MICROGRIDS & SUSTAINABILITY OVERVIEW

Microgrid & DER Systems

Larry Rozcicha – Business Development Manager

Powering Business Worldwide

Eaton Company Overview

- **Eaton (HQ in Cleveland)**
  - Electrical Sector HQ in Pittsburgh
  - Smart Grid offices in Minneapolis, Milwaukee, Carrington ND, and Gaithersburg, MD
  - ~99,000 employees worldwide
  - 100+ Year Tradition of Quality
  - $22B+ Scale to Invest
- **Ranked among *Fortune* Magazine's World's Most Admired Companies**
- **One of *Ethisphere* Magazine's World Most Ethical Companies**
- ***Thomson Reuter* Top 100 Global Innovator**
- ***Corporate Responsibility Officer* Magazine's 100 Best Corporate Citizens**

- **Reduce carbon emissions 50% by 2030**
- **$3B in R&D 2030 for sustainability solutions**

Eaton helps the world use electrical, fluid and mechanical power more reliably, efficiently, safely and sustainably

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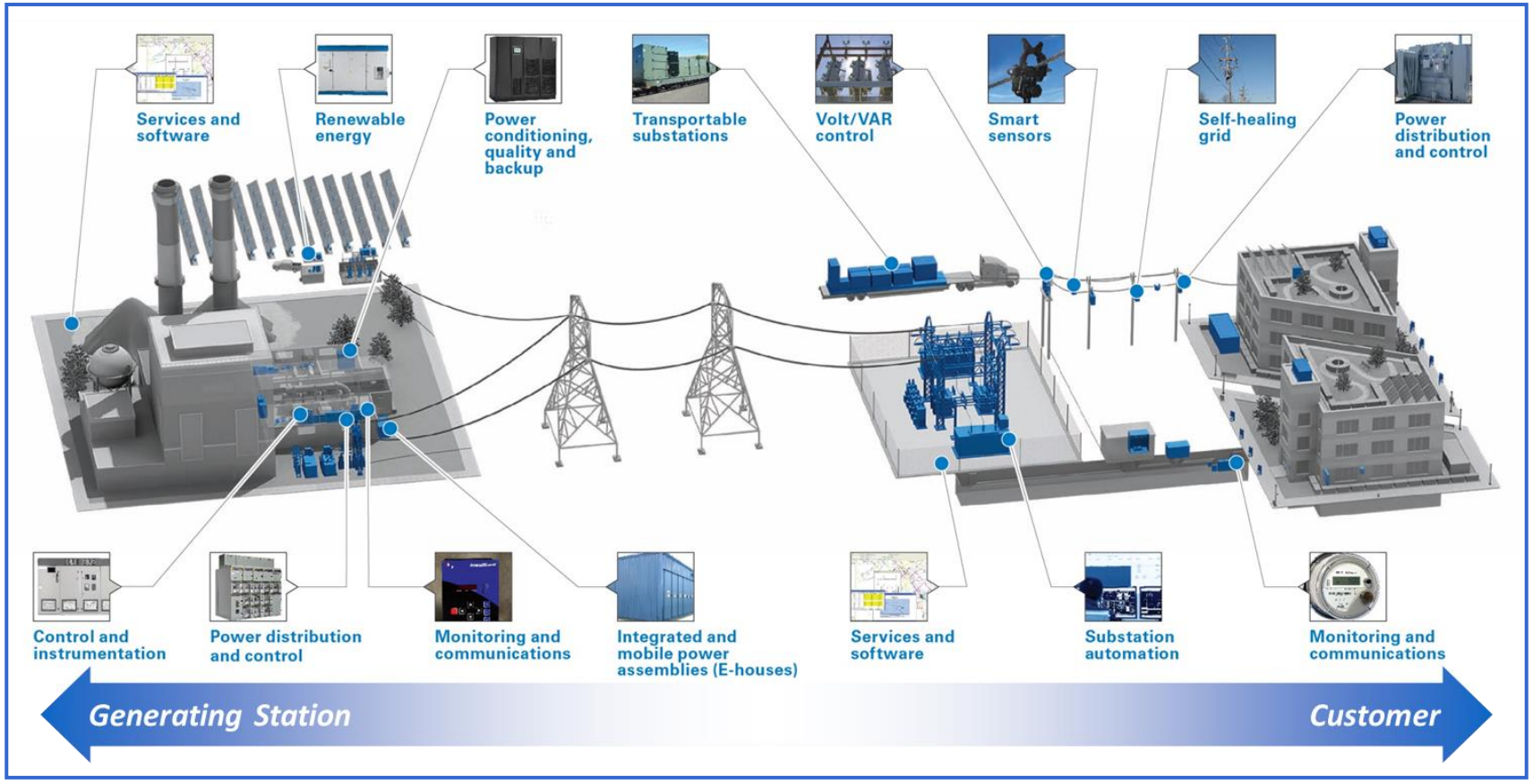
Eaton: Global Power Management Company



