1. Measure the portfolio across a variety of OFM “health” indicators, not just service contract costs.

1. Address workforce challenges by leveraging regional strengths and sharing best practices.

1. Achieve operational efficiency and effectiveness across the portfolio.
Emerging Building Technologies’ two programs — GSA Proving Ground (GPG) and Pilot to Portfolio (P2P) — enable GSA to make sound investment decisions in next-generation building technologies based on their real-world performance.
Next Generation Solutions: Leading by Example

Emerging Building Technologies provides GSA a “one stop shop” for objectively assessing innovative building technologies in real-world environments (GSA Proving Ground), and deploying those that deliver (Pilot to Portfolio).
Emerging Technologies

● Mission: Enable GSA to make sound investment decisions in next generation building technologies based on their real-world performance

● GSA’s Proving Ground (GPG) assesses real-world performance of next generation technologies
  ○ Identify promising technologies at the edge of commercialization
  ○ Pilot technology installations within GSA’s real-estate portfolio
  ○ Partner with DOE labs to objectively evaluate real-world performance
  ○ Identify technologies with broad deployment potential for GSA
  ○ 600 technologies considered, 63 technologies evaluated, 33 reports published, 20 technologies proven for GSA

● Pilot to Portfolio (P2P) supports the deployment of proven next generation technologies
  ○ Process influence supports the introduction of proven technologies at key lifecycle entry points: new construction, retrofits, end-of-life replacement
  ○ Portfolio analysis utilizes existing GSA databases to identify buildings with aging, inefficient equipment and tenant comfort issues
  ○ Project initiation support provides technology specifications and IT security approval
  ○ Dynamic training offers webinars, dashboards and interactive tools
  ○ 13 proven technologies deployed, $7M in estimated annual savings
<table>
<thead>
<tr>
<th>Building Envelope</th>
<th>HVAC</th>
<th>Lighting</th>
<th>Energy Management</th>
<th>Water</th>
<th>On-Site Renewables</th>
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<tbody>
<tr>
<td>Hi-R Low-E Window Retrofit System</td>
<td>Condensing Boilers</td>
<td>LED Fixtures with Integrated Advanced Lighting Controls</td>
<td>Chiller Plant Control Optimization System</td>
<td>Weather Station for Irrigation Control</td>
<td>Photovoltaic System Performance</td>
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<tr>
<td>Low-E Window Film</td>
<td>Fan Belts: Synchronous and Cogged</td>
<td>LED Downlight Lamps for CFL Fixtures</td>
<td>Socially Driven HVAC for Personal Control</td>
<td>Wireless Soil-Moisture Sensors for Irrigation Control</td>
<td>Photovoltaic-Thermal Hybrid Solar System</td>
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<td>Nanocoating Solar Control Films</td>
<td>Indirect Evaporative Cooler</td>
<td>Occupant Responsive Lighting</td>
<td>Wireless Pneumatic Thermostats</td>
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<td>Wood-Pellet Biomass Boilers</td>
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<td>Thermochromic Windows</td>
<td>High-Performing Commercial Rooftop Units</td>
<td>TLED Lighting Retrofits with Dedicated Drivers</td>
<td>Wireless Sensor Networks for Data Centers</td>
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<td>Vacuum Insulated Panels for Roofing Applications</td>
<td>Smart Ceiling Fans</td>
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<td>Variable-Speed Maglev Chiller</td>
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<td>Variable-Speed Screw Chiller</td>
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Proven Deployment Potential for GSA
## Technologies Under Assessment

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<td>Dual Zone Indoor Shades</td>
<td>Drop-In Smart Switched Reluctance Motor</td>
<td>Advanced Lighting Controls with LED</td>
<td>Adaptive Control for Chilled Water Plants</td>
<td>Electrochemical Water Treatment for Cooling Towers</td>
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<td>High Efficiency HVAC</td>
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<td>Intelligent Energy Valves for Hydronic Systems</td>
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<td>Smart Scrubbers for HVAC Load Reduction</td>
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<td>Circuit-Level Energy Monitoring</td>
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<td>Alternative Water Treatment for Cooling Towers</td>
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<td>Predictive HVAC Optimization</td>
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<td>Monitoring and Partial Water Softening for Cooling Towers</td>
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<td>Wireless Sensors and Analytics</td>
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<td>Catalyst based Water Treatment for Cooling Towers</td>
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</table>
Once a technology has been proven, it must fit within GSA’s concept of Operational Excellence and have an attractive Total Cost of Ownership.
Operational Excellence Goals

