

PPUC Case Study Cost Effective Reliability S&C and PPUC Presented by: Eduardo Soares Sep/2024



### Outline



### Agenda

### 1. Palau Public Utilities Corporation

- 1. Introduction
- 2. Project Background

### 2. Decision on technology

- 1. Similar case studies from North America
- 2. Affordability
- 3. Simplicity

### 3. Case Study Results

- 1. Training and Installation
- 2. Operation summary

### 4. Conclusion

### **Palau Public Utilities Corporation**



#### **Overview**

- Established in 2013 (operating since 1994).
- 47 miles of 34.5kV Transmission
- 114 miles of 13.8kV Distribution
- 28MW Generation
- ~7,000 customers (~80% residential)



Palau Public Utilities Corporation Today's Conservation is Tomorrow's Prosperity



### **Reliability Concerns - 2019**

- Aside from Koror, load spread on long feeders to North of main island.
- Exposure to severe weather events and high vegetation growth.
- Program started in 2019-20 to investigate transmission and distribution reliability improvements.
- Evaluated several automation options, including load-break switches, single-phase reclosers and three-phase reclosers.
- Budget severely constrained.
- What can they learn from similar past experiences ?





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### Implement a Comprehensive Plan – The FPL Story







Surrounded by Coastline



Heavy Storm Landfall



High Rates of Lightning



Rapid Vegetation Growth

Confidential

### **FPL Serves More than 12 Million People Across Florida**







# Seven storms in two years!





# Achieving Resiliency Through Smart Grid Initiatives



Before the Storm



**During** the Storm



After the Storm

# Achieving Resiliency Through Smart Grid Initiatives



Before the Storm



**During** the Storm



After the Storm



### Storm Secure Program (2006-Present)







**Pole Inspections** 



Vegetation Management



Underground Conversions

### **Before the Storm | Smart Grid with Fault Management Solutions**





### Feeder: 7,000 Installed

IntelliRupter<sup>®</sup> PulseCloser<sup>®</sup> Fault Interrupter

### Lateral: 95,000 Installed

TripSaver® II Cutout-Mounted Recloser

### Grid-Edge: 30,000+ Installed

VacuFuse<sup>®</sup> II Self-Resetting Interrupter

# Achieving Resiliency Through Smart Grid Initiatives



Before the Storm



**During** the Storm



After the Storm



### **Storm Comparisons**



### **Charley** 2004 – 1.9\*







#### Hurricane wind speed (74 + mph/119 + km/h)



Gale force wind speed (58-73 mph/93 km/h - 117 km/h)



**Tropical storm wind speed** (39-57 mph/63 km/h - 92 km/h)

#### Irma 2017 – 4.3\*







#### \*Please Note:

Cyclone Damage Potential Index = force of wind, radius of wind field, and duration of winds experienced.

#### The higher the number, the higher the intensity of the storm

### **During Storms | Hurricane Ian Restoration**





Dayo

# Achieving Resiliency Through Smart Grid Initiatives



Before the Storm



**During** the Storm



After the Storm



#### FPL & Gulf Power's SAIDI 2006-2020



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### **Does a Fusing Strategy Make Sense for Your Laterals?**



#### Using Fuses for Lateral Protection Results in Avoidable Costs and Decreased Reliability





**80%** of overhead line faults are due to **temporary causes** 



Sustained fuse outages **require a crew** to restore power



Truck rolls can exceed \$1,000

## Keep the Power On for More Customers with TripSaver<sup>®</sup> II Cutout-Mounted Recloser



Improve Reliability



Reduce Costs



### Deploy with Confidence



An electronic recloser that uses a vacuum bottle to interrupt fault current

- Automatically restores power for temporary faults
- Locks out, drops out for permanent faults
- Brings fault isolation and reclosing closer to the problem

## Keep the Power On for More Customers with TripSaver<sup>®</sup> II Cutout-Mounted Recloser



### Improve Reliability



Reduce Costs



Deploy with Confidence



Keep the Lights on Without Inundating Your O&M Budget and Crews

## Dramatically Reduce Expensive Truck Rolls



Vehicle Costs Gas, Insurance, Depreciation, Maintenance, Emissions



**Circuit Topology Costs** 

The Longer the Length, the Higher the Cost-Savings

### **Reduce Costs**



### Keep the Lights on Without Inundating Your O&M Budget and Crews





### No more patrolling for a fault that isn't there



# Less time spent on avoidable fuse replacements



More time spent on **unavoidable interruptions** 

## Keep the Power On for More Customers with TripSaver<sup>®</sup> II Cutout-Mounted Recloser







Reduce Costs



### Deploy with Confidence



#### A Like-For-Like Replacement







Emulate TCC curves for **fuses** 



### **Simple Deployment & Operation**

### Drop-out visibility



### Self-powered with no comms required to operate



# Installs into a cutout mounting



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### **TripSaver II Project at PPUC**



### **Initial rollout map**







### **3 years since installation**

Locations - EAST	Temporary Faults*	Permanent Faults*
Kokusai	92	6
Downstream	8	3
Galaxy	21	12
Dirrus	122	24
Melekeok	32	8
TOTAL	275	53

Locations - NORTH	Temporary Faults*	Permanent Faults*
Uumang	47	5
Ngril	11	2
Ollei	13	1
Ngurang	56	4
Oketol	9	4
Ngerbau	17	2
TOTAL	153	18



### **3 years since installation**

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#### **Conclusion:**

- 428 outages avoided
- 428 truck-rolls avoided
- ~2.5 tons of CO2 emissions avoided
- Payback ~1.5 years average



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### S<sub>r</sub>C

### Key takeaways

- Affordable and reliable energy distribution plays a key role in the uptake of use of renewables – parallel effort
- Simple devices, such as single-phase reclosers can have a great impact in reliability whilst keeping affordability in check
- Success story in 40+ countries, including several pacific islands



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