Deliver innovative technologies to help our customers generate, deliver, and manage energy safely, efficiently, and reliably

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Eaton Electrical Engineering Services & Systems

Field Services

- ✓ 24/7 Emergency Response
- ✓ Acceptance Testing
- ✓ Startup
- ✓ Commissioning
- ✓ Maintenance
- ✓ Service Contracts

Power System Engineering

Studies:

- ✓ Arc Flash
- ✓ Microgrid
- ✓ Short Circuit
- ✓ Overcurrent
- ✓ Harmonic
- ✓ Load Flow
- ✓ Motor Starting

Power System Automation

- ✓ Protection & Control Systems
- ✓ Dashboards
- ✓ Foreseer /EPMS
- ✓ Power Xpert Enterprise Solutions
- ✓ Metering

Turnkey Projects

- ✓ Project Management
- ✓ Engineer, Procure & Construct (EPC)
- ✓ Local Support, Crisis Response
- ✓ MicroGrids
- ✓ Battery Storage

Aftermarket & Life Extension

- ✓ MV & LV Power Circuit Breaker Replacement
- ✓ Equipment Rebuild & Reconditioning
- ✓ Life Extension & Modernization

TOTAL LIFE CYCLE SOLUTIONS BY EATON

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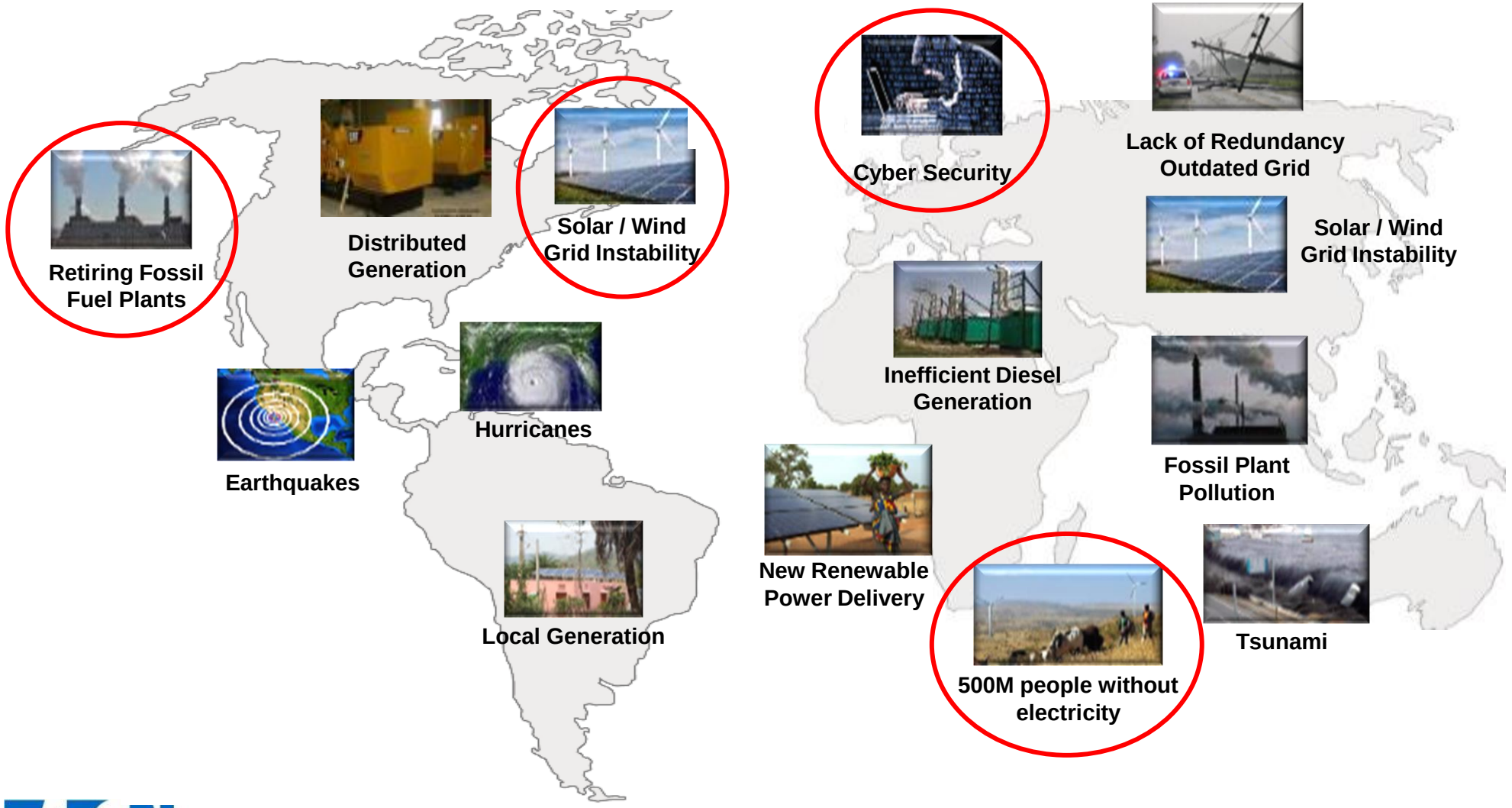
Climate change and extreme weather events are impacting access to reliable power

