EU-05

Distributed Energy Solutions, Smart Grids and Storage – The Perfect Combination for Sustainability and Resiliency

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Distributed Energy Solutions, Smart Grids and Storage – The Perfect Combination for Sustainability and Resiliency

Key Takeaways

- Distributed energy solutions support sustainability & carbon reduction objectives
- Impact of pairing renewable energy with energy storage
- How advanced smart grid technology enables true resiliency
- Project examples: Healthcare & Federal Facilities

AMERESCO

Nicole Bulgarino

Executive Vice President, Federal

Nicole has over 20 years of experience in developing and executing innovative energy efficiency and distributed energy solutions through multiple diverse contract structures. Ms. Bulgarino has overseen the development and implementation of over $2 billion in federal energy projects, including deep energy retrofits, advanced microgrids, and customer-sited power purchase agreements (PPA).

What is resiliency?

1: Resiliency is the capacity to recover quickly from difficulties; toughness

2: The power or ability to return to the original form

Questions to consider:

1. How do your existing power systems respond to electrical service disruptions?
2. What are the impacts of a disruption in electric service to your installation's operations?
3. How would you define your critical load needs and speed of required response times?

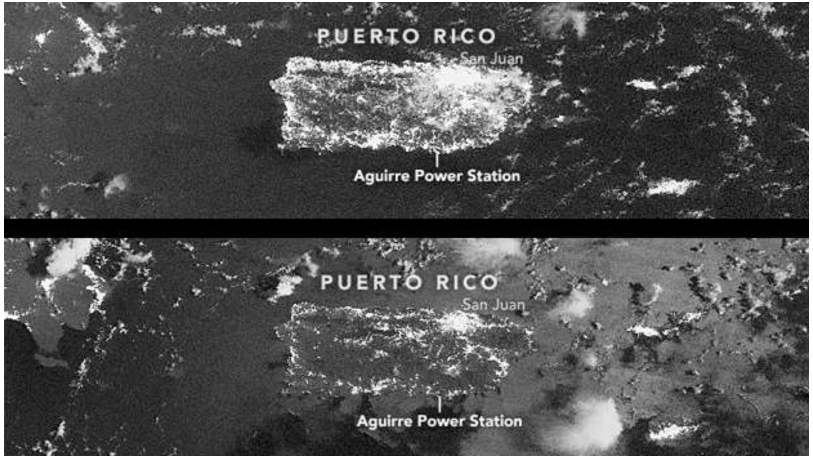
Threats to Energy Supply

Age & Deterioration

- End of system life
- Deferred maintenance
- Obsolescence

Utility Failure

- Cascading local or regional utility failure 2003 – First energy blackout
- Local reliability issues 2016 – Substation fire causes outage for 1.5M people in Puerto Rico for up to 72 hours.
- 2017 – Outer Banks construction mishap
- 2019 – UK power supply plant failure effecting 1 million



Threats to Energy Supply

Physical Security

- Many service points are on the public perimeter of customer sites.
- Vandalism or worse can compromise power supply briefly or for hours when equipment is destroyed.
- 2013 – Gunfire on PG&E substation near San Jose, CA
- 2019 – Venezuelan power outage due to "electromagnetic attack" against the power grid

Weather

- Hurricanes, tornados, lightning, fire, & ice storms!
- 2008 – Oahu, HI out for 12 hours due to a lightning strike
- 2017 – Catastrophic wildfires in California
- 2017 – Hurricane Maria in Puerto Rico
- 2019 – Hurricane Dorian in the Bahamas
- 2019 – California utility blackouts to avert wildfires

Threats to Energy Supply

Cybersecurity

- Many legacy utility and SCADA systems were developed pre-internet and may be loosely modernized to an IP world
- New "connected" systems may lack rigorous network and cyber defenses until recently
- Cloud-based services: Who protects the "Cloud"?
- Wireless communications – how do you control the signals?
- Upgrades and patches – are you current?

Smart Grids & Energy Resiliency

How did we get here?

