



# IPERC<sup>®</sup>

## Microgrids for Resiliency

**Brad Luyster**

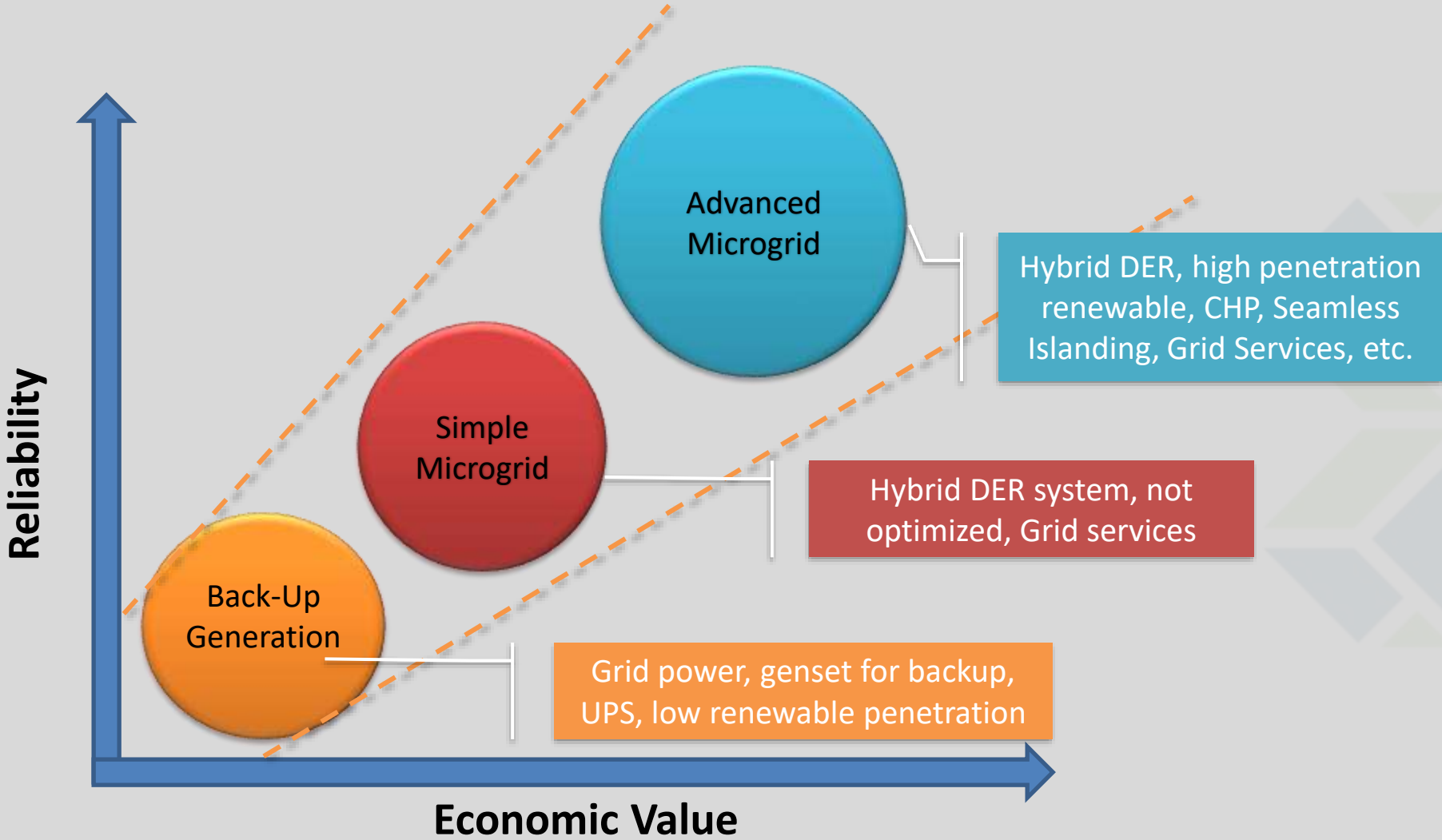
► **Director of Business Development**

ADVANCING *THE POWER OF ENERGY*

# Microgrid Critical Success Factors



# Microgrid Value Improved by Resiliency

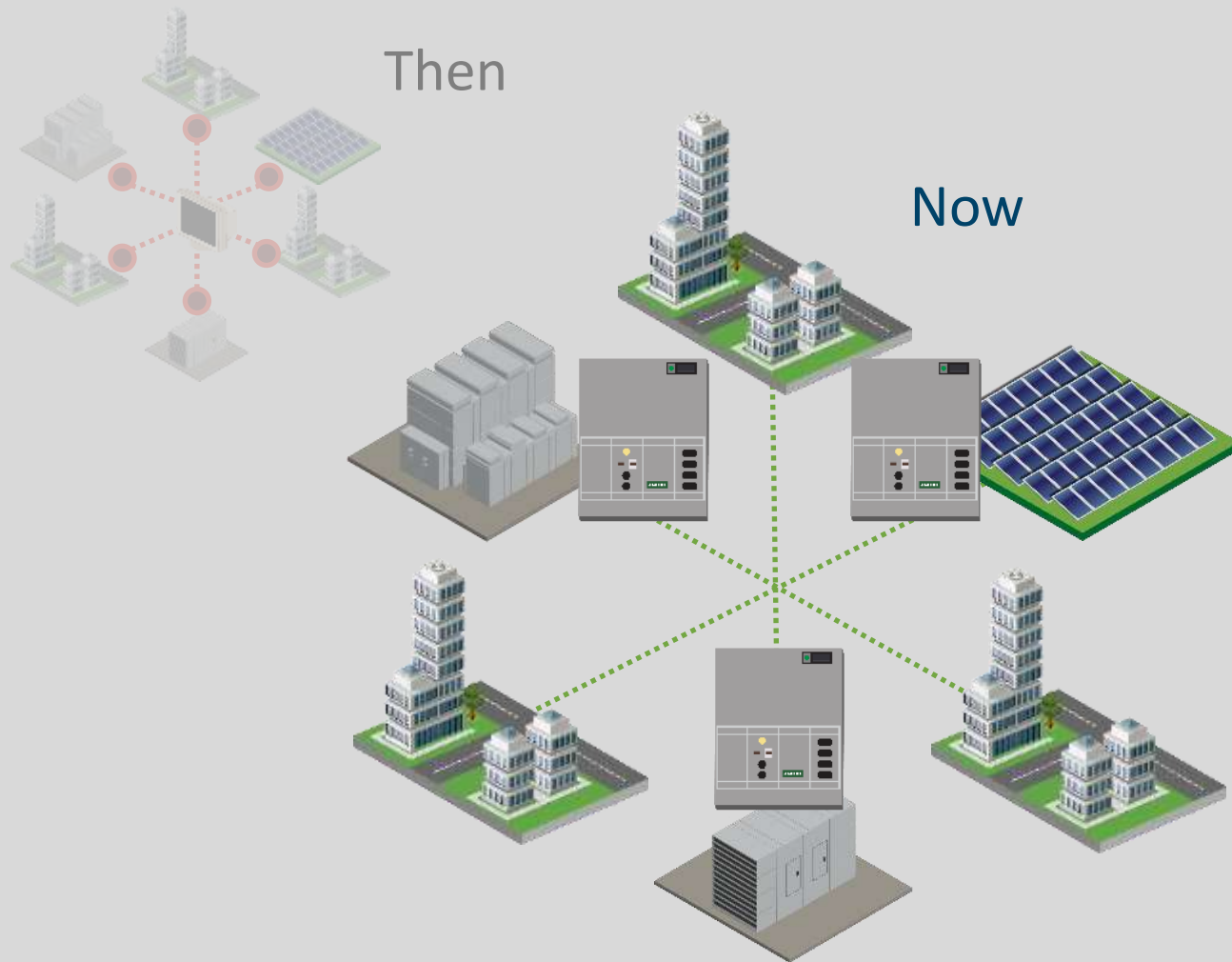




## Standard Available Microgrid Operations

- Grid-Tied
- Island
- Transitions
  - Black start
  - Intentional Island
  - Island to Grid-Tied
- DER Optimization
- Storm Preparedness
- Islanding with renewables (Green Mode)
- Peak shaving
- Curtailment
- Renewable smoothing
- Frequency Regulation
- DER Monitoring and Control
- Power Factor Correction

