

Case Study in Resilience: A First-of-its-Kind Microgrid in New York City

enel x



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Enel X

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The Enel Group Worldwide

The world's largest utility, changing the way the world uses energy



The Enel X Vision

Enel's 2017 acquisitions form the basis of Enel X



- Innovative energy storage and microgrid projects
- Optimization of Distributed Energy Resources



- Global leader in demand response
- Strategic commercial & industrial energy management provider



- Market-leading smart EV charging hardware
- Optimization of EV charging for load balancing and sustainability



Enel X portfolio of solutions

4 Global Product Lines



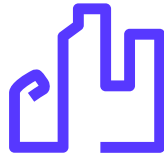
e-Industries

Consulting and auditing service

Distributed generation on/off site

Energy efficiency

Demand response and storage solutions



e-City

Smart lighting

Fiber optic wholesale network

Distributed generation & energy services

Demand response and storage solutions



e-Home

Installation, maintenance and repair services

Automated home management

Financial services

Home 2 Grid



e-Mobility

Charging infrastructure (public & private)

Maintenance and other services

OEM back-end integration

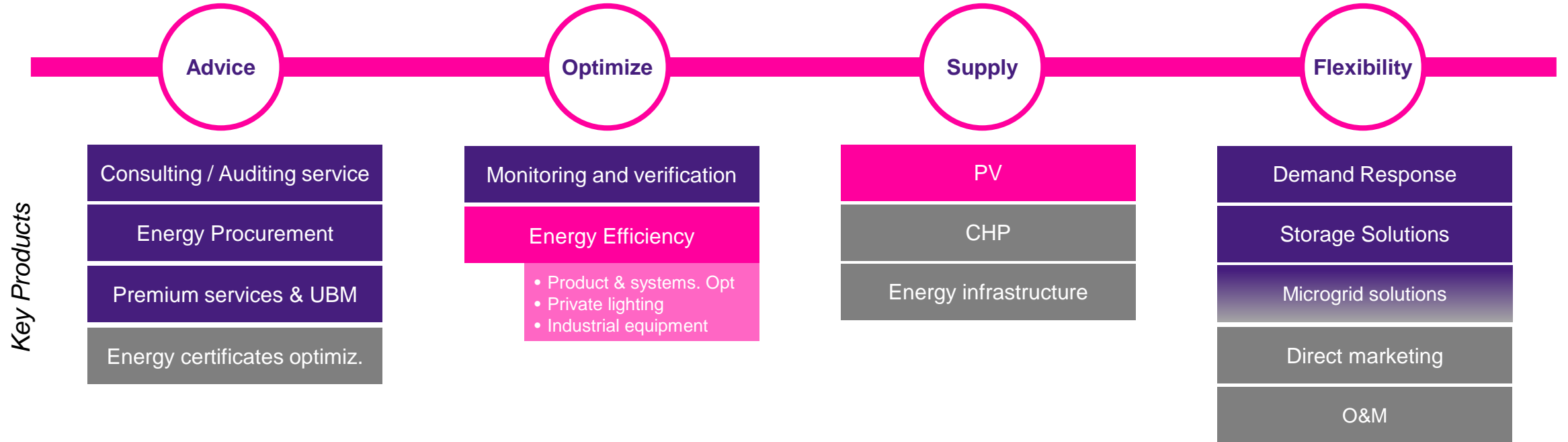
Vehicle Grid Integration

Flexibility

Addressing new customer needs with innovative technologies

Enel X Product Categories and Clusters

An Integrated Solution Offering



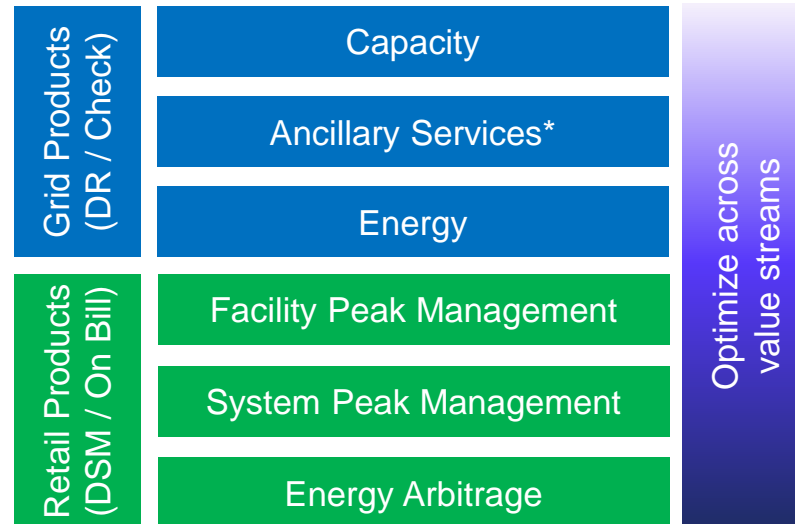
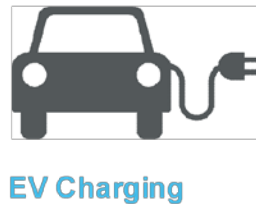
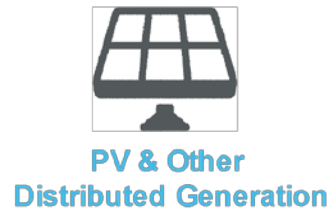
Global portfolio structured in 4 categories and 14 products clusters