Global Megatrends Impacting Today's Power Grid



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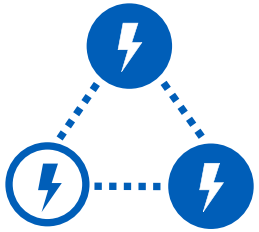
RESILIENCE: Microgrids are a grid within the Grid designed to provide uninterrupted, reliable power in the event of a Grid outage



Distributed Energy Resources (DER) System

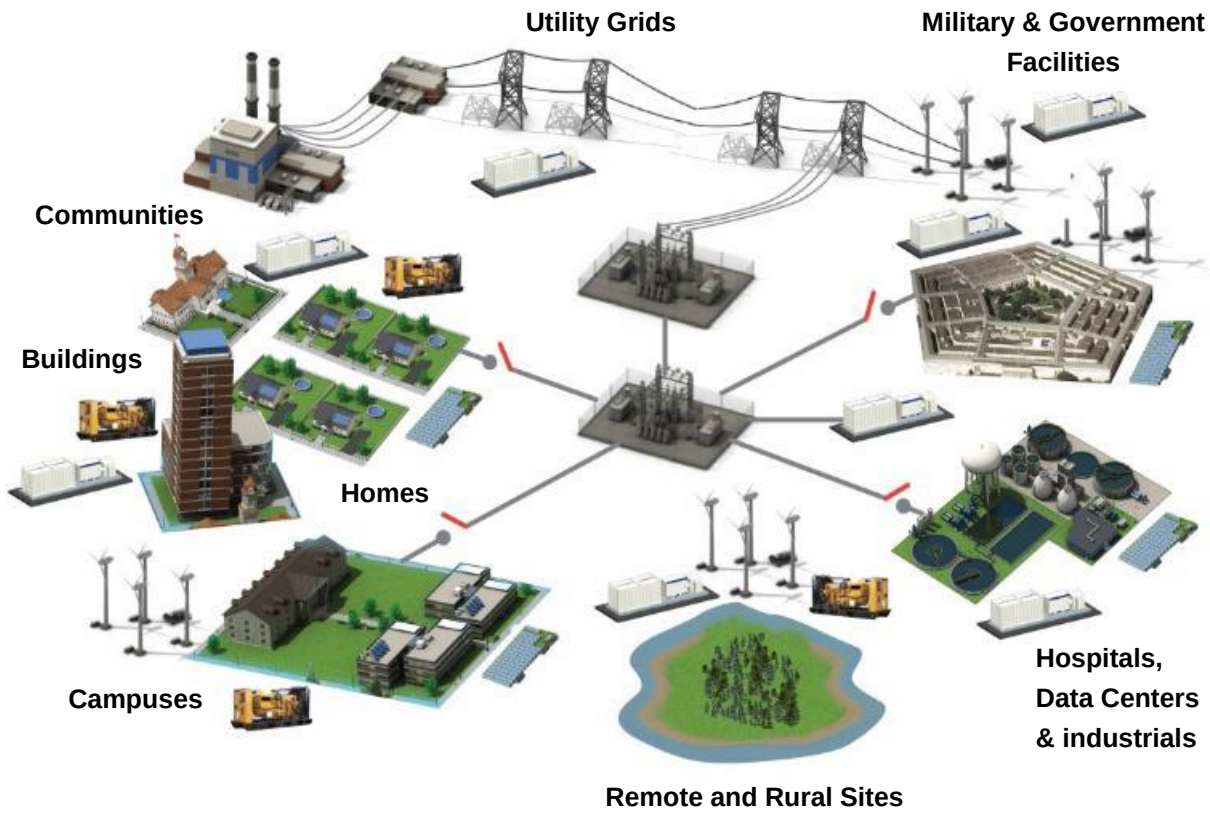
A defined boundary of interconnected electrical loads and decentralized generating assets controlled as an integrated system and operating in parallel with the grid

A **Microgrid** is a DER system than can operate autonomously or “islanded” from the Grid for maximum system resiliency

Common system elements

- **Controllable loads**
  Machinery, equipment, EVs, computing, lighting, HVAC, etc.
- **Distributed Energy Resources**
  Generators, solar, storage, fuel cells, combined heat & power (CHP)
- **Intelligent Controls**
  Hardware (DER controllers) and software (control algorithms)

