



OVERVIEW OF BATTERY ENERGY STORAGE MARKETS

AUGUST 2016

MANAGEMENT CONSULTING FIRM

SINCE 1983 NYSE LISTED: NCI

ACQUIRED OVER 55 COMPANIES

THE SECOND LARGEST ENERGY CONSULTING FIRM

2015 REVENUE USD\$919.5M

5200+ EMPLOYEES

500+ ENERGY CONSULTANTS & ENGINEERS OVER 15+ EXPERIENCES

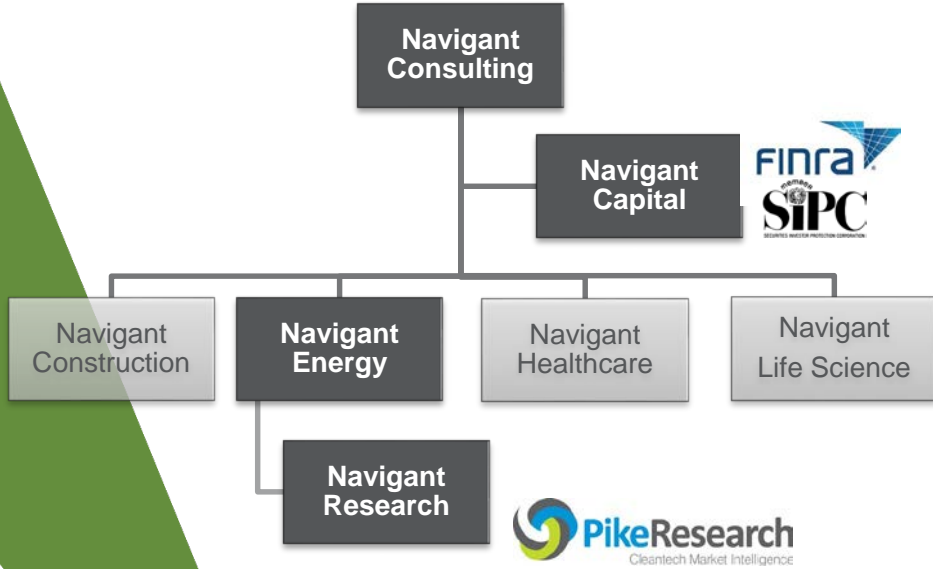
50+ OFFICES

OIL&GAS

RENEWABLES

POWER&UTILITIES

NCI Organization



GLOBAL ENERGY PRACTICE SOLUTION OFFERINGS AND CAPABILITIES

- Business Strategy and Implementation
- Innovation and R&D Management
- Organizational Design
- Change Management
- Technology Advisory
- Merger & Acquisitions
- Integrated Resource Planning
- Business Case Development
- Risk Management
- Physical and Cybersecurity
- Regulatory Compliance
- Federal and State Regulatory Support
- Policy Development and Code & Standards



- Market Strategy and Pricing
- Customer Engagement
- Emerging Technologies (renewables, distributed generation, storage, microgrids, and others)
- Energy Efficiency
- Demand Response
- Customer Analytics
- Operational Excellence
- Asset Management
- Grid Operations
- Distributed Resource Management
- Restoration and Outage Management
- Manufacturing Impact Analysis
- Equipment / Appliance Testing

NAVIGANT RESEARCH AREAS OF FOCUS



ENERGY TECHNOLOGIES

Wind Energy
Grid-Tied Energy Storage
Advanced Batteries
Microgrids
Distributed Natural Gas
Distributed Renewables



UTILITY TRANSFORMATIONS

Grid Networking and Communications
Grid IT Systems and Analytics
Grid T&D
Residential Energy Innovations
Demand-Side Management
Utility Innovations
Utility Technology Disruption



TRANSPORTATION EFFICIENCIES

Electric Vehicles
Advanced Transportation Technologies
Mobility
Transportation Forecast

