



# Distributed Energy Solutions

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# Ecosystems transform rapidly as technology advances

NYC 5<sup>th</sup> Avenue  
1900



Source: National Archives

NYC 5<sup>th</sup> Avenue  
1913



Source: George Grantham Bain Collection

Can be difficult to predict the pace of change, but we can see what is coming





# Powerful trends shaping the nature of electricity



## DECARBONIZATION

By 2026, **RENEWABLES** will represent 40% of global installed generation capacity

### IMPACT

Growing share of renewables an increasing challenge to the traditional power system model

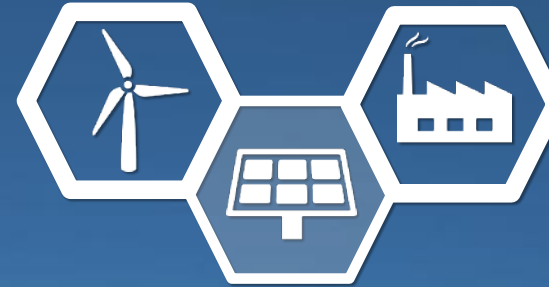


## DIGITIZATION

**EXPONENTIAL GROWTH** of connected devices & smart sensors

### IMPACT

Real time decision making becomes possible .. new software solutions open breakthrough optimization



## DECENTRALIZATION

**GROWING PENETRATION** of Distributed Energy Resources

### IMPACT

End users become active actors of the power system ('prosumer') ... growing grid complexity



## ELECTRIFICATION 2.0

**ELECTRIFICATION OF ENERGY-INTENSIVE USES**

### IMPACT

Step increase in electricity consumption .. accelerating Decentralization



# Regarding NYS Market place

What we bring to the effort for NYS market place:

Pre-Analytics to determine Size-mix of Technologies	Solar Equipment & Installation	Storage Equipment & Installation	CHP Equipment & Installation	Controls Equipment & Installation	Dispatching Algorithm, Signaling, Monitoring	Systemwide Responsibility (Interface to Customer)
1 ★	★	3 ★	★	2 ★ Priority	★ Priority	★ Priority

Audience-members we want to connect with to form a team in NYS:

Pre-Analytics to determine Size-mix of Technologies	Solar Equipment & Installation	Storage Equipment & Installation	CHP Equipment & Installation	Controls Equipment & Installation	Dispatching Algorithm, Signaling, Monitoring	Systemwide Responsibility (Interface to Customer)
★		★	★	★		★



# GE has extensive technology and business capability .. need partners to complete solutions

## Comprehensive solutions

### Design system

economic & power model, grid integration

### Products & solutions

Grid, storage, CNG, solar w/ integration

### Turnkey system

Implement and execute system

### Deal structuring

Project structure & financing for ownership

### Control & Optimization

Monitor, control, bill, utility integration

### Research & development

Future proof the system

## Strong capabilities to support distributed energy



1

SYSTEM DESIGN



2

CONTROLS



3

ENERGY STORAGE



SOLAR



4

GE RESEARCH



PROJECT EXECUTION



GRID SYSTEMS



FINANCING

GE and partners have technology & solutions for industrial & distributed energy customers



# GE's Distributed Energy Solutions

## Customer Electricity Solution

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## Delivering solutions for customers