Microgrids can be | **Community • Campus • Building • Home**



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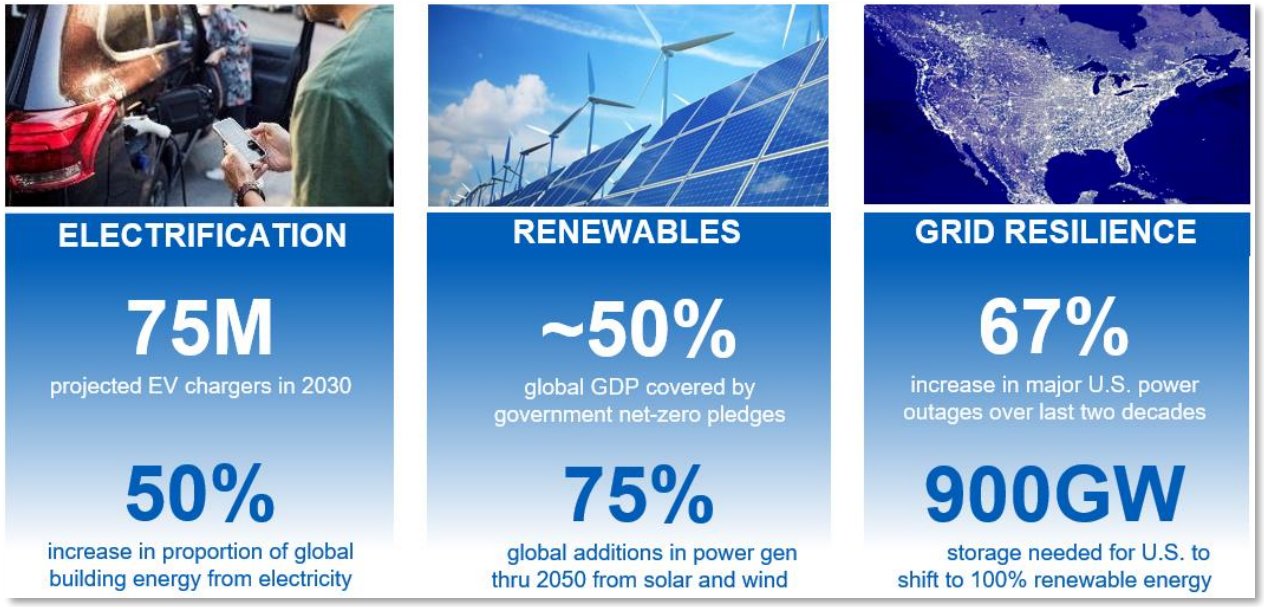
No better time to stand up a microgrid

Energy Transition mega-trends are fueling microgrid growth



Sources: EIA, Wood Mackenzie, Climate Central, BloombergNEF

Access to available financing and incentives
- Federal Stimulus & Investment Tax Credit (ITC)
- Energy as a Service business models

Evolving regulatory environment
- FERC Order 841 – energy storage
- FERC Order 2222 – wholesale markets

Improving microgrid/DER economics
- Rising electricity prices & tariffs
- DER monetization with grid services

Expanding global commitments to ESG goals
- Government climate change actions/proposals
- Ambitious net zero pledges by corporations

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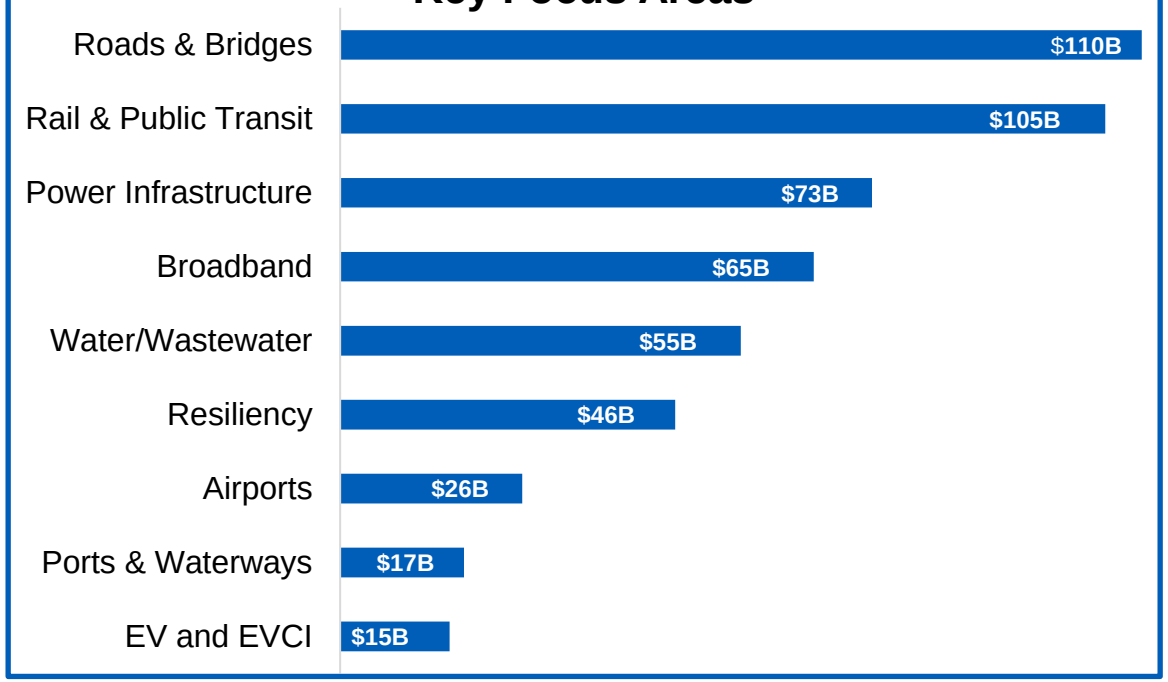
Federal - Infrastructure Investment Jobs Act
Bipartisan Infrastructure Bill

