



# The Smart Grid at Work

Vision, experience, investments  
and resources powering the  
grid of the 21st century



imagination at work

**A Smart Grid is  
comprised of various  
solutions focused on the  
integration of two  
infrastructures:**

**Electrical System**  
+  
**Information System**

### **A Smart Grid:**

- Empowers consumers
- Improves efficiencies
- Optimizes resources
- Increases reliability
- Reduces emissions

# The focus on the benefits, not just the infrastructure



**Transform today's grid to  
realize new benefits**

**Ensure full societal benefits  
for our economy, environment  
and energy security**

**Focus funding on totality of the solution**

**Software solutions alongside infrastructure  
improvements are critical to delivering  
the promise of the smart grid**

**Understand the impacts of investment choices**



# Manage risk

- Apply best practices
- GE Risk/Reward models maximizing cost/performance for power generation worldwide
- Eliminate miscrees and wasted cost
- Capitalize on all viable opportunities
- New supplier relationships



# Smart messaging

- Marketing initiatives to excite and educate consumers
  - Drive acceptance of new energy-use model
  - GE outreach to government and regulators
  - Move all constituencies to successful adoption
  - Education and engagement – to help you

The screenshot shows a website with a green background and a central graphic of a globe with a grid overlay. The top navigation bar includes links for 'SIGN UP', 'SUBSCRIBE TO THE NEWSLETTER AND', 'ENERGY ISSUES', 'SMART GRID SOLUTIONS', 'INTERACT', 'TAKE ACTION', 'RESOURCES', and 'WHAT IS THE SMART GRID?'. Below the navigation, there's a large section titled 'SO WHAT IS THE SMART GRID ANYWAY AND WHY SHOULD I CARE?' with icons for 'MANAGE RISING COSTS', 'ENERGY INDEPENDENCE', 'GREEN JOBS', 'ENVIRONMENTAL IMPACT', 'POWER RELIABILITY', and 'MODERN INFRASTRUCTURE'. To the right, there's a section titled 'WHAT IS THE SMART GRID?' with a sub-section for 'An Energy Internet' featuring a video thumbnail and a 'Watch Video | Share' button.

[www.itsyoursmartgrid.com](http://www.itsyoursmartgrid.com)



# It's going to keep getting better

**Developing grid-communications, generation, transmission, distribution and consumer products that tie into today's smart grid investments**

- Smart appliances
- Wind integration technologies
- Hybrid electric cars
- A complete portfolio of smart grid enhancers



# Typical Smart Grid Objectives

## Consumer

- Increased satisfaction, program participation & education**
- Reduce costs, improve reliability, energy management & CO2**

## Distribution

- Improve system reliability and efficiency**
- Enable increased renewables often part of a RPS**

## Transmission

- Increase effective system capacity and reliability**
- Improve observability of transmission system**

## Asset

- Extend life of assets and reduce capital and maintenance costs**
- Improve system utilization and reliability**

## Workforce

- Improved planning, operations and maintenance efficiency**
- Utility strategic requirements**



# ...GE's Smart Grid – a complete view

## Energy Resources      T&D      Customer

### Renewables

Wind Turbines  
Solar Power  
Biogas Engines  
Hydro Power  
Energy Finance



### Natural Gas

Large-Frame Turbines  
LM Turbines  
Energy Finance



### Base

Steam Turbines  
Log<sup>on</sup> GCC  
Cleaner Coal  
ESBWR Nuclear



### CO<sub>2</sub> Capture

BP H2 Joint Venture  
Synfuels Technology



### Storage

Smart Inverters & Batteries



### Back Office

Geospatial Asset Mgmt  
SCADA/EMS/DMS Software  
Optimization & Diagnostics  
Metering Comm Systems  
Communications Security  
Work Force Management

### Subs and

Field Communications from Office  
to Sub to Meter  
Automation  
Protection  
Network Equipment  
Physical and Cyber Security  
Asset Condition Monitoring  
Engr Procure Const

### Infrastructure

Transformers - Pwr, Dist,  
Net  
Capacitors  
Voltage Regulators  
Surge Arrestors  
Busway

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### Comm & Indust

C&I Smart Meters  
Water Treatment  
Factory Automation  
Energy Finance  
Energy Management