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## Business Models

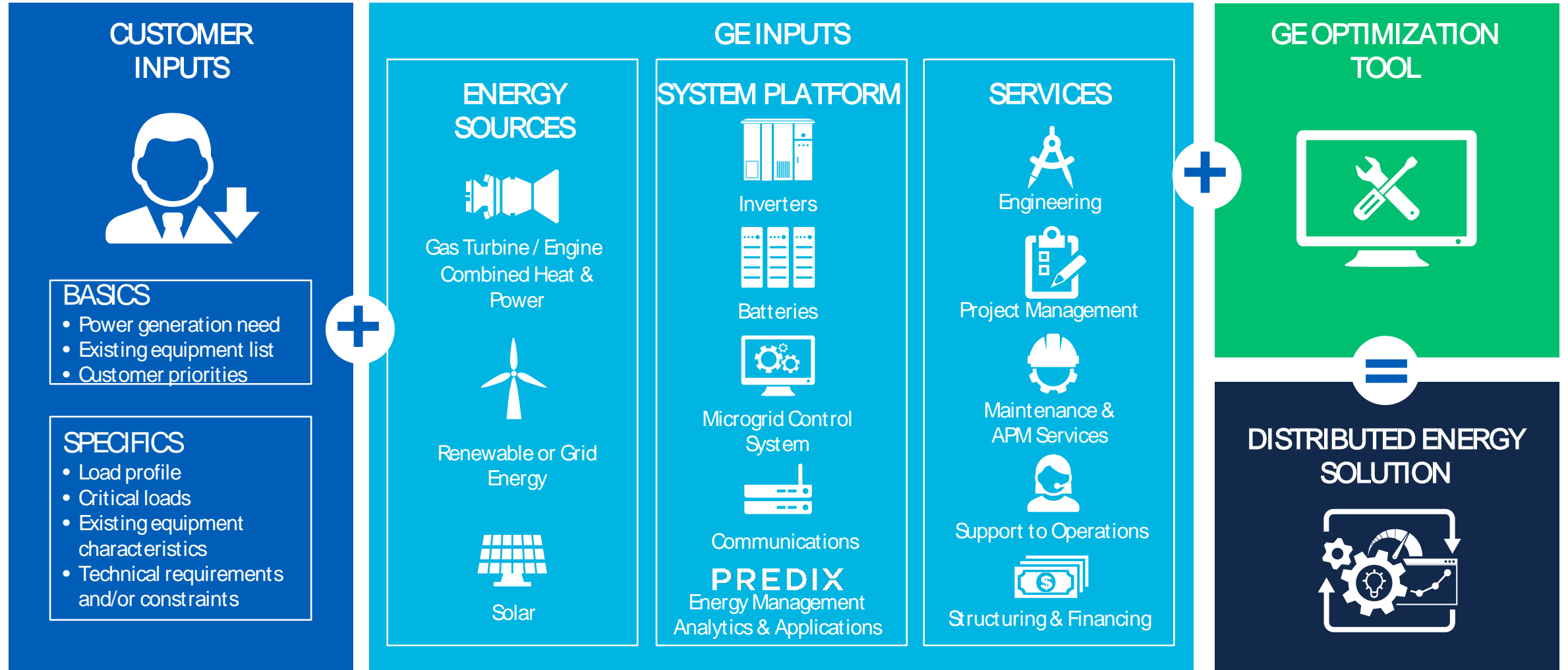
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1. Platform solution ...SW + equipment
2. Turnkey Systems ...design & build project
3. Own & operate ...finance, support customer & utility





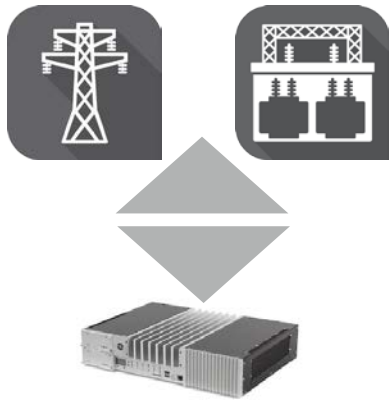
# GE Distributed Energy Solutions design approach



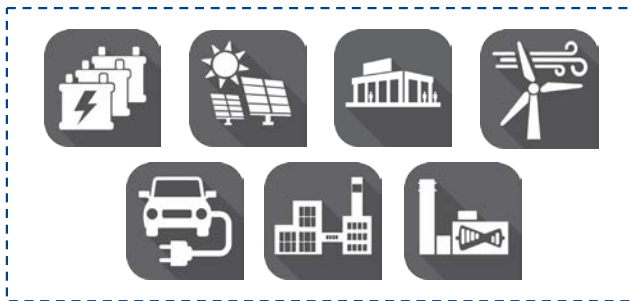
# Distributed Energy Platform .. scalable to create customer value