Summary

$1.2 Trillion
($550B New Spending)

Key Focus Areas



** **Add $65B for Power & Grid**

Status

- President Bident signed the bill into law on Nov. 12
- Funding second half of FY 2022; funding over 5 years FY 2022 – 2026
- President Biden named former New Orleans Mayor Landrieu senior adviser responsible for coordinating implementation of the bill that includes big jumps in spending on roads, bridges, rail, airports, transit, ports, broadband internet and water projects.
- New programs will require agency guidance; will take longer to disperse funding

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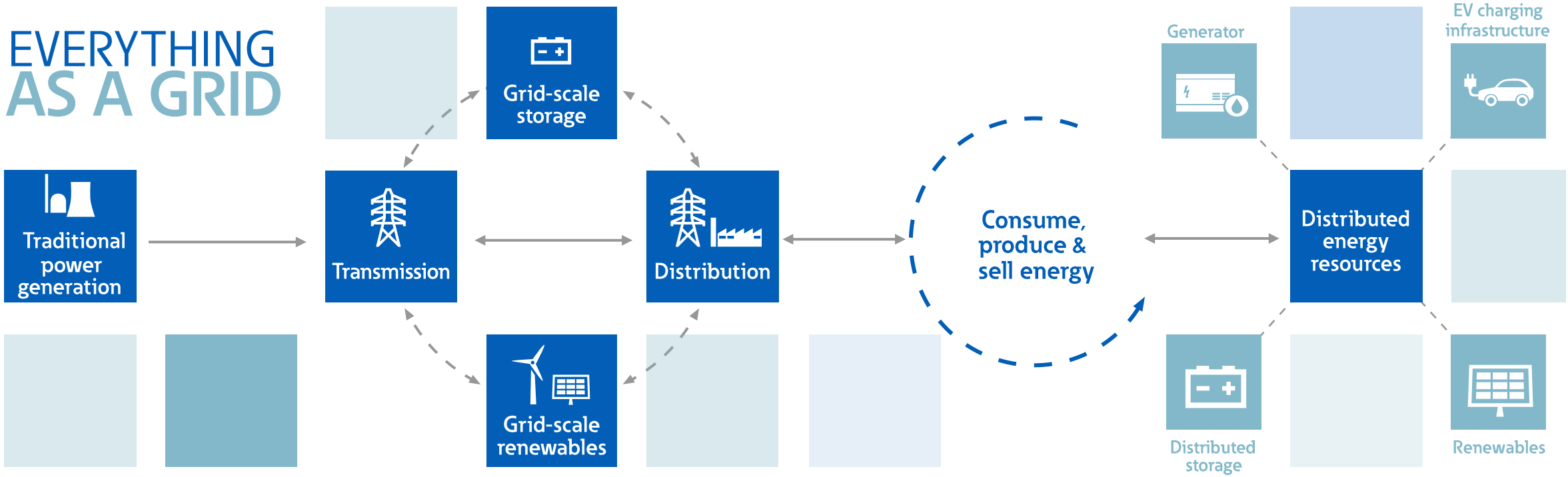
The new power paradigm with the Energy Transition is opening up new opportunities with decentralized power



✔ Less carbon

✔ More resilience

✔ Lower cost

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Why do you want a Microgrid?