How we will achieve our vision: Connect any asset to any product anywhere in the world

Connect all types of distributed energy assets...

... and optimize across all available grid and retail products

... using a flexible and scalable global technology platform



DER Management System

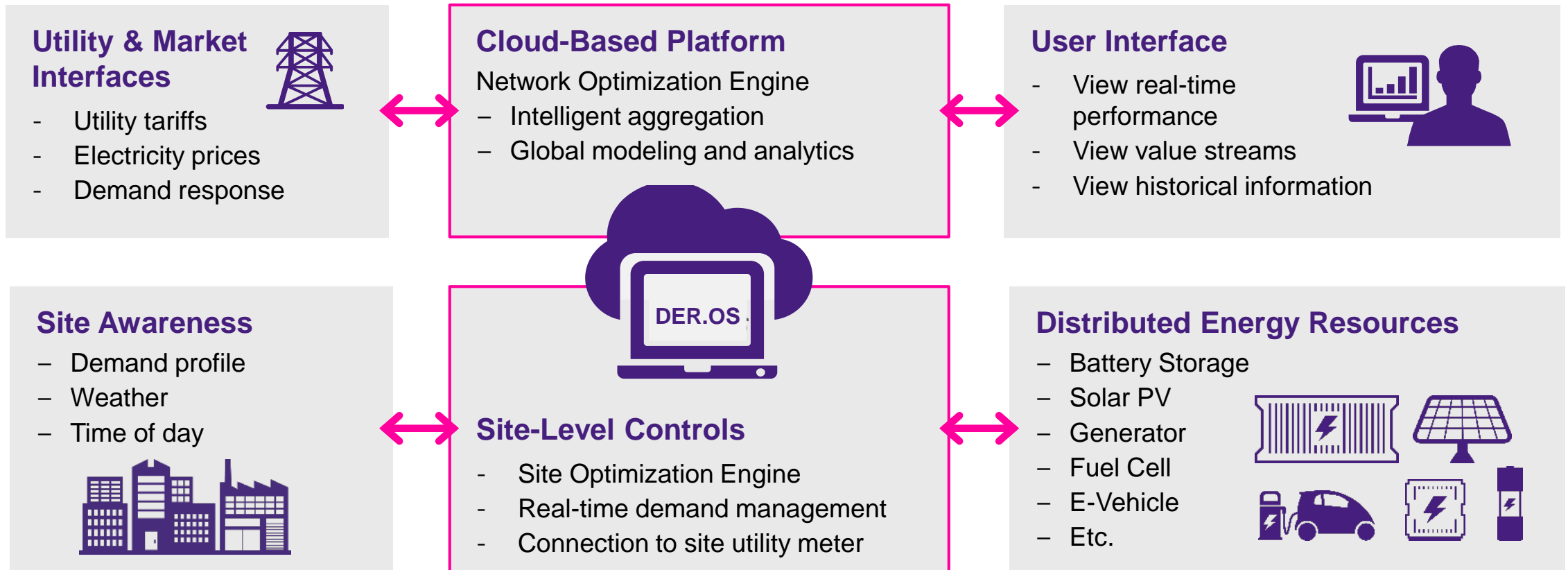
Virtual Power Plant Optimization

Cloud Based Architecture

* Ancillary Services includes primary, secondary, and tertiary reserves. "Fast DR" refers to Ancillary Services and other fast-response, higher-value DR and DSM products such as facility peak management and energy arbitrage.