*Connect, monitor, and control DER with integration to utility / ISO*

## Distributed energy platform



*Local System Control*

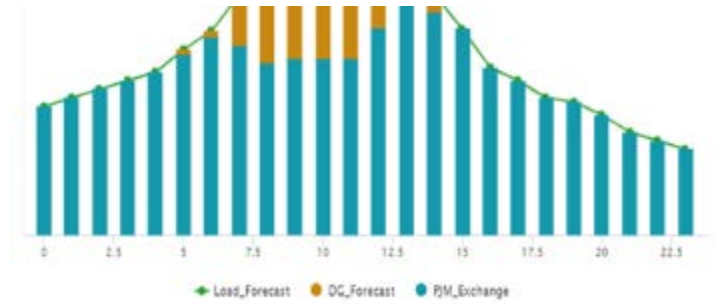


## Managing DER while interfacing with utility

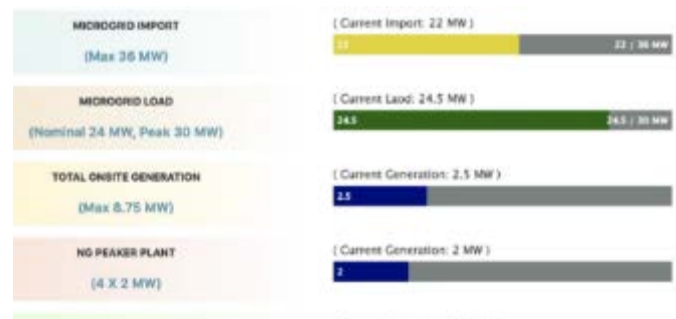
### Energy asset monitoring



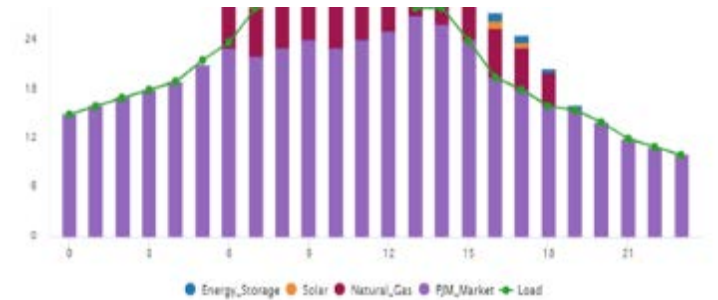
### Operating plan



### DER control



### Energy optimization



Proven solution enabling distributed energy ...running at customer sites





# Microgrid Management & Controls Platform

Connect new & existing DER via vendor agnostic controls system to view, control, & optimize distributed energy systems.



## System Capabilities

Real-time dashboard and monitoring

Asset and performance management

Comprehensive operational planning

Multi-asset portfolio optimization, scheduling, and dispatch

Energy market interface with end to end bid-to-award management

Customer billing and reporting

Energy monitoring and account management



# GE's Distributed Energy Solutions...control platform

## FUNCTIONALITY

### Operations Planning

Constraints management, optimization, schedule & dispatch

### Operations Management

Configurable dashboards, alarms & notifications, remote command & control

### Energy Accounting

Usage analytics, data visualization & trend analysis, third party data interfaces

### Market and Trading Operations

Market interface, bid-to-award management, performance verification

### Financial Accounting

Bill rule configuration, bill run and verification, tenant billing, tenant engagement portal

### Energy System Performance and Optimization

Configurable dashboards, KPI management, alerts & notifications, facility real-time monitoring (EV, Storage, efficiency, etc)

### Distributed Energy Resource Integration

Vendor and technology agnostic data collection, dispatch, and control (EV, storage, CHP, buildings, fuel cells, solar)

### Application integration

Tools to enable integration with 3<sup>rd</sup> party software tools to exchange data, coordinate schedules, perform orchestration, etc



# GE RESERVOIR STORAGE

Enhanced to reduce installation cost and shorten project schedule

### ELECTRICAL INTEGRATION

- DC disconnect, service rated
- Auxiliary power equipment
- Optional combiner Package for DC coupled PV
- Bottom and front entry cable option

### CUSTOM ENCLOSURE

- High density 4 MWh design
- All weather design
- Outdoor rated
- High efficiency cooling
- Long service life