### Residential

Smart Meters  
Home Area Nets  
Home Energy Mgr  
Security  
Healthcare  
Entertainment  
Consumer Services

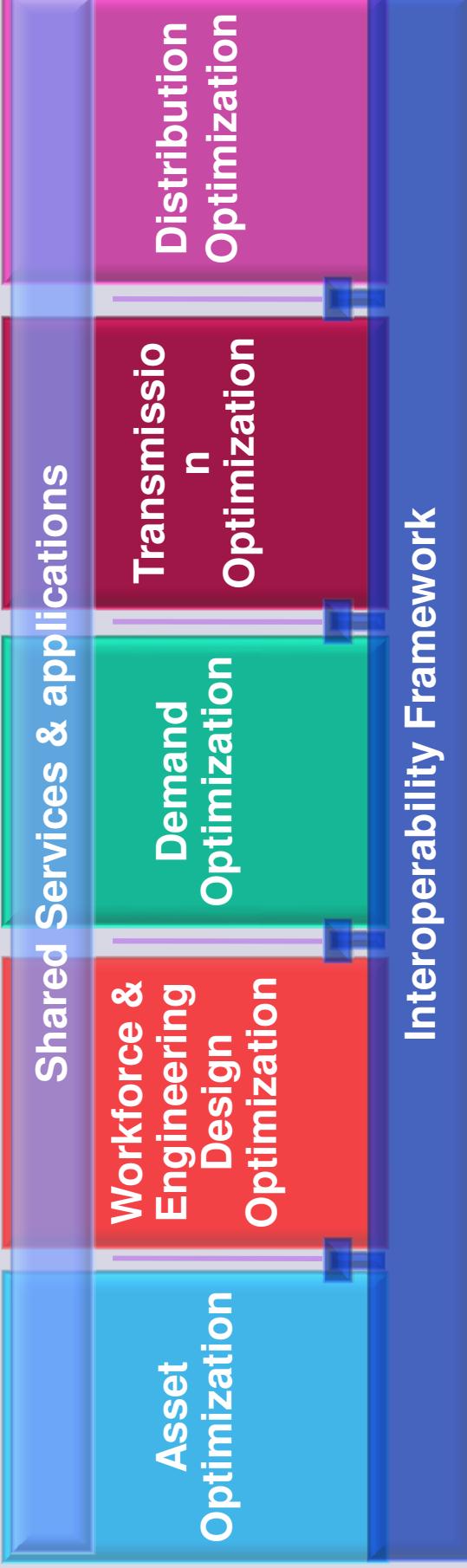


# GE Activity in Smart Grid Standards

 <b>NIST</b>	<b>Smart Grid Interoperability &amp; Cyber Security</b>	 <b>Smart Grid Electricity Advisory Committee</b>	 <b>IEEE</b>	 <b>Board of Directors</b>	 <b>Power &amp; Energy Society (PES) Past President</b>	 <b>PES Intelligent Grid Coordinating Committee</b>	 <b>Power System Relaying Committee</b>
 <b>NERC</b>	 <b>Industrial Control Systems WG</b>	 <b>BOREAS Cyber Security WG</b>	 <b>Smart Grid Task Force Technology</b>	 <b>Smart Grid Task Force Policy</b>	 <b>Smart Grid Task Force Standards</b>	 <b>Smart Grid Strategic Group 3</b>	 <b>US Principle</b>
 <b>GRIDWISE</b>	 <b>Interoperability WG</b>	 <b>Implementation WG</b>	 <b>Legislative and Policy WG</b>	 <b>State Legislative and Policy WG</b>	 <b>Home 2 Grid (H2G) WG</b>	 <b>Business and Policy (BnP)</b>	 <b>US TAG</b>
 <b>AHAM</b>	 <b>Smart Grid Task Force</b>	 <b>US National Committee (USNC) VP, Technical Study Committees</b>	 <b>EPRI</b>	 <b>Advanced Metering Infrastructure</b>	 <b>GE</b>	 <b>imagination at work</b>	 <b>9 / GE /</b>