Proprietary DER Optimization Software

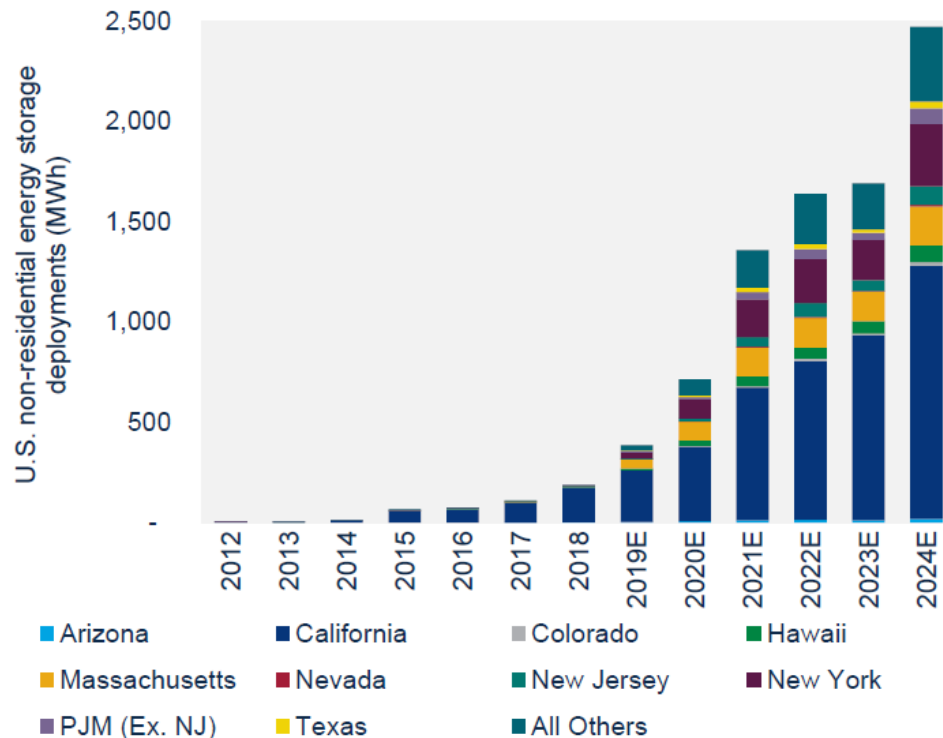
Cloud-based platform enables real-time optimization engine to produce predictable financial returns from any combination of DER assets across any market and timeframe



U.S. non-residential market drivers

Non-residential market struggled in 2018, but 2019 and 2020 will be breakout years

U.S. non-residential market outlook, 2012-2024E (MWh)



- **Incentives are critical to the non-residential market.** The Self-Generation Incentive Program has been the key driver in California, especially in the period 2014-2017. The SMART program in Massachusetts and the Bridge Incentive in New York are the frameworks that will open up these markets in 2019.
- **Demand-charge management historically has been the major use case for non-residential storage.** In general, C&I customers with predictable, peaky loads on tariffs with demand charges above \$15/kW-month see clear economic cases for storage.
- **Grid services will be a key value stream in the early 2020s.** Already, non-residential storage is being deployed to provide resource adequacy in California. ISO-NE and NYISO are expected to see storage development for capacity as well. The resolution of FERC Order 841, which directs independent system operators and regional transmission organizations to allow storage to participate and be compensated for wholesale market services provided, will open more doors for non-residential storage to provide grid services.
- **Resilience is increasingly becoming a piece of the non-residential storage conversation.** Regions like the Northeast and Southeast U.S. already grapple with outages from inclement weather. Massachusetts, New Jersey and New York are the vanguard of states promoting storage with an eye to provide resilience. However, resilience value is challenging to quantify economically, and thus these projects will require government incentives and/or additional value streams to be viable.

