



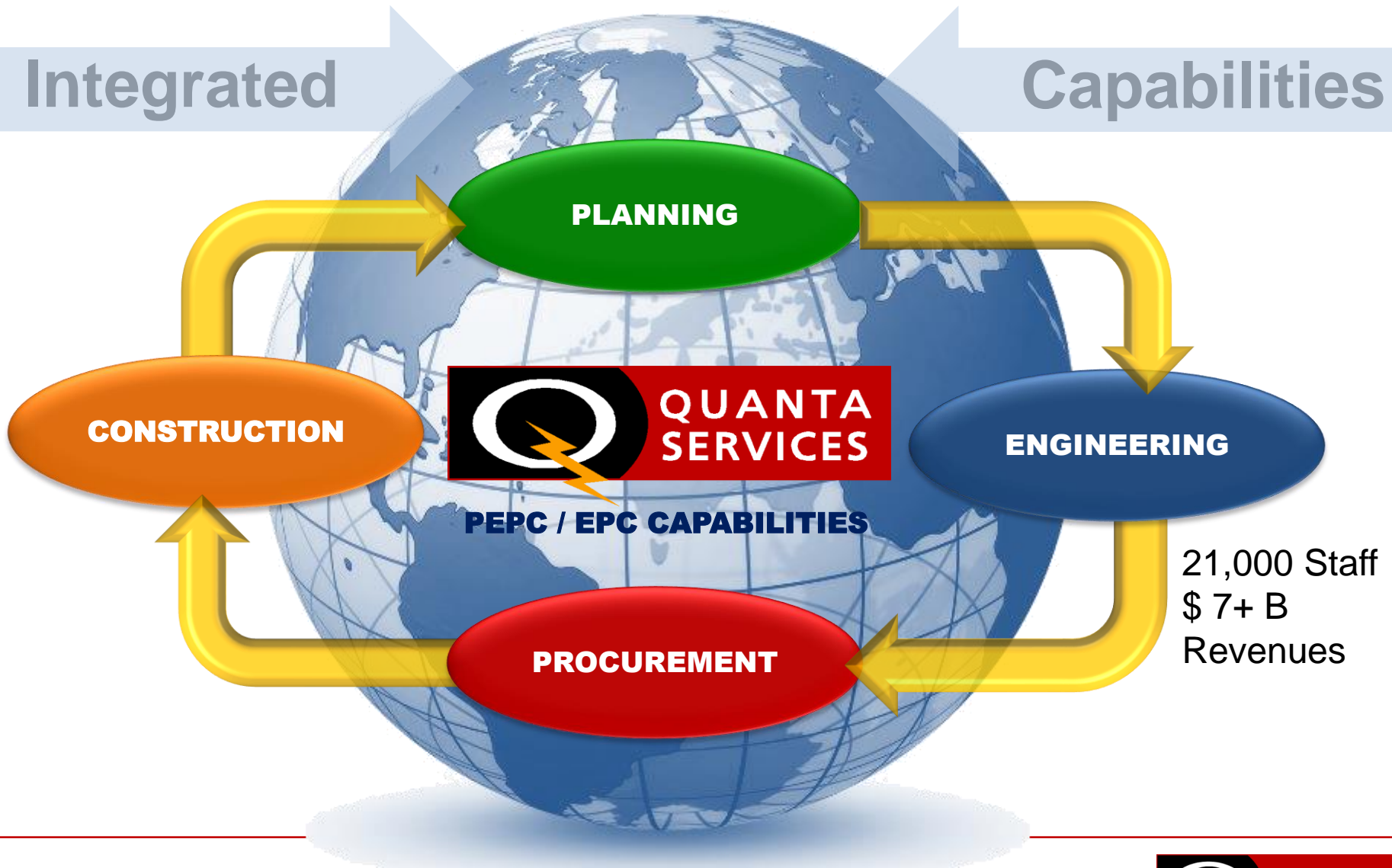
# GRID MODERNIZATION

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# Quanta Services

Integrated

Capabilities



# Quanta Technologies

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- Consulting Organization Focused on Electric Power
  - Transmission Planning and Regulatory Support
  - Distribution Planning
  - Protection and Control
  - Enterprise Integration
  - Renewables Integration
  - Synchrophasor & Wide Area Monitoring
  - New Technologies and Strategic Planning
- 100 Professionals
- President of IEEE PES 2016-2017
- NAE Members
- 65 Patents Held (and counting)

# Challenges Facing the Electric Power Sector

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- Regulatory Uncertainty
- Nuclear Plant Retirements
- Flat or Declining Net Demand
  - Maintaining Revenue Adequacy for T&D
- High Renewable Penetration Consequences
  - Variability and Volatility
  - Loss of Inertial and Governor Response
  - Marginal Clearing Price Spot Market Paradigm Challenges & Need for Capacity Markets
- Integrating Distributed Energy Resources
- Critical Infrastructure and Cyber Security

# Grid Modernization

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- Two Way & Non Radial Distribution Systems
- Monitoring and Control of Distributed Resources
  - How to Exploit the Internet of Things
- Advanced Sensors
- Dynamic Protection and Automation
- Energy Storage

# Energy Storage

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- Just Starting on the Cost Reduction Curve
  - 5 Years “Behind PV” on this Progression
- Game Changer for Power System Planning and Operations
- Could Dramatically Affect Markets
- Challenges
  - Cost (today)
  - Standards
  - Regulatory Positions
  - Tools for Planning and Integration
  - Storage is too Often Made to Fit a Generation, Transmission, Distribution, or Customer Template
    - Storage is a New Asset Class for Many Purposes
    - Regulatory Treatment and Market Design Need to Treat It as Such