# GE Smart Grid Building Blocks

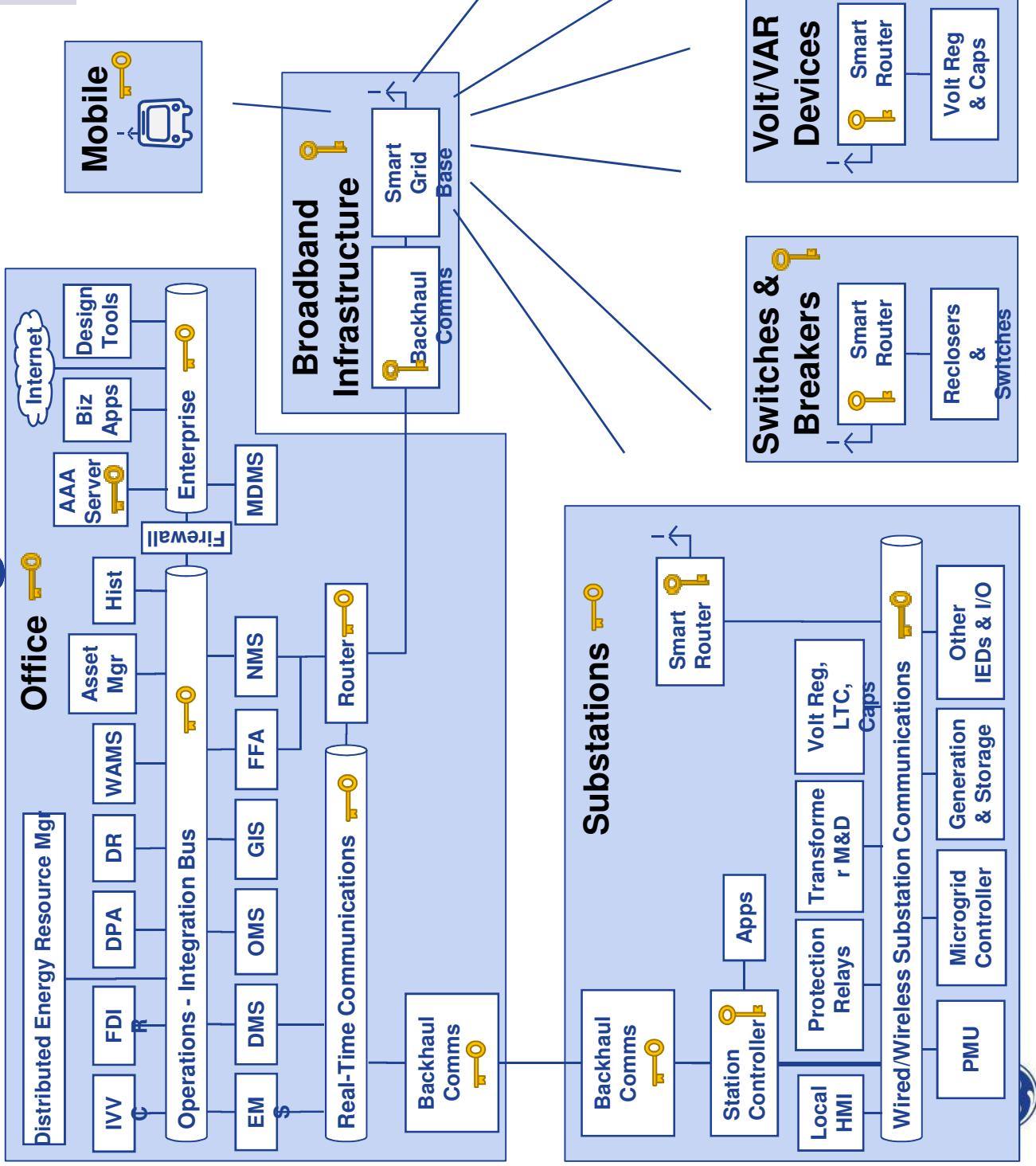
## Smart Grid Pillars