### BLADE PROTECTION UNIT

- Active string regulation extends life up to 15%
- Reduce fault currents by up to 5X to improve safety
- Intelligent DC bus enables direct PV integration
- Enables safe replacement of individual battery modules
- Reduces NFPA PPE levels from HRC4 to HRC2

### BATTERY BLADE UNIT

- Integrated protection unit
- Serviceable with integrated lockable disconnect device
- Digital twin technology for lifecycle management
- 1500V Class with less cable, fuses and switches
- Tier 1 Li-Ion cells for highest cycle life

**UP TO 15% EXTENDED BATTERY LIFE UTILIZING PROPRIETARY BLADE PROTECTION UNITS**

**UP TO 50% REDUCED CONSTRUCTION TIME WITH FACTORY BUILT & TESTED SOLUTION**

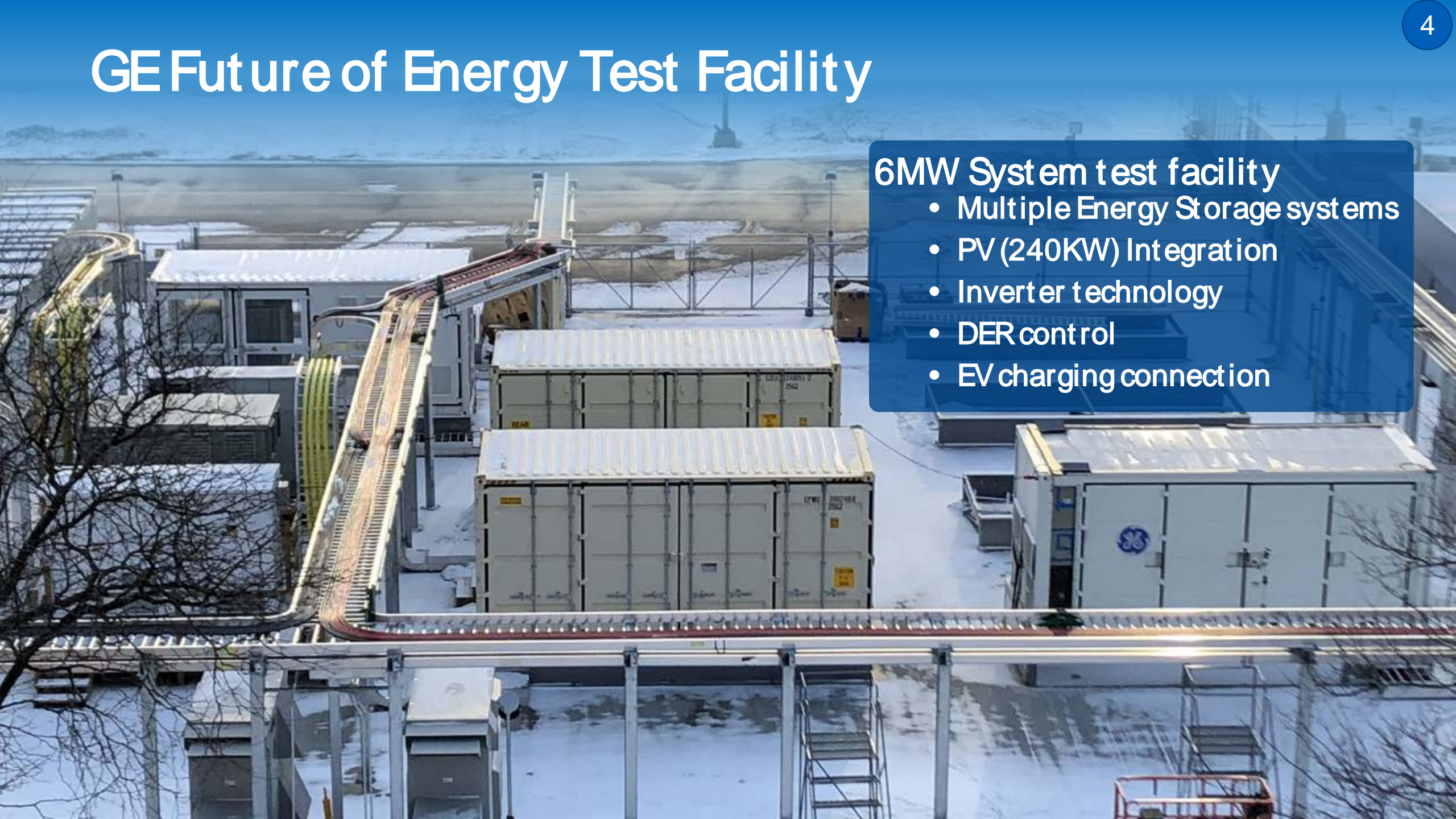
**ENABLE UP TO 50% MORE SOLAR ENERGY SALES WITH ENHANCED PV TO INVERTER LOADING RATIO**



