Energy Resilience in FAA:
Lessons Learned from Puerto Rico

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Hosted by:

FEMP
Federal Energy Management Program

TVA
Standard FAA Energy Resilience

- The FAA ensures Energy Resilience with a blend of utility, standby engine-generators (E/Gs) for essential systems, and uninterruptible power systems for critical systems.
  - Typical power configuration for FAA facilities providing services to the flying public.

*Safety of the flying public is always priority #1.*
Hurricane Maria Impacts to FAA

• Hurricane Maria devastated Puerto Rico and destroyed the utility system.

• Several FAA sites across the island have been without utility power since landfall.
  – Bulk of sites on E/Gs initially
  – Power grid restored to many sites
  – FEMA E/Gs have been deployed in absence of grid
  – Some sites require road repair for full restoration
Maria Impacts to Remote FAA

• On Pico del Este, critical surveillance and communication facility completely isolated:
  – Utility line was downed through the El Yunque National Forest
  – Utility transformer was overturned and damaged
  – Site on FAA E/G until FEMA E/G was deployed
  – Utility substation remains out-of-service
  – Road is currently under repair
Pico del Este

(Left) Radar and Comm Site

(Right) Ridge below Site
Long-term Restoration Issues

• Since September 20, 2017, utility power has been unavailable at the FAA facility.
  – Estimated utility line replacement cost is $3,000,000 to $5,000,000 (FAA responsibility)
  – Substation remains offline (utility responsibility)
  – FEMA E/G is operating 24/7 with standby FAA E/Gs (in case of FEMA E/G outage)
  – Without FEMA E/G, standby FAA E/Gs require biennial replacement
Concerns and Alternatives

• FAA Concerns:
  – Utility restoration uncertainty
  – Historically poor power reliability
  – High restoration costs

• FAA Alternatives:
  – Full-time E/G suite (i.e., five E/Gs arranged N+2)
  – Renewables and batteries alone
  – Renewables and batteries (primary) with E/Gs (standby)
Design Considerations

• FAA Services require 24/7 availability
• Solar PV must fit inside current FAA fence line
• Wind must be within 1.5 miles to retain site performance
  – Too far and generators interfere with surveillance
• Renewables and E/Gs must support simultaneous operations and battery charging
  – 200% minimum production per source
Proposed Structure Change

• Remove antenna towers        Done - FAA
• Remove tower bases           Done – FAA
• Remove trailer              Done – Maria
• Reduce structure to one story  Requested
Alternatives Issues

- Operating in El Yunque National Forest
- Full-time E/G suite (i.e., five diesel E/Gs)
  - Fossil-fuel emissions
  - Noise
- Renewables and batteries alone
  - Limited solar and wind
  - Oversized charging requirements
  - Very large battery complements to accommodate cloudy, still days
Selected Alternative

• Renewables and batteries with E/Gs (standby)
  – Conceptual operations (nominal)
    • Solar PV  10 am to 2 pm
    • E/G sets  2 pm to 10 pm
    • Batteries  10 pm to 10 am
    • Wind-based charging (when available)
  – Fossil-fuel emissions and noise reduced to 8 hours
  – Maximum use of solar and wind resources
  – E/Gs provide 100% standby (on cloudy, still days)
Status

• Completed
  – Site Survey
  – Conceptual Design
  – Market Survey

• Future
  – 100% Design
  – Assess DoE contract vehicles
  – Implementation (18-24 months)
Questions