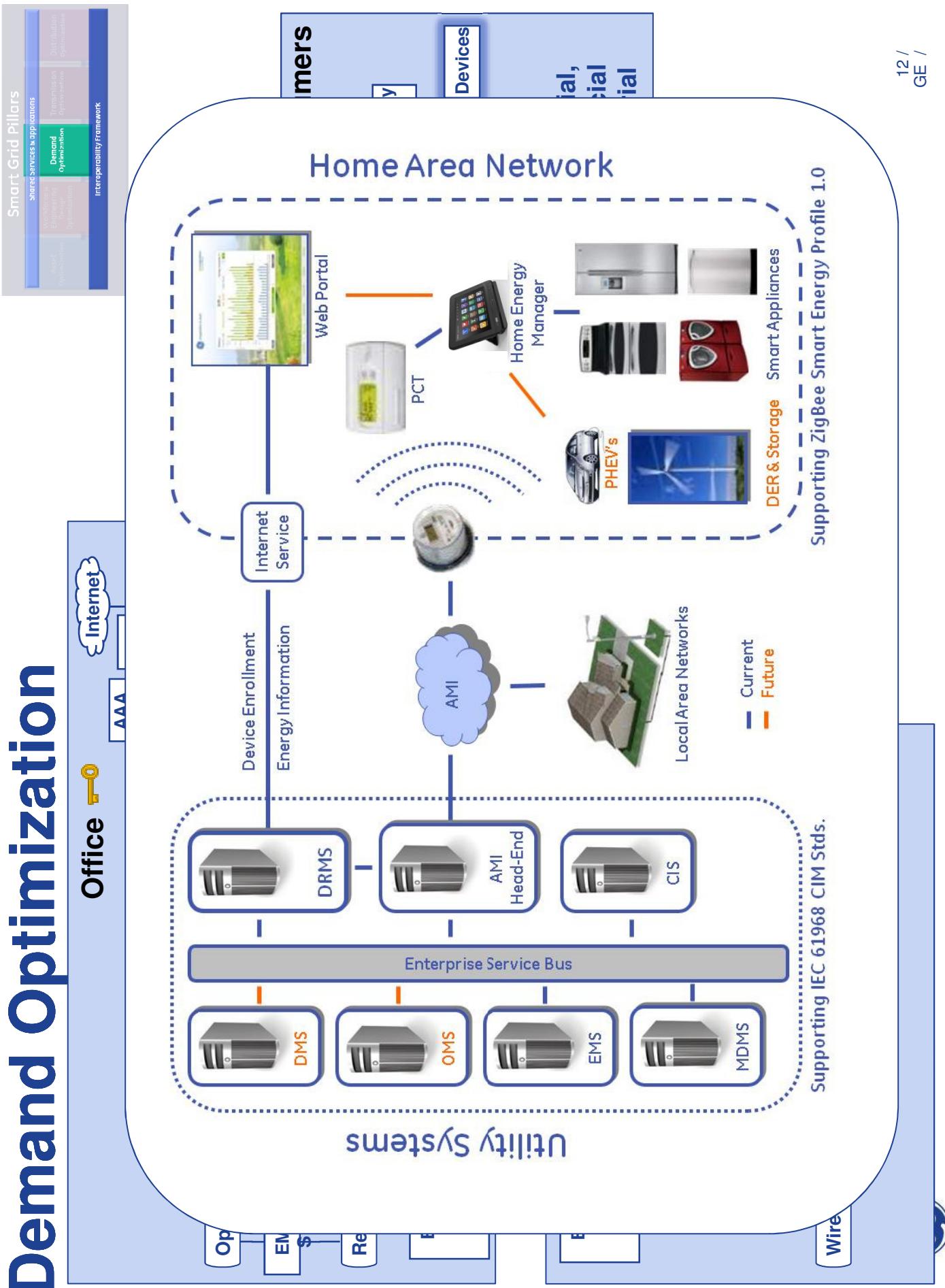
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# Smart Grid – integrated solutions