- Traditionally, energy is provided by an independent utility
- Critical Loads Gain Redundant Energy Supply
- Renewables Initiatives Add New On-Site Power
- Advanced Smart Technologies Expand & Add Capabilities

But ultimately when the lights go out… **Are we resilient?**

Distributed Energy Solutions

Network of energy generation systems connected to the utility grid

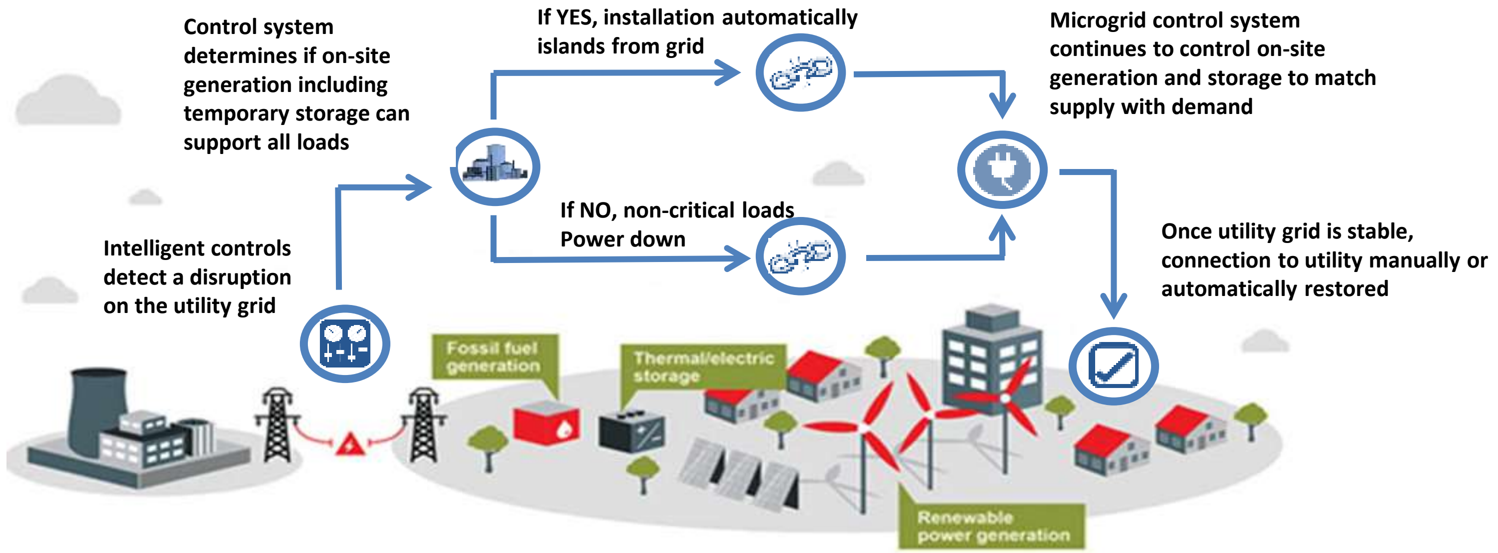
- **Sample Components in a Distributed Energy System**
  - Combined heat and power
  - Solar PV
  - Biomass
  - Wind
- **Benefits**
  - Lower energy costs
  - Improve energy security and reliability
  - Lower carbon emissions
  - Enable resiliency by adding emergency backup or peak demand power

Energy Storage Systems

Enable storage of excess energy to be used at a later time; systems are rechargeable and allow for electrochemical, mechanical, or thermal energy storage

- **Sample Components in Energy Storage**
  - Battery storage to support power-generating assets
  - Electric bill management
  - Consumption of on-site generation
  - Demand response
  - Frequency regulation
  - Backup power / microgrid support
- **Benefits**
  - Bridge energy consumption and production
  - Energy security
  - Increase efficiency
  - Energy cost savings
  - Demand cost savings

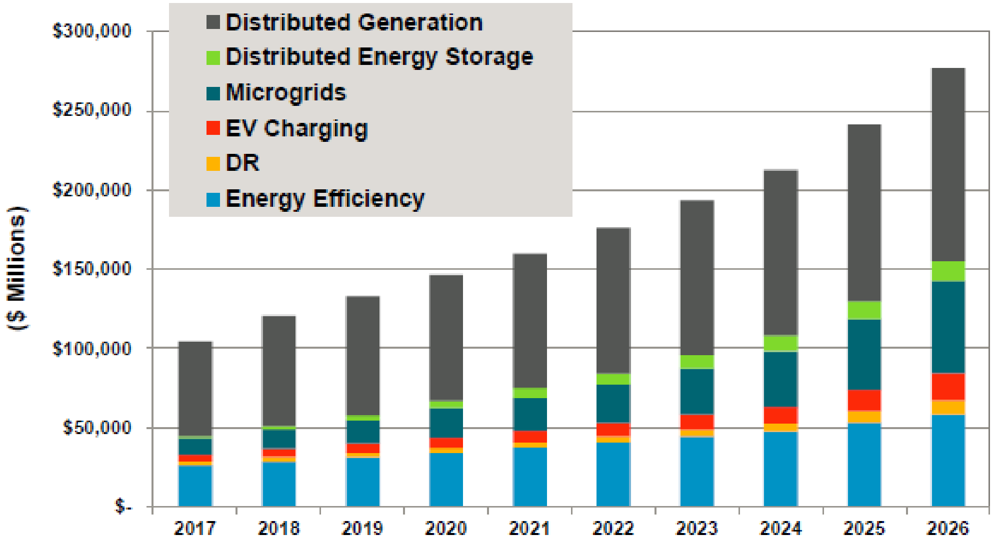
Smart Microgrids and Energy Resiliency: *Where are we going?*