Value Propositions of a Microgrid / DER system

Sustainability: minimize carbon emissions

- Reduce greenhouse gases
- Incorporate solar, energy storage, fuel cells, CHP
- Sell clean power back to the grid

Resilience: support for critical operations

- Bolster operations to ensure business continuity
- Serve critical loads 24/7/365
- Support generation & loads during times of grid instability
- Protect against harmful effects of poor power quality

Efficiency: energy cost savings

- Reduce energy consumption
- Minimize energy costs through fuel switching, load control & grid services
- Improve & monetize flexibility of energy & process (Co-optimization)
- Energy/fuel source arbitrage

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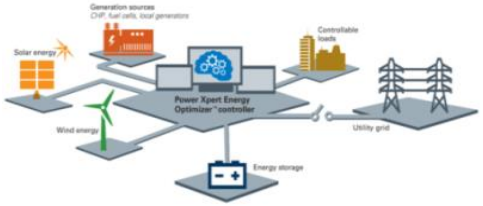
Microgrid Feasibility Study



Analysis of electrical power system infrastructure

- Identification of microgrid configuration
- Evaluate existing and future distributed energy resources
- Plant site audit - equipment, ratings and operating conditions

Short and long-term microgrid configurations:

- Critical load uptime and black-start capabilities
- Extended outage capabilities: 1-hour, 1-day, or 1-week
- Power quality and system resilience
- Financial pay-back options

Microgrid conceptual design

- Preliminary sizing and siting of DERs and energy storage
- Control system architecture
- Recommended modes of operation and switching sequences

Microgrid protection

- Short-circuit and coordination studies
- Interconnect requirements study
- Island mode protection analysis

Power Xpert Energy Optimizer™ configuration

- Customer objectives and applications
- Legacy and new device communication protocols

CYME for Microgrids

1. Develop microgrid models including DER
2. Load flow/short circuit/contingency studies
3. Quasi static analysis analysis for microgrid applications

PSCAD for Microgrids

Develop microgrid models with fully implemented controls, communication and protection details that can be customized for pre-engineering and controller HIL testing

PXeO Configuration tools

1. Controller HMI screens for application configuration and testing
2. Load and modify local and system software/configuration packages

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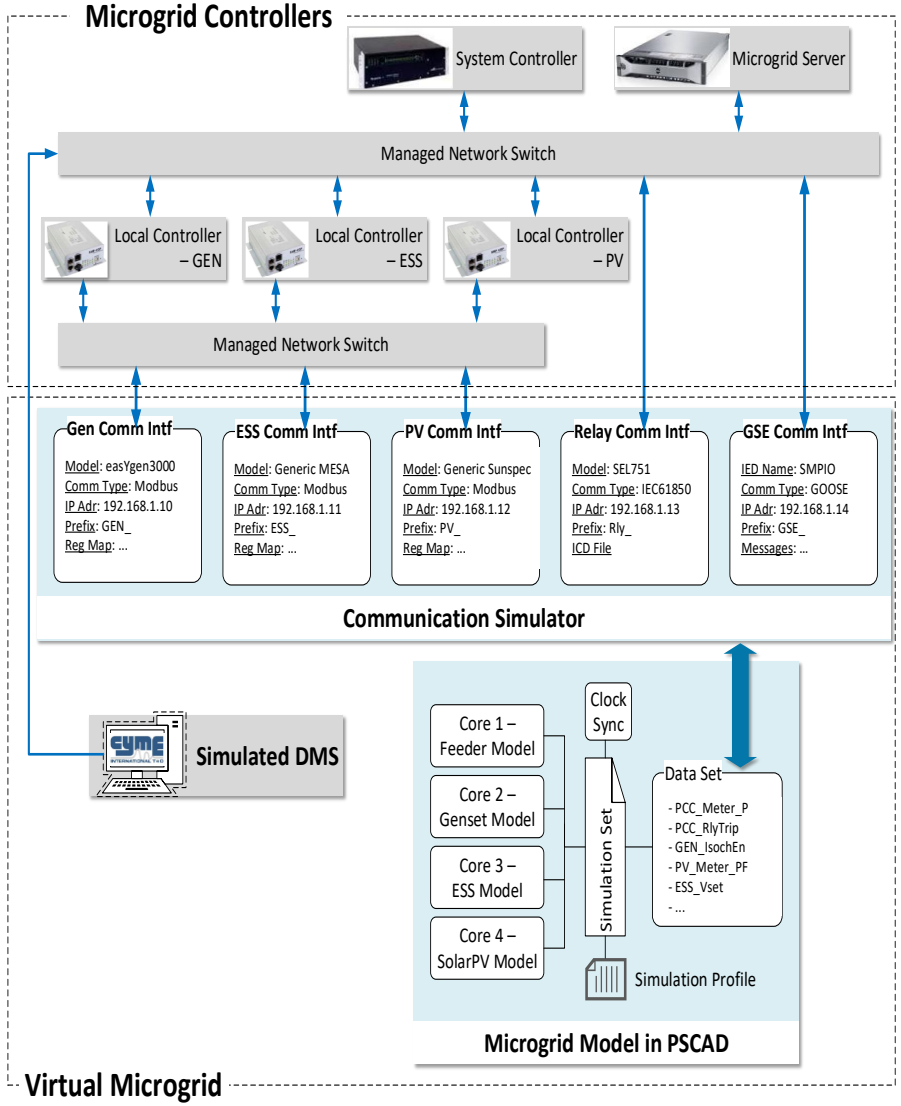
Virtual Microgrid Capabilities

- Distribution model portable from CYME
- Generic and customizable DER models
- Easy communication configuration with most popular protocols (Modbus, IEC61850, DNP3, ect.)
- Easy profile integration for case studies
- Capable of integrating LVRT/HVRT/ZVRT with protection coordination
- Flexible in terms of model fidelity
- Use as digital twin for microgrid controller(s) development and validation



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EVERYTHING AS A GRID

A Case Study for Resilience:

Eaton is collaborating with Enel X to develop a microgrid at our Arecibo, Puerto Rico plant to keep the power on. No matter what.