# Demand Optimization



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GE /

# Distributed Energy Resources

Distributed Energy Resource Mgr

\$5B investment



Asset Optimization

Engineering Design

Interoperability Framework

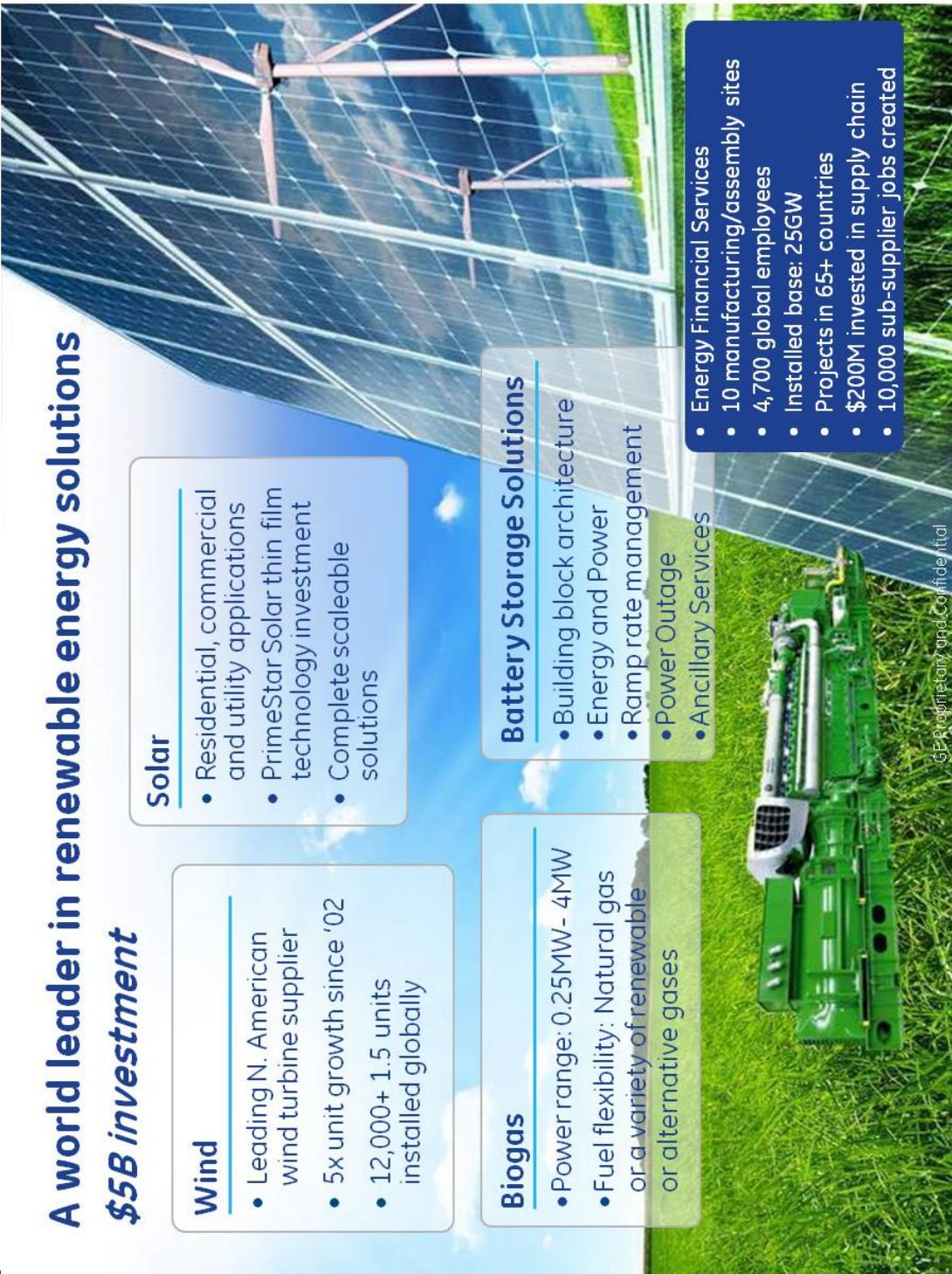
Transmission Optimization

Demand Optimization

Share Services & Applications

Smart Grid Pillars

A world leader in renewable energy solutions  
\$5B investment



## Solar

- Residential, commercial and utility applications
- PrimeStar Solar thin film technology investment
- Complete scalable solutions

## Wind

- Leading N. American wind turbine supplier
- 5x unit growth since '02
- 12,000+ 1.5 units installed globally

## Biogas

- Power range: 0.25MW- 4MW
- Fuel flexibility: Natural gas or a variety of renewable or alternative gases

## Battery Storage Solutions

- Building block architecture
- Energy and Power
- Ramp rate management
- Power Outage
- Ancillary Services