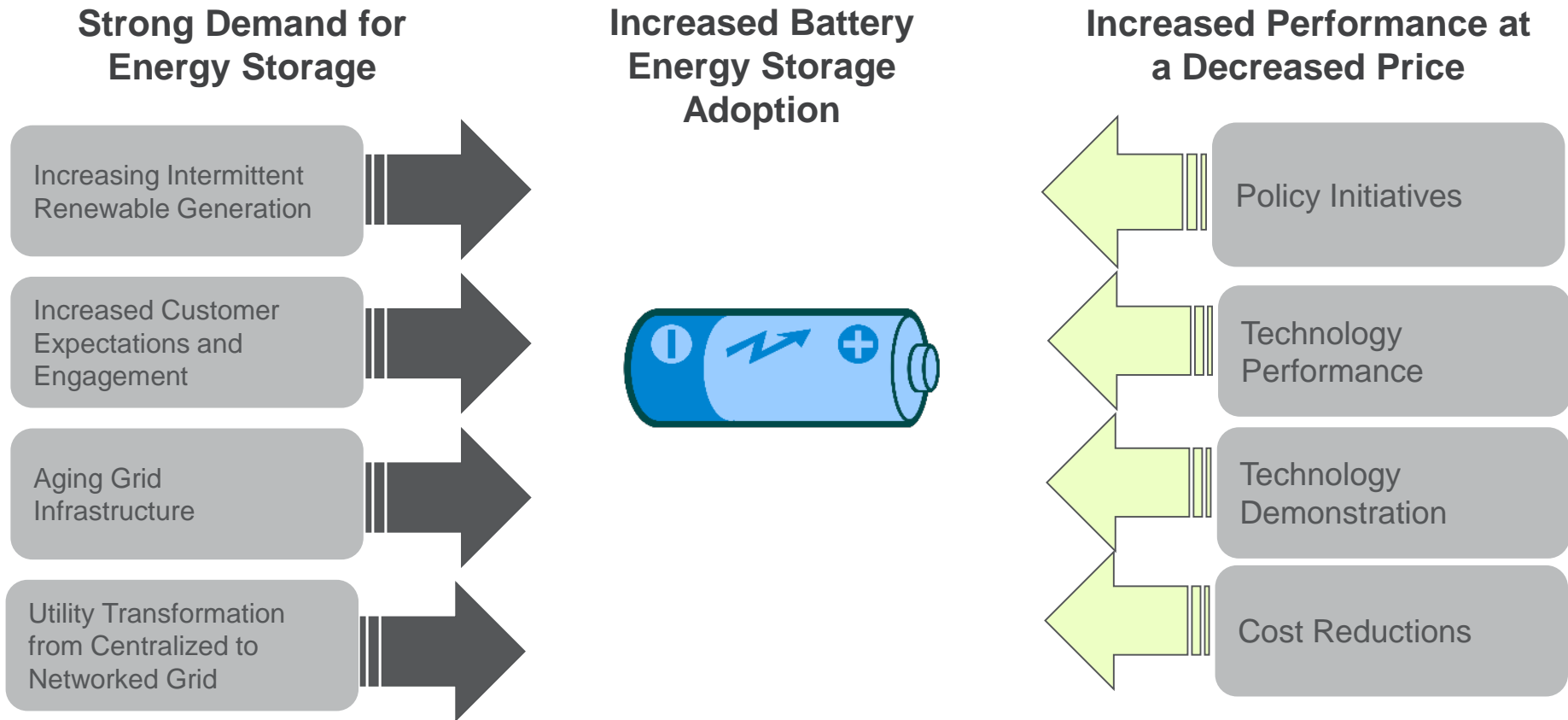


BUILDING INNOVATIONS

Intelligent Building Management Systems
Energy Efficient Buildings
Lighting Innovations
Smart Cities

ENERGY STORAGE DRIVERS

Industry changes are driving demand for energy storage, while policy, technology, and cost advances are making it a more attractive option.



DISTRIBUTED ENERGY STORAGE: MAJOR TRENDS

- Distributed energy storage (residential, C&I) is a fast growing section storage market, with much of the market not constrained by a need for new market rules.
- Lithium Ion (Li-ion) technology is capturing an increased market share due to rapidly falling costs, high efficiency, and a smaller footprint
- Increasing competition in from energy service companies and solar PV providers
 - More vendors offering integrated solutions as part of building energy efficiency + solar PV
- Value of resiliency and improved power quality an important driver for many C&I customers
- Software platforms allowing virtual aggregation of distributed systems to provide grid services and compete in energy markets, greatly increasing value proposition
- Innovative business models and project financing will be key to further market growth