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CHALLENGE: Eaton's circuit breaker factory in Puerto Rico was hit by Hurricane Maria highlighting the need for a more resilient energy infrastructure

Bolster critical operations:

Eaton's intelligent microgrid control technology balances where, when and how electricity is consumed, ensuring **power resilience** for the site during Grid outage events

Resilience is

- an investment in business continuity
- the ability to recover quickly from a crisis

Deliver on our sustainability goals:

Reduce carbon emissions from Eaton operations **50%** **by 2030** positioning Eaton to achieve carbon neutrality

Sustainability matters

- Shift to low-carbon, resource-efficient operations
- Reduce demand on local energy infrastructure

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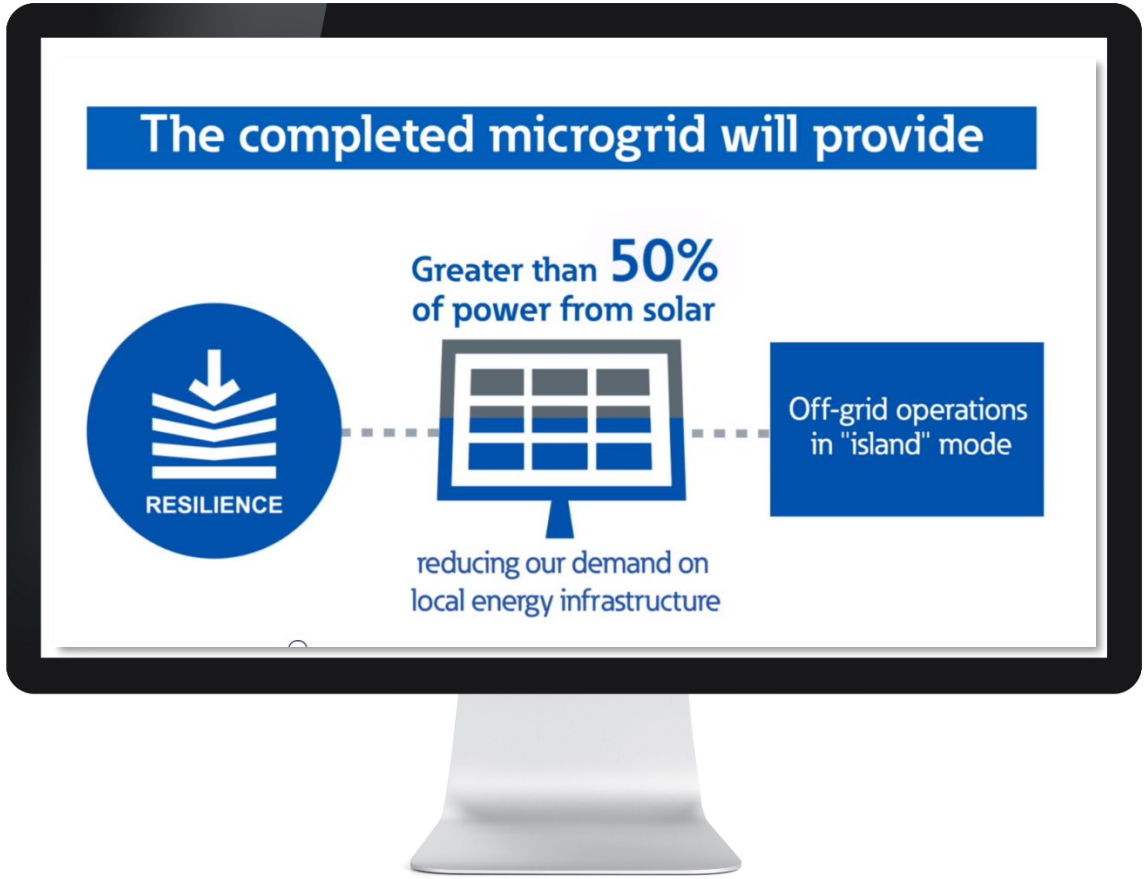
A sneak peek at Eaton's solar + storage-based microgrid currently under development with Enel X at our manufacturing facility in Puerto Rico



Eaton's Arecibo, Puerto Rico plant

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Watch the video again at:
Eaton.com/MicrogridProjects

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Enel X is the lead developer of Eaton's Puerto Rico microgrids leveraging Eaton's power system design and engineering capabilities