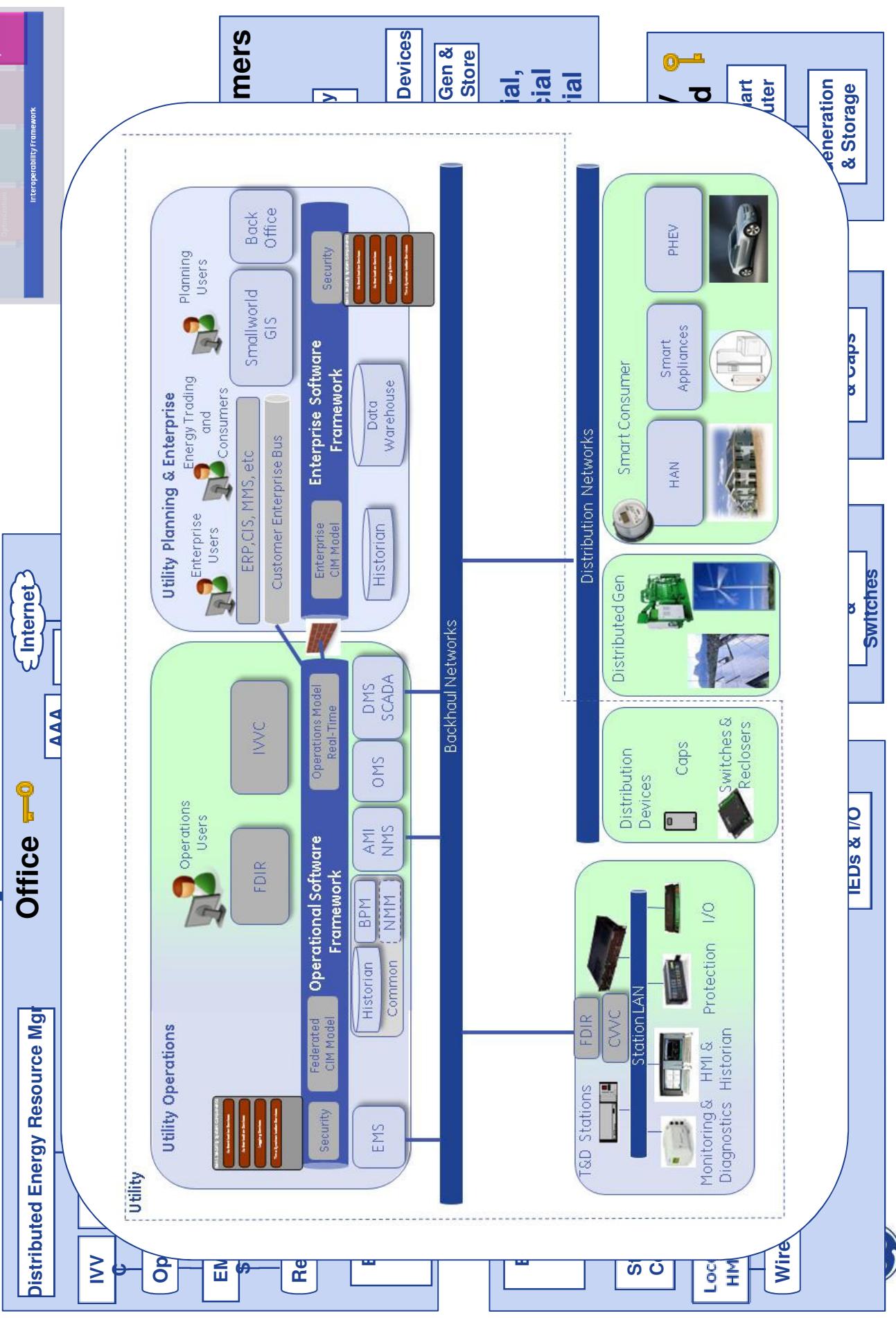
- Energy Financial Services
  - 10 manufacturing/assembly sites
  - 4,700 global employees
  - Installed base: 25GW
  - Projects in 65+ countries
  - \$200M invested in supply chain
  - 10,000 sub-supplier jobs created