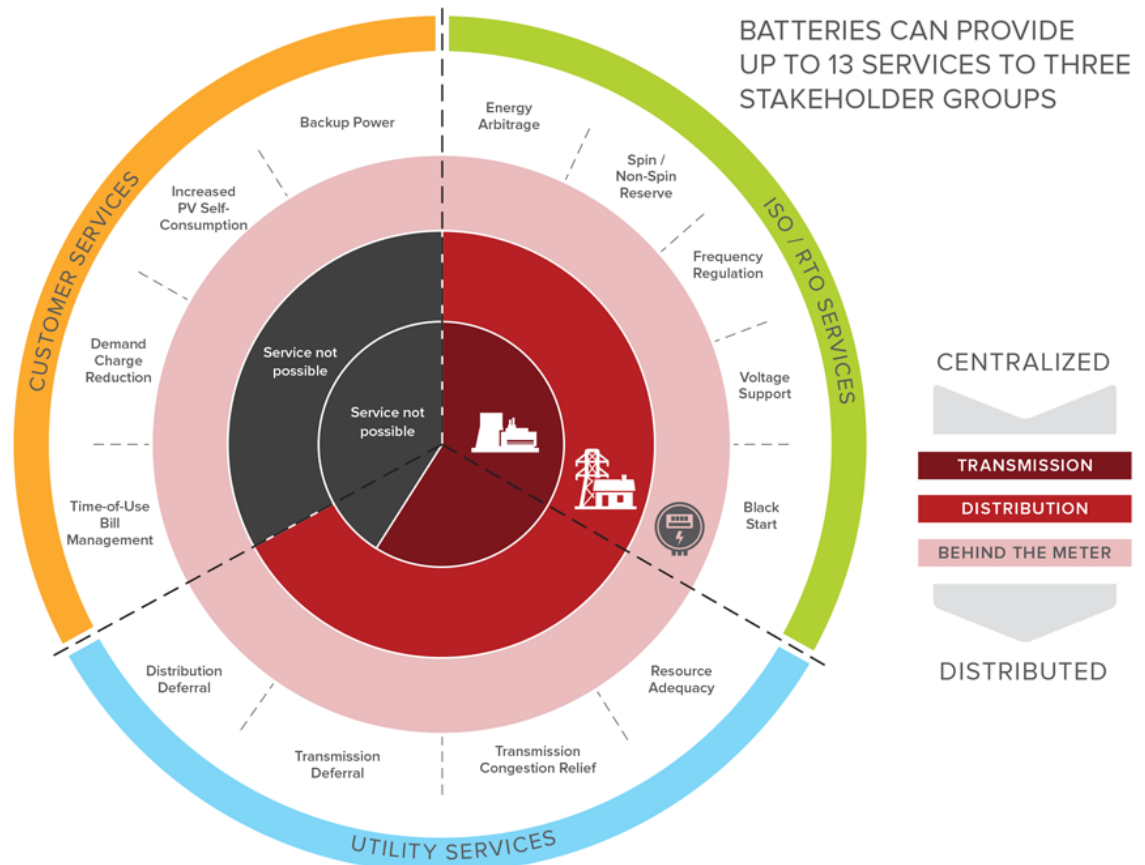
UTILITY-SCALE STORAGE: MAJOR TRENDS

- Regulatory reforms—clarifying rules for storage in energy and ancillary service markets—will be key to growth in many regions
 - FERC Barriers Request
- Software and control systems are becoming increasingly important to capture multiple revenue streams, improving project profitability
 - Flexible ESSs are increasingly being demanded to serve various applications, depending on real-time grid conditions
- The needs of utilities and grid operators will vary in markets around the world, leading to demand for a range of technologies
- Innovative business models and project financing will be key to further market growth

THE RISE OF VIRTUAL POWER PLANTS

Software platforms that can analyze, operate, and optimize battery energy storage-enabled virtual power plants (VPPs) will be positioned to capitalize on the emerging distributed energy resource (DER) market.

- Energy storage sector stakeholders now recognize that behind-the-meter (BTM) battery energy storage systems (ESSs) can deliver grid benefits to RTO/ISOs and distribution system and utility customers.
- This evolution is driving the development of software and hardware platforms that can analyze, control, and optimize aggregated ESSs, giving rise to VPPs.
- VPPs that can analyze, control, and optimize BTM systems to provide multiple benefits across the grid will be at a competitive advantage.
- It will take regulators and power market rulemakers time to take advantage of these technology developments
- Navigant Research believes that battery energy storage-enabled VPPs will emerge as a significant class of DER that are poised to lead the U.S. grid toward more distributed generation.



ENERGY STORAGE CHALLENGES



Jurisdiction Over Interconnection and Sales of Generation/Storage on Distribution Facilities

Is this a Net Energy Metering (NEM) facility without excess generation at the end of a billing period?

YES



Physical Interconnection Sales Jurisdiction

NO 1. A NEM Facility with excess sales or
2. Not a NEM Facility

Is this a Qualifying Facility (QF) selling under a PURPA rate to the interconnected EDC?

YES



Physical Interconnection Sales Jurisdiction

NO 1. QF not selling to interconnected EDC at PURPA rate or
2. Not a QF

Is this a Qualifying Facility (QF) not selling to interconnected EDC at a PURPA rate?

YES



Physical Interconnection Sales Jurisdiction

NO 1. Not a QF

Is this a generator interconnecting to a non-OATT distribution facility?

YES



Physical Interconnection



Sales Jurisdiction

Physical Interconnection Sales Jurisdiction



1. On a distribution line with prior FERC jurisdictional sales or
2. On a transmission line

NO

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