U.S. General Services Administration

Big Data and Energy Information

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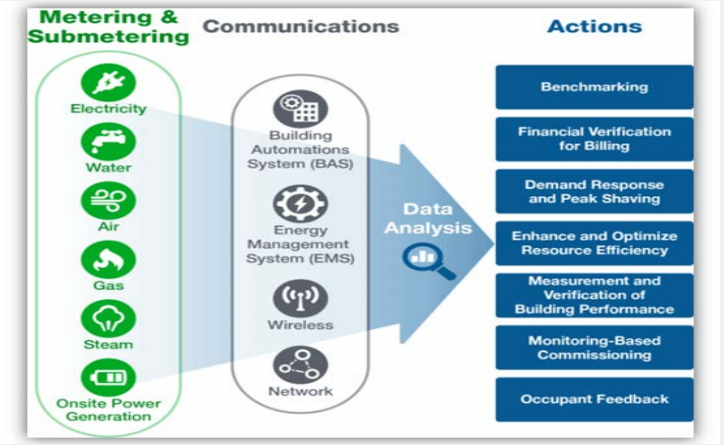
Sub-metering

Meters Enable Action

- Energy Efficiency is America's Cheapest Energy Resource (Average 2.8 Cents per kWh, AEEE 2014)
- Sub-metering Promotes Energy Savings:
  - Operational Cost Savings
  - Improved Building Management
  - Enhanced Operational Efficiency



Action	Observed Savings
Installation of meters	0 to 2% initial impact but savings will not persist
Bill allocation only	2-1/2 to 5% - improved occupant awareness
Building tune-up and load management	5 to 15% - improved awareness, identification of simple operations and maintenance improvements, and managing demand loads per electric rate schedules
Ongoing commissioning	15 to 45% - improved awareness, ongoing identification of simple operations and maintenance improvements, and continuing management attention

Free Sub-metering Decision Tool: https://sftool.gov/plan/submetering

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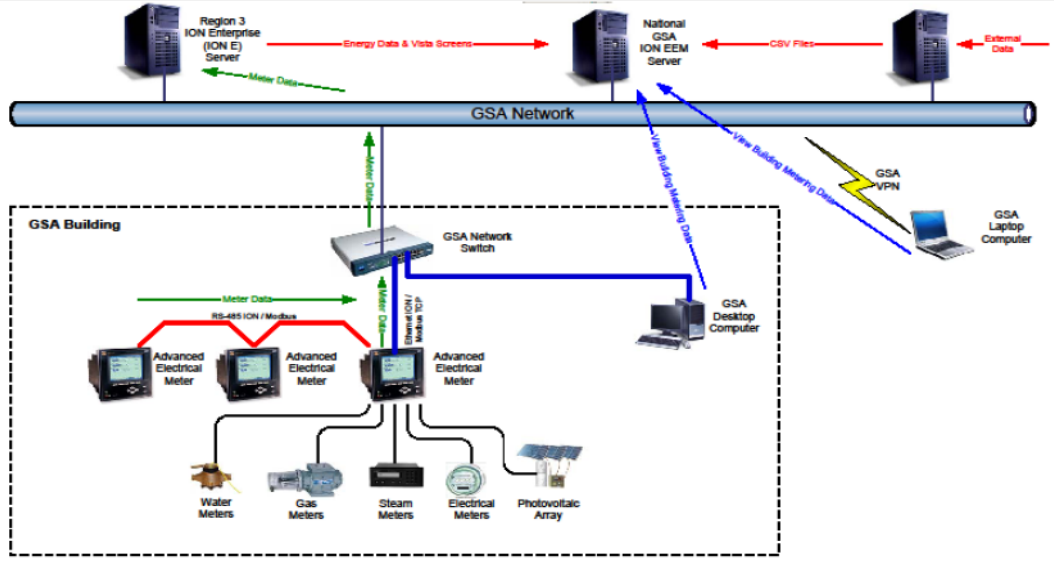
GSA Advanced Metering

What We Do with Big Data

- Diagnose Equipment and Systems Operations
- RETUNING
- Benchmark Utility Use

- ID Potential Projects
- ID Power Quality Problems
- Modelling (Advanced Users)
- On-Site Generation Monitoring