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Note: Some items under

# Distribution Optimization



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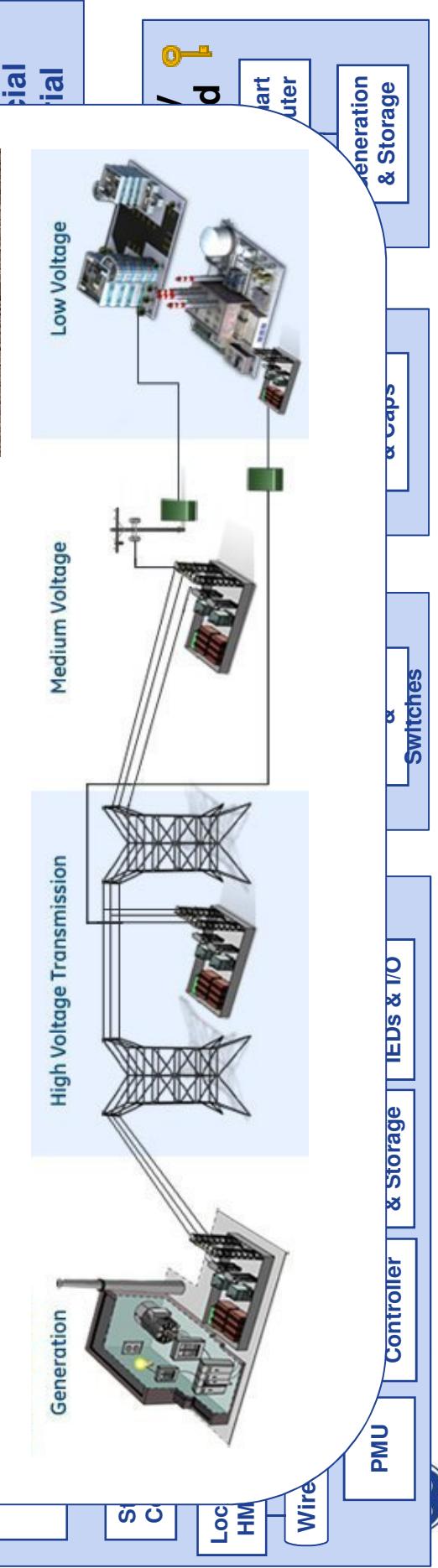
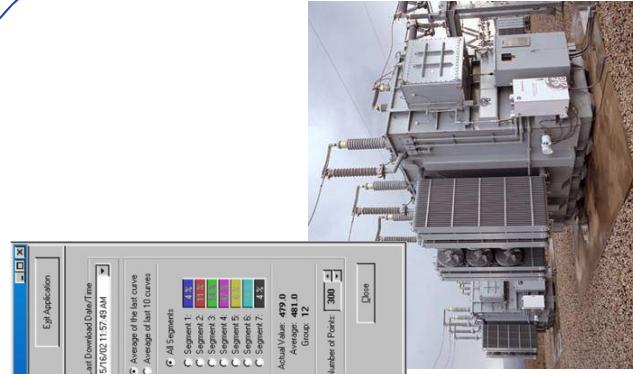
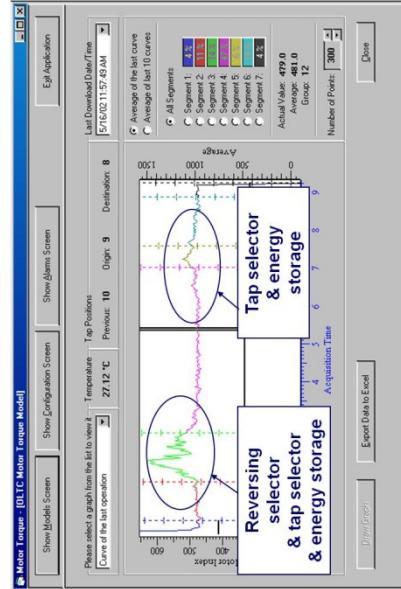
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# Asset Optimization