Our definition of a microgrid

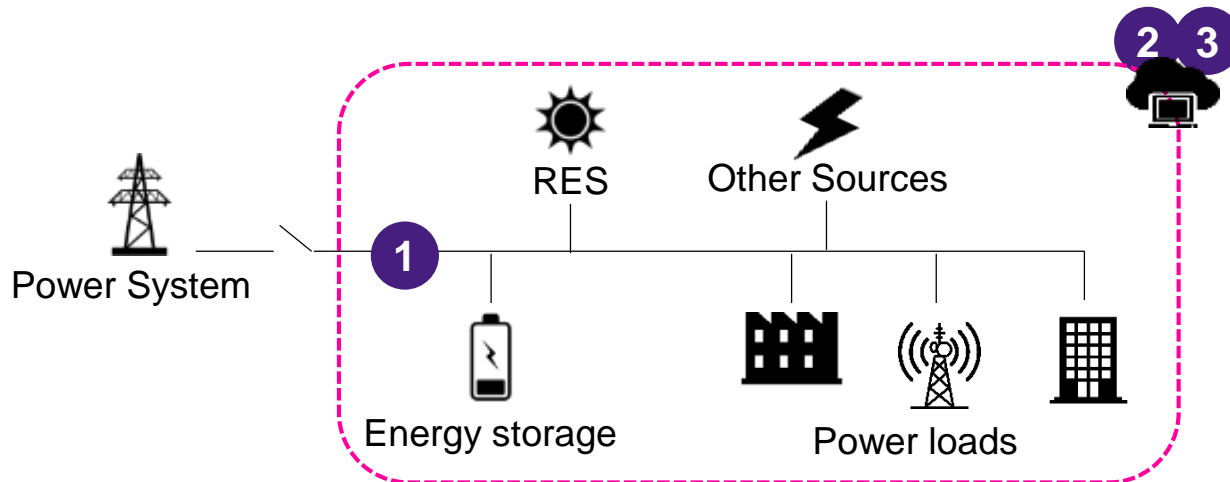


Defining features

Microgrid definition

“A microgrid is a distribution network that incorporates a variety of possible distributed energy resources that can be optimized and aggregated into a single system that can balance loads and generation with energy storage and is capable of islanding whether connected or not connected to a traditional utility power grid.”

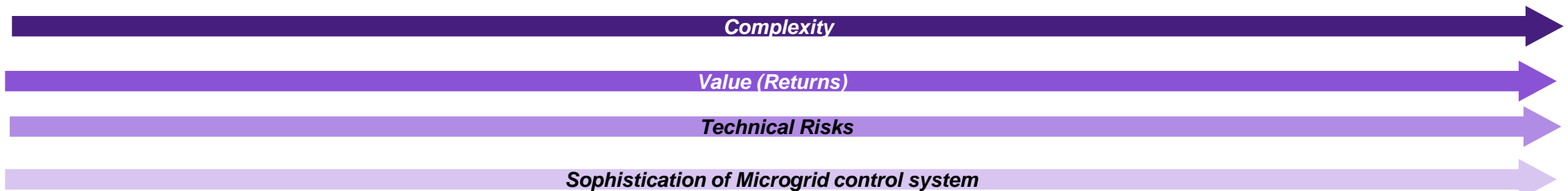
- 1 Networks (mixed asset fleets) of DERs capable of islanding
- 2 Sophisticated system with flexible management of generation and load
- 3 Software platform as microgrid controller (most advanced microgrids)
- 4 Project focused on resilience, renewable energy integration or economic optimization



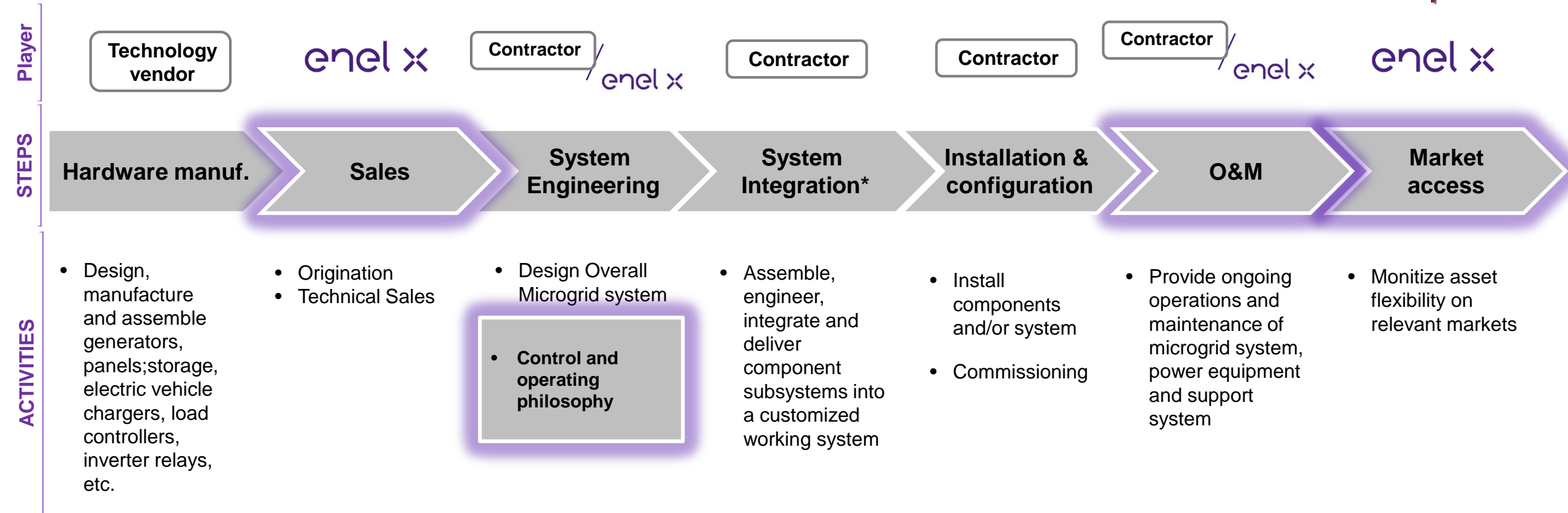
Microgrid complexity can range from simple to large advanced system