CONSERVATION ● **DISTRIBUTED GENERATION** ● **ENERGY STORAGE** ● **CONTROLS**

The Market is Responding to the Impact of Energy Threats...

Annual Total DER Revenue By Technology, World Markets, 2017-2026



Source: Navigant Consulting

How does a Smart Grid provide Resiliency?

Preventing Power Disruptions

- Disconnecting From The Utility During Grid Outages

Integrating Advanced Technologies

- Intelligent Control Systems
- Energy Storage
- On-site Generation Assets

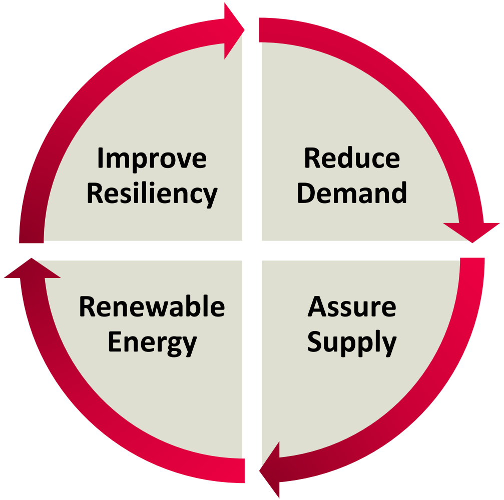
Capabilities

- Managing Critical Energy Loads
- Demand Response
- Fast Load Shedding
- Managing Assets In Island Mode

How to Approach Energy Sustainability and Security Projects

Energy Storage

- Support microgrid scheme during Loss of Utility (“Bridge Power”)
- Self fund via savings and revenue streams:
  - Utility Bill Management
  - Self Consumption of PV
  - Ancillary Services



Energy Efficiency

- Reduce annual loads through conservation measures
- Minimize capital investment requirement

On-Site Generation

- Renewable: Local, sustainable generation often coincident with peak demands
- Traditional: Support long term continuous operation

Smart Controls

- Safely disconnect during LOU and Fast Load Shed
- Optimize efficiency and operation of generation and storage assets

The Combination of Sustainability and Resiliency – Real Examples Deployed

Case Study: Parris Island

Bringing Reliable, Secure Energy to the Marine Corps Recruit Depot

This comprehensive project will further the Marine Corps Installation Command mission to ensure a reliable, secure energy supply and reduce lifecycle operating costs of Marine Corps facilities while managing future commodity price volatility.

8,000 Acre Recruit Depot
19,000 Recruits Trained Each Year

Case Study: Parris Island

Deploy combined heat and power (CHP) and solar photovoltaic (PV) generation assets and to integrate them with a battery energy storage system (BESS) and a microgrid control system (MCS) capable of fast load shedding.

Key Project Points

- **Energy And Water Efficiency:** Replaced Aging Infrastructure With Advanced Technologies Including, Water (121 Buildings), LED Lighting (29,000 Retrofits), HVAC, Chillers, Cooling Towers, and Steam Traps Upgrades
- **Onsite Energy Generation:** 10 MW Solar PV And Combined Heat and Power
- **Energy Storage Systems:** 4 MW / 8 MWH BESS Supports Islanding From The Utility
- **Microgrid Solutions:** Advanced and Intelligent Load Control Systems Integrates Storage and Energy Generation
- **Operations And Maintenance:** Ameresco Will Maintain Responsibility For The 22-year Performance Period

Case Study: Parris Island

Benefits

Mission Critical Energy Resiliency

- Uninterruptible Power in Support of Critical Training Operations

Annual Reductions

- Utility And Operating Costs: $6.9 Million
- Utility Energy Demand: 75%
- Water Consumption: 25%

Financing

- No Upfront Costs
- Savings Pay For The Investment

Nearly 20,000 solar modules at carport and ground-mount sites provide power generation along with shelter for more than 500 parking spaces.