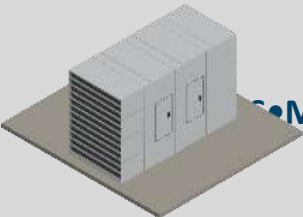
# Distributed Control Maximizes Resiliency



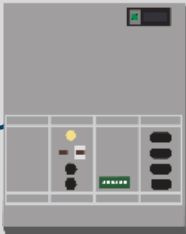
- ✓ Reflects current internet mentality
  - ✓ Distributed Intelligence
- ✓ Distributed CPUs create resilience
- ✓ Consistent platform facilitates updates
- ✓ Original code written for cybersecurity
- ✓ Inherently scalable

# Supports All Common Communication Protocols and Media

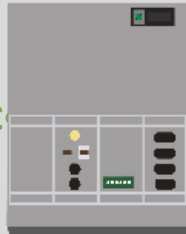
Modbus over serial



•MODBUS•MODBUS•MODBUS



•IPERC•IPERC•IPERC



•DNP3•DNP3•DNP3•DNP3



DNP3 over Ethernet (or utility proprietary)

IPC-to-IPC:  
Encrypted IPERC  
proprietary  
protocol over  
fiber, Ethernet or  
wireless

•IPERC•IPERC•IPERC•IPERC

•IPERC•IPERC•IPERC•IPERC

BACNet over Ethernet



•BACNET•BACNET•BACNET



•IPERC•IPERC•IPERC



•CANBUS•CANBUS



CAN bus over serial

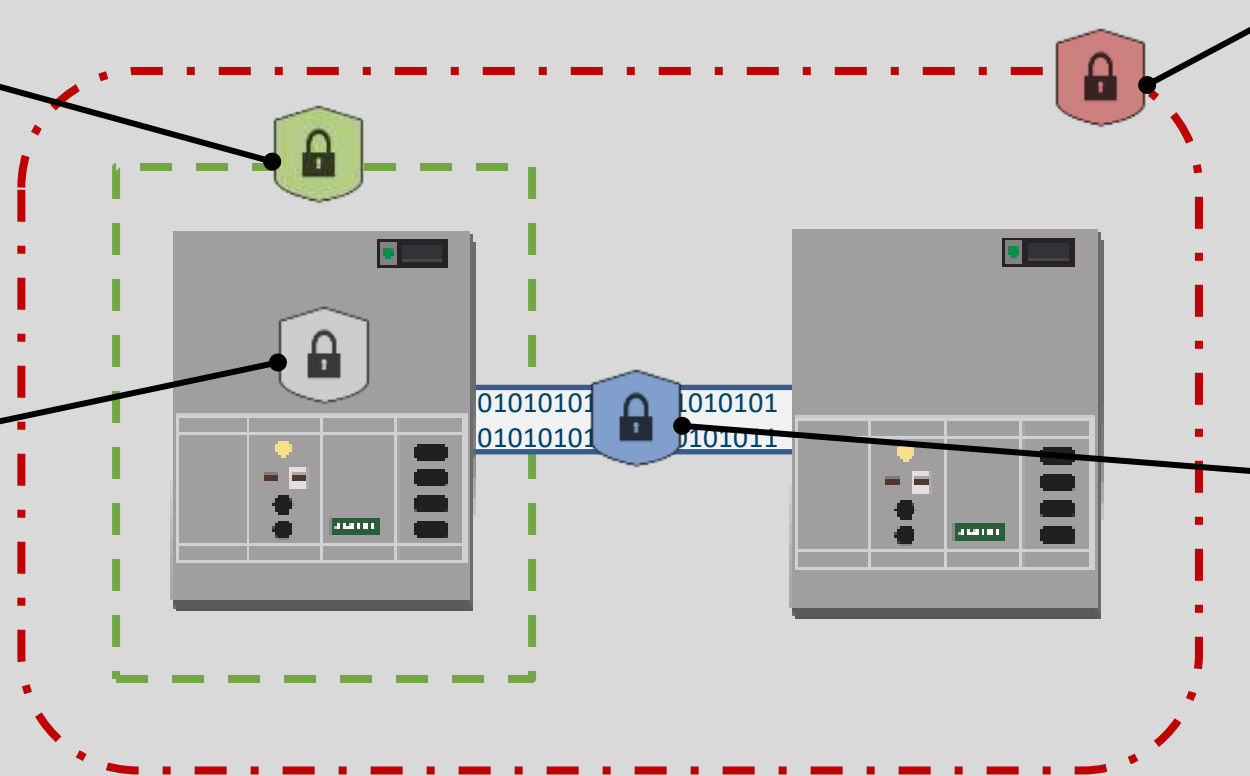
# Defense-in-Depth is Essential Against Constantly Evolving Threats