	Inverter-based	Basic	Advanced
Enel X Optimization capabilities and differentiating value	Storage optimization (Battery + Curtailable DER with Backup power)	Multi DER optimization	Optimal aggregation (Site optimization + Optimal DR Participation)
Size	100kW – 1MW	1MW – 5MW	5MW+
Products	Mainly Solar + Storage	Solar + Storage + Gensets	Solar + Storage + Genset + Others
Customer Type	Small – Large C&I	Large C&I, Campus	Utility, Community, Military
Software Capability	Monitoring	Rules based	Advanced Optimization
Industrial Controls required	Minimal	Basic	Advanced
Global market size (est)	8GW+	5GW	10GW+ (includes off-grid)
Level of commoditization	High	Medium	Low
Avg Capex	\$100k - \$10m	\$1-10m	\$5-50m



A general overview of our focus within the value chain for energy storage and microgrids



Customer Spotlight: Marcus Garvey Village

Automated deployment of DERs for maximum resilience and value



Microgrid



400 kW solar PV



400 kW fuel cell



300 kW/1,200 kWh
energy storage

625-unit complex in Brooklyn, NY

Deployment Needs

- Renewable, self-sufficient power supply during outages
- Con Ed's BQDM program
- NYISO demand response

Project Details

- NYC's first solar + storage microgrid in an affordable housing development
- First lithium-ion battery system approved for a multi-family building in NYC
- BQDM requirements mandate that the site can self-consume all power it creates, without exporting to the grid

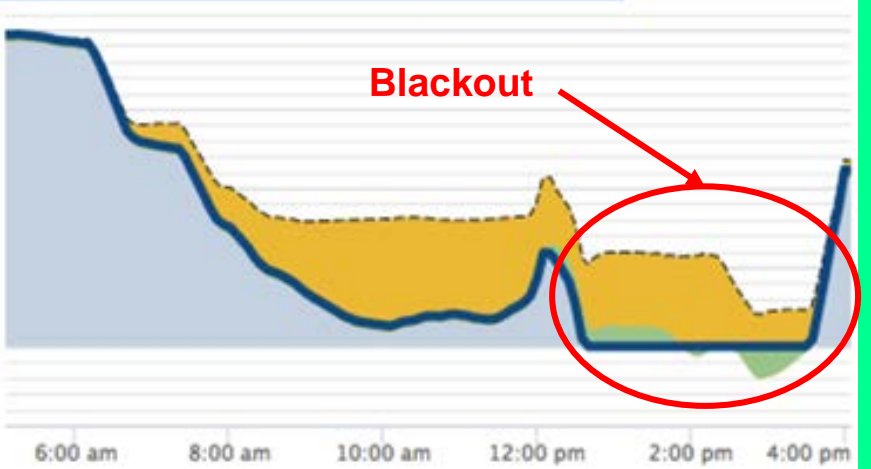
Resilience in Action in Costa Rica



Establishment Labs	
Site	San Jose, Costa Rica
Load Profile	~1.4 MW Peak load
Configuration	Storage - 500 kW/1000 KWh Solar - 272 kW
Applications	Multi-DER Aggregation Critical Load Backup Power TOU Energy Arbitrage TOU Demand Charge Reduction



- Storage + Solar + Backup Power/Microgrid for Critical Loads for this biomedical company
- Solar + Storage System designed to support Critical loads in the medical manufacturing clean room. Maintains all systems to ensure the room stays “clean” during an extended outage



Four Key Aspects of a Microgrid

Seamlessly deploying microgrid assets to capture multiple value streams



Site-level Resilience	Local Grid Reliability	Sustainability Goals	Return on Investment
Self-sufficient power supply in the event of grid outages	Participation in grid-level stability programs	Reduce reliance on fossil fuels for resilience	Maximize cost reduction, incentive payments

“This installation is an important part of a portfolio-wide effort to use renewable energy to enhance property sustainability and residents’ quality of life in line with our double bottom line approach to development.”

**—Josh Weisstuch,
Project Manager at L+M
Development Partners**

Thank You

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