A holistic approach to evaluate building technology and design approaches for the long run

- Reduce overall total cost of ownership (TCO)
- Integrate operability and maintainability into designs
- Improve transition from building delivery to operations
- Incorporate feedback from operations to building delivery
Benefits of Operational Excellence

- Way to ensure maximum use of operations budget
- Have standardized tools and processes to evaluate Total Cost of Ownership
- Emphasis on capturing lessons learned and calibrating TCO Tool assumptions with actual data and outcomes
GSA continues to leverage our utility acquisition knowledge across government
GSA Public Utility Areawides

- 100 Areawide contracts with 2 more in negotiation
- GSA working with OMB to get Tier 2 Spend Under Management (SUM) Rating under Category Management
- Use of the Areawide Contracts steady
  - FY16: $1.4B on 2,580 contract actions
  - FY17: $1.0B on 3,006 contract actions
  - FY18: $1.4B on 2,657 contract actions
Recent GSA UESC Projects

2017 - San Francisco, CA

   Pacific Gas & Electric awarded $4.4M investment value project for Appraisers Building

2018 - Philadelphia, PA

   Philadelphia Gas Works awarded $960K investment value project for 2 courthouses and a federal office building
Deregulated Electric and Natural Gas Commodity Programs

GSA’s Deregulated Electric and Natural Gas Acquisition Programs assist agencies in purchasing energy in deregulated and competitive markets.

- $345 million in annual third-party spend
- 1174 end-use accounts
- 30+ agencies
- 37 states
- 99 utility service territories
- 160 active supply contracts
- 40% of supply contracts served by small businesses
- 20% renewable included in electricity contracts on average
GSA Deregulated Commodity Contracts

Legend:
- Blue: Gas Only
- Grey: Electric Only
- Green: Electric and Gas
- White: Limited Opportunities
Energy Rebates

FY17 Energy Rebate Program

- $4.7M income; $4.9M obligated for energy efficiency projects

FY18 Energy Rebate Program

- $5.5 M income; $5.0 M obligated for energy efficiency projects

GSA has issued updated national energy rebate guidance for regions to follow.
Demand Response


GSA primarily participates in grid-based demand response programs

• Grid based DR is coordinated through a third-party contractor and only available in certain territories.
• GSA has enrolled approximately 25 megawatts demand
• $1M in annual benefit

GSA looking to participate more in utility based demand response programs

Grid based rebates are added to energy efficiency fund

Utility based incentives are applied as a credit on the utility bill
### GSA Locations Using Grid Based Demand Response

#### Energy Division - Demand Response

<table>
<thead>
<tr>
<th>Region</th>
<th>Demand Response map</th>
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<tbody>
<tr>
<td>R11</td>
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<td>R3</td>
<td><img src="image" alt="Map Region R3" /></td>
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</tbody>
</table>

2018 KW Reduction Estimates:
- > 2,500
- 2,000
- 1,300
- 600
- < 25

Map credit: Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS
Renewable Energy

GSA obtains 13% of total electricity from renewable sources (statutory goal 7.5%)

Sources include

• Competitive electric supply procurements (typically 20% total supply)
• Renewable Energy Certificate purchases (REC)
• Onsite renewable resources (112 active renewable systems that generate approximately 36,000 MWh annually)
Renewable Energy Projects

### Renewable Energy Production

**RE Type**
- Solar Photovoltaic
- Solar Thermal (including water and space conditioning)
- Geothermal Heat Pumps
- Geothermal
- Wind
- Wood and wood residuals

**Energy Generated (kWh)**
- > 4,256,674
- 3,000,000
- 2,000,000
- 1,000,000
- < 0

Map of the United States highlighting renewable energy projects and energy generation data.
Total Cost of Operations

- Work Order Throughput (WOT)
- Energy Utilization
- Workforce Utilization
- Tenant Satisfaction