## PHYSICAL

- Controlled Access
- Environmental Protections
- Locked Enclosures

## COMPONENT

- Operating System Hardening
- Firmware Updating
- Encrypted Data
- Host Intrusion Detection
- Auditing



## SYSTEM PERIMETER

- Firewalls
- Intrusion Detection
- Hardened switches
- Secure remote monitoring

## COMMUNICATION

- Internet Protocol Version 6
- Encryption
- Peer-to-peer authentication
- Whitelisting
- Enclaving

***The control system must function with attackers inside***

# DoD Leads Resilient Microgrid Development

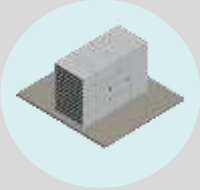
## Joint Base Pearl Harbor-Hickam, HI

SPIDERS I - Wastewater treatment plant – Completed 2013

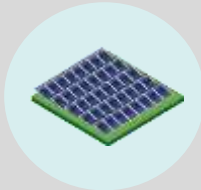
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2.5

Megawatts



Generators  
2.4MW



Solar  
150 kW

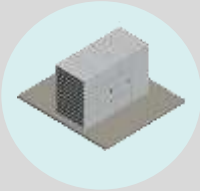
## Fort Carson, CO

SPIDERS II – 4<sup>th</sup> ID HQ and data center – Completed 2015

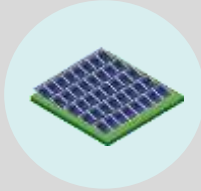
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4.3

Megawatts



Generators  
3.15 MW



Solar  
1.0 MW



Electric Vehicle  
200 kW



ATO  
RMF



# DoD Leads Resilient Microgrid Development

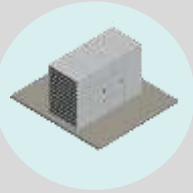
## Camp Smith, HI

SPIDERS III - Entire PACOM HQ base – Completed 2015

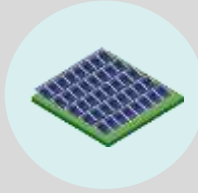
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5.8

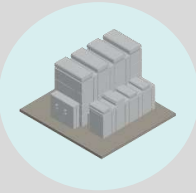
Megawatts



Generators  
5 MW



Solar  
300 kW



Storage  
500 kW



ATO  
DIACAP

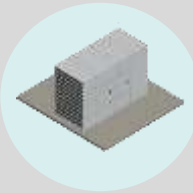
## Fort Belvoir, VA

ESTCP – Scheduled Completion 2018

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2.5

Megawatts



Generators  
900 kW



Generators  
1.6 MW



ATO  
RMF

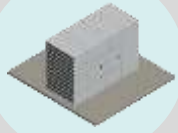
# Commercial & Utility Facilities Seek Resilience

## Ameren Technical Application Center, IL

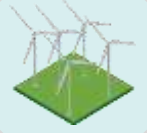
Utility prototype with 15 use cases – Completed 2017

1.5

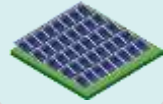
Megawatts



Generators  
1.0 MW



Wind  
100 kW



Solar  
150 kW



Storage  
250 kW



Electric Vehicle  
Load Only



## Agricultural Production Facility, HI

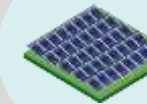
Off-grid industrial facility – Scheduled completion 2018

2.0

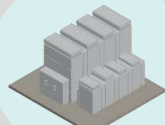
Megawatts



Generators  
500 kW



Solar  
1.0 MW



Storage  
500 kW

