.

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