Distributed Energy Resource Mgr

Office 

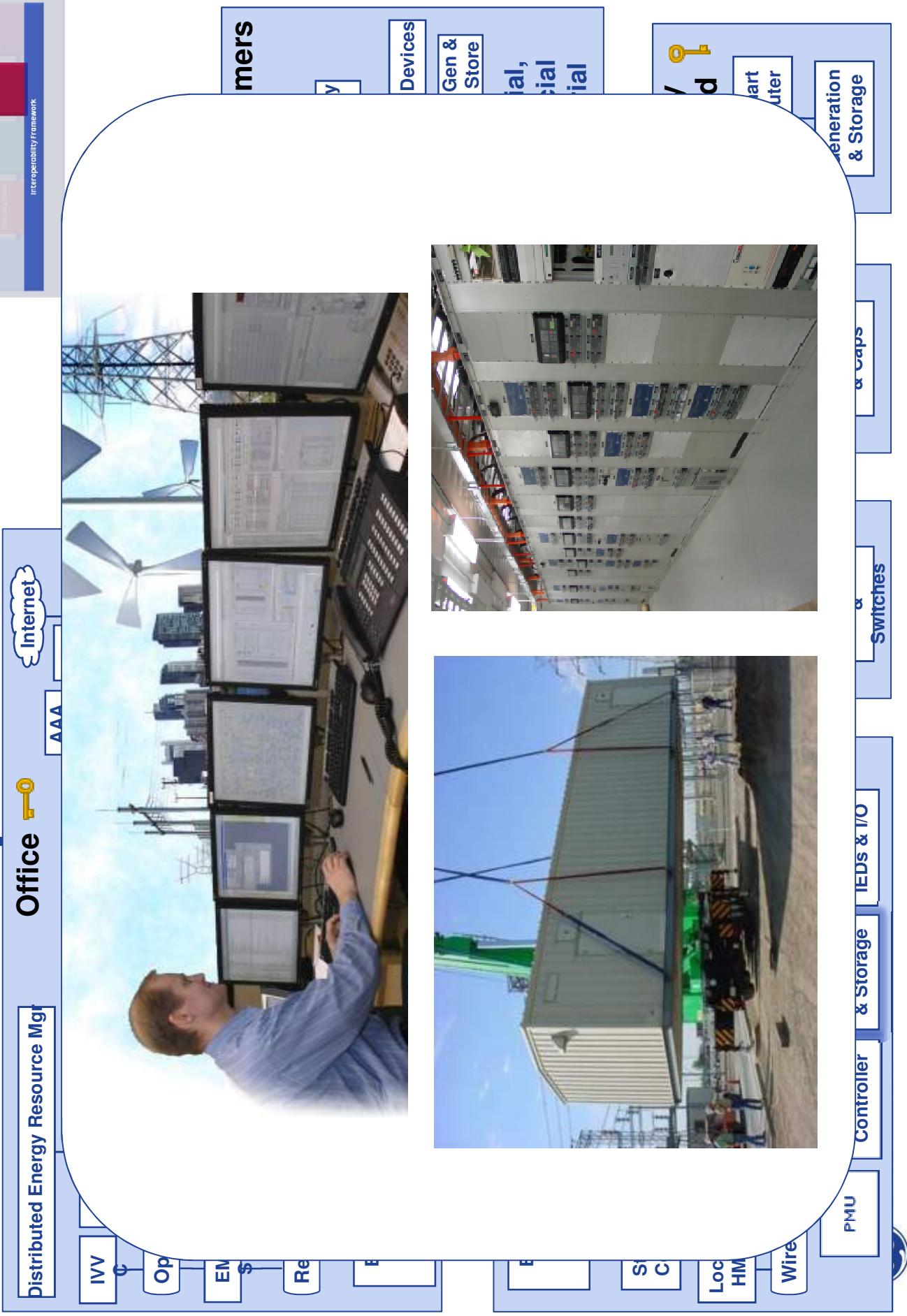
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Note: Some items under

# Transmission Optimization



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**Note:** Some items under

# Smart Grid Challenges Going Forward ...

**Benefits & Costs** – Proving the business benefits of the SG system that achieve the business & technical objectives to drive Stimulus Applications &

**Smart Grid Road Map** – Separating the hype from the available and prioritizing resources

**Data** – Provide & maintain accurate & secure network model that is synchronized with asset data & work management processes, shared across operating departments.

**Analytics** - Provide analytics to turn raw data into actionable information to support real time decision support

**Visualization** - Provide state of the art visualization tools that provides understandable & actionable information

**Technology Migration** - Provide a systems design that utilize legacy tools yet facilitates migration to next generation technology.

**Users** – Dramatic change management required. Evolution, not revolution

**Safety** – Ensure that systems are designed and personnel are trained on new operating practices to maintain a high level of

**Security** – Ensure that systems meet the utility and regulator's security requirements





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