	EaaS project financing	*Design, build & construct*	*Microgrid hardware*	*Microgrid software*	*Market services*	*Operations & maintenance*
Eaton	Operating expense for Eaton	Engineering Services conducted feasibility studies and will design & construct the microgrid system	Eaton's power distribution equipment & Power Xpert Energy Optimizer microgrid controller	Resilience-based protection with off-grid, "islanded" microgrid control		Eaton will provide ongoing site maintenance of the microgrid system
enel x	Microgrid is owned and financed by Enel X through a 20-year PPA	Co-developed the feasibility studies and secured the utility interconnect agreement	PV & battery energy storage systems	Grid-connected control and economic optimization, e.g. demand response (Enel X's DER.OS)	Market participation: Sell excess power back to the Puerto Rico utility grid	

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THE RESULT: our Arecibo microgrid project highlights Eaton's Everything as a Grid approach at work

EVERYTHING AS A GRID

Balance business goals by fully integrating the microgrid and on-site power generation with more renewables enabling two-way power flow with decentralized power

Safely add more renewables and energy storage

Transform operations to become more **sustainable** and **resilient**

all while lowering costs

Microgrid designed to withstand **CAT 5** hurricanes

Energy as a Service (EaaS) financing by enel X through a 20-yr PPA

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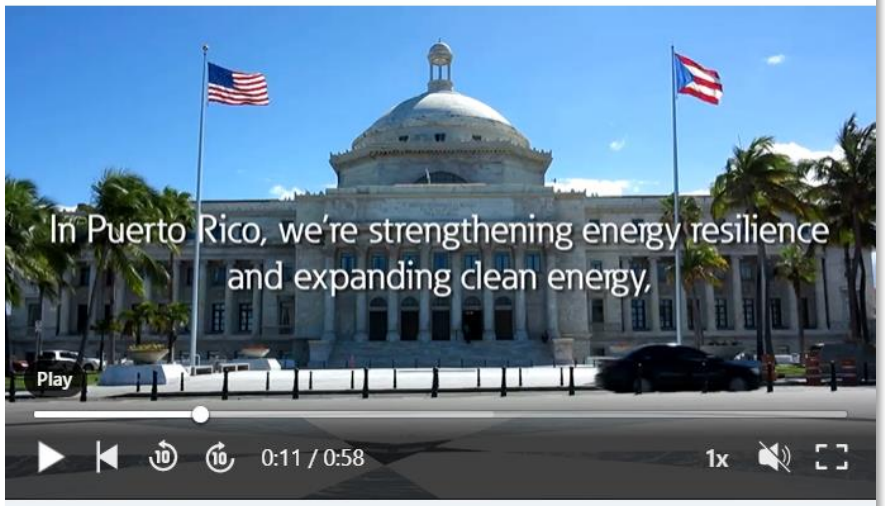
Eaton is doubling down on our microgrid investments in Puerto Rico with a second Enel X project at our Las Piedras manufacturing site

Eaton
1,098,489 followers
3w • Edited •

We're proud to announce that we're expanding clean energy infrastructures, powering our manufacturing sites in Puerto Rico. Partnering with Enel X, we're building sustainable energy systems designed withstand hurricanes. See how we're reducing emissions and advancing energy resilience: https://lnkd.in/djuekPfx #EverythingAsAGrid #ClimateAction #Microgrid



Eaton and Enel X expand clean energy infrastructure in Puerto Rico

Matt Barnes • 1st
Director at Enel X
3w •

Anything worth doing is worth doing twice... I'm excited to be teaming up with Harold Ruckpaul, Bill Murch, and Richard Gorze from Eaton to bring our second microgrid in Puerto Rico forward. Projects like these will help bring sustainable, resilient, and cost-effective solutions to areas that face severe weather, climate change, and grid stability challenges.

Surya Panditi • Following
CEO and President of Enel X North America
3w •

This September marked four years since Hurricane Maria dealt Puerto Rico one of the largest and longest power outages in U.S. history. Today, Enel X and Eaton's second microgrid on the island is helping to build back an energy system that is more resilient and sustainable by:

- ✔ Reducing stress on the local utility system
- ✔ Allowing Eaton to reliably generate and store renewable energy to keep operations running smoothly through all challenges
- ✔ Ensuring reliable access to electricity and helping Puerto Rico reach its decarbonization goal of 100% renewable energy by 2050

Microgrids like these serve as a model for energy resilience in hurricane-prone geographies within the U.S. #EnelX

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LESSONS LEARNED:
Eaton’s microgrid in Puerto Rico

1. Align goals for your microgrid with business goals like business continuity and corporate sustainability to justify the investment
2. Energy as a Service financing through a partner who owns and operates the microgrid shifts the investment from CapEx to OpEx
3. Maximize the economic benefit of your microgrid by selling power back to the grid

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Thank you!

What questions do you have?

EVERYTHING AS A GRID

Eaton.com/Microgrid