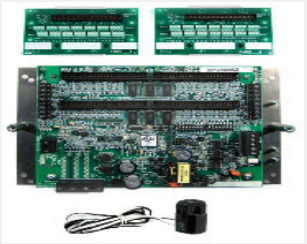
Interaction with Other GSA Programs:

- ION (Schneider)
- GSALink
- FirstFuel
- Shave Energy
- ENERGY STAR
- RWA Program
- GHG Reporting
- gBuild

GSA Proving Ground

Energy Management

- Evaluating Next-Gen Building Technologies in Real-World Operational Settings
- Recent Energy Management Technologies
  - Advanced Power Strips
    - *+16,000 Units Deployed at 80 Federal Facilities*
  - Wireless Sensor Networks
    - *Payback under Five Years in Data Centers*
  - Circuit Level Energy Monitoring
    - *Broad Deployment, Particularly Beneficial in Data Centers and Office Buildings with High Overtime Utility Usage*



Increased Occupancy and EUI

- 2017 PNNL Study to Explore Occupancy-EUI Correlation
  - GSA Headquarters Washington, DC (High Occupant Density)
  - Byron Rodgers Federal Building and Courthouse Denver, CO (Low Occupant Density)

	1800 F Street, DC	Byron Rogers, Denver
Density Increase	34% (2500->4000, w/41k SF added)	52% (457->957)
EUI Reduction	86.6 -> 69.1 (2015), (58.7 in FY16)	90 -> 39.6
Energy Savings Estimated from Efficiency Only	20-32%	56%
Energy Savings Estimated from Consolidation Only	60%	41%
Estimated O&M & Energy Cost Savings from Consolidation	$7.7 million	$2.7 million
Estimated Increased Energy Use from Additional Occupants	12%	7-11%
Ratio of Density Increase to Energy Increase	2.8:1	From 4.7:1 to 7:1

Pacific Northwest National Laboratory, 2017

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The Impact of High-Performance Buildings

- Comparative Analysis of 206 Federally-Owned, GSA-Managed Buildings; Controlled for Geography and Size
  - 103 Guiding Principles-Compliant Buildings
  - 103 “Legacy Stock” Buildings

- GSA’s High-Performance Buildings:
  - Use 19% Less Energy; 23% Less Water
  - Cost 16% Less to Operate
  - Reduce Landfill Waste by 18%
  - Increase Tenant Satisfaction by 2.5%

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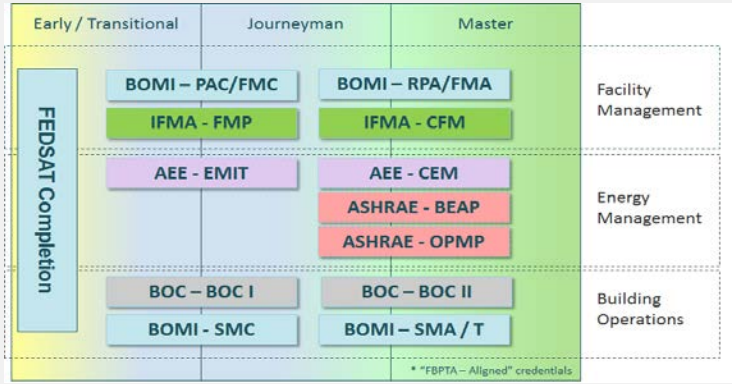
Federal Buildings Personnel Training Act

Address the Big Building Data Management Knowledge Gap

- Engagement, Time, and **Expertise** are Critical to Review Data and Act on it
- Ensure Building Operators have the Core Competencies, Curriculum, and Knowledge Network they need to Maximize Building Operation Efficiency
- Leverage the Expertise of Training Providers to Reduce Energy and Operating Costs by ~$2B Annually*



*Building Retuning Meta-Analysis - *Pacific Northwest National Labs - 2015*

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Resources

- Sub-Metering Wizard
  - Https://sftool.gov/plan/submetering
- Facilities Management Institute
  - Https://fmi.gov/
- GSA Proving Ground
  - Https://gsa.gov/gpg
- The Influence of Occupancy on Building Energy Use Intensity and the Utility of an Occupancy-Adjusted Performance Metric
  - Http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26019.pdf

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