# GE Future of Energy Test Facility

## 6MW System test facility

- Multiple Energy Storage systems
- PV (240KW) Integration
- Inverter technology
- DER control
- EV charging connection



# Case Studies



# Philadelphia Navy Yard microgrid

## Grid Modernization

- Smart meters, communications, microgrid management & DERMS
- Optimize consumption efficiency & environmental footprint

## On-site Generation

- 10 MW substation with PECO tie-ins
- 8 MW natural gas peak shaver/back up power
- 1 MW on-site solar generation

## Customer Benefits

- |         |                  |                         |
|---------|------------------|-------------------------|
| ↓ Capex | ↑ Resilience     | Economic<br>Development |
| ↓ Opex  | ↑ Local Capacity |                         |



**GE ROLE:**

- Energy master plan for microgrid*
- Design and implement microgrid controls for monitoring*
- DER Platform to monitor & optimize microgrid system*

**Enable local load growth in congested area without expanding city infrastructure**





# Portsmouth Naval Shipyard



## Resilience

- Demonstrate Fast Load Shed microgrid controls & Energy Storage integrated with onsite generation to enhance reliability
- Provide ancillary services to the ISO
- Generate cost savings.

## On-site Generation

- 2 5MW gas turbines
- 2 diesel generators
- 500kW Energy Storage

## Customer Benefits

↑ Resilience



### GE ROLE:

*Design and implement load shedding & islanding*

*Substation and relay upgrades for system control*

*Implementing DER platform for monitoring & optimization*

**Campus microgrid with demonstrated islanding and fast load shed functionality**



Note: Partnership with Ameresco

# Industrial captive power

## Turning onsite solar to Reliable Power

- Adding communications and GE DES platform
- ~6 week installation process on brownfield sites

## Existing On-site Generation

- 8 MW Solar
- 1MW fuel cell
- 500kW batteries
- ~20 EVs

## Customer Benefits

- ↑ Resilience
- ↑ Visibility
- ↓ Energy cost



**GE ROLE:**  
*Implement DER platform for system visibility*  
*Enhance system monitoring and connectivity*

Delivering reliable power ...meeting customer demand







# Industrial energy efficiency

## Finding efficiency in existing buildings

- Adding communications and GE DES platform
- Installation 50+ year old brownfield site

## On-site Implementation

- Energy monitoring
- Grid connected controls
- Smart monitoring

## Customer Benefits

- ↑ Resilience
- ↑ Visibility
- ↓ Energy cost



### GE ROLE:

*Implement DER platform to connect DER & building loads*  
*Analyze energy usage with DER Platform for energy savings*

Identify and implement efficiency opportunities with scale to onsite power





# Conclusion

# GE's Solutions to support Distributed Energy and resilience

## Grid studies and system design

Power economics, systems planning, regulatory requirements, market impacts

## Grid integration

Grid Analytics, Utility visibility, Edge Intelligence

## Onsite energy solutions

Solar, storage, on-site gas power, microgrids, Control & optimization

## Power equipment platforms

Energy storage, grid, gas turbines





# Following up with GE

**GE DISTRIBUTED ENERGY SOLUTIONS:** <https://www.ge.com/power/hybrid/distributed-energy-solutions>

**MODEL YOUR MICROGRID:** <http://ge.homerenergy.com/location>

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