Case Study: Sutter Health

Bringing Green, Sustainable Energy to the Hospital

Santa Rosa Regional Hospital, run by Sutter Health, recently installed solar panels and now plans to add battery storage to prepare for future outages.

Benefitting Patients, Employees, the Community, and the Environment

Case Study: Sutter Health

Sutter Health is passionately committed to their patients and community. A close-knit community, devastated by wildfires, knows more than ever about the importance of green initiatives and the need for sustainability for generations to come.

Key Project Points

- **Technology:** 1.6 MW of solar power
- **Generation:** The power generated (more than 2.4 million kWh annually) is consumed on-site
- **Sustainability:** Offsets the hospital's electricity usage by 40%, bringing on-site generation to 85% of total site electricity use
- **Carport:** Campus-wide carport solar module installation provides shading for patient and employee cars
- **Carbon Reduction:** The solar project at is expected to reduce carbon emissions by 1,725 Metric Tons, the CO2 equivalent to 500 patient rooms powered for one year

Case Study: Portsmouth Naval Shipyard

Bringing Seamless, Fully Resilient Energy to the Shipyard

Microgrid technology allows critical systems across the shipyard's grid to disconnect completely from outside grid power for self-sufficient operation.

With newly installed technologies and equipment, the Shipyard saves on energy

Case Study: Portsmouth Naval Shipyard

Three phases of comprehensive energy conservation projects under over 18 years. As well as a microgrid solution funded to demonstrate islanding capabilities, which eliminates downtime during a loss of the electric public utility.

Key Project Points

- **Technology :** Advanced Smart Metering & Controls; Combined Heat and Power Plant; Smart Grid; Energy Storage
- **Capacity:** Peak load > 13 MW
- **Load Management:** Dynamic Load and Generation Matching During Island Transitions
- **Improvements**: Steam, Air, and Hot Water Systems
- **Equipment:** (1) 5.5MW Combustion Turbine; (1) 5.2MW Combustion Turbine; (2) 2MW Diesel Generators; Battery Energy Storage System

Case Study: Portsmouth Naval Shipyard

Benefits

Critical Energy Resiliency

- Sustain Critical Loads
- Shed Non-critical Loads During

Sustainability

- Energy, Water and Carbon Reduction Goals
- Annual Energy Savings of up to 43 Million kWh

Financing

- No Upfront Costs
- Savings Pay For The Investment
- Protection Against Energy Market Pricing Volatility

Storage provides a bridge between loss of utility and standby diesel generators

Case Study: Philadelphia Navy Yard

Resiliency Services and Critical Support

This multi-million-dollar peaking plant is anticipated to run during the Navy Yard's peak demand periods and during intervals of high-cost energy and capacity from the grid.

On-site generation will support energy demand for the 1,200-acre campus as businesses continue to locate here and grow

Case Study: Philadelphia Navy Yard

Natural-gas fired peaking plant that will anchor one of the largest private microgrids in the United States located at the Navy Yard in Philadelphia.

Key Project Points

- **Technology Type:** 8 megawatt (MW) Peaking Plant; Microgrid Integration
- **Capabilities:** Peak Management; Ancillary Services
- **Resiliency:** Critical support in the event of extended grid outages
- **Growth Demand:** Reliably meet the projected demand growth needs of the Navy Yard and its tenants
- **Financial:** Generate revenues to help offset the cost of the increased capacity

Smart Grid Objectives

A Successful and Resilient Microgrid provides…

- ✓ Utility Cost Management
- ✓ Integrating New & Existing Energy Resources
- ✓ Adapts to Multiple Contingency Events
- ✓ Flexibility of Fuels & Generation Technology
- ✓ Organization & Translation of Different Control Domains
- ✓ Microgrid Sustainment
- ✓ Physical & Cyber Security
- ✓ Clear Communication of System Status & Actions
- ✓ Opportunities for Qualified Operator Intervention

Lessons Learned & Important Factors to Consider

1. Identify Your Energy Security Needs Early
2. Define Possible Threats For Your Organization
3. Integrate Legacy and New Energy Assets into One Smart System
4. Fund Resiliency with Storage & Other Distributed Energy Assets

THANK YOU!

QUESTIONS?

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