EEMS HIGH LEVEL BENCHMARKING OF US MUNICIPAL AND FEDERAL PROGRAMS

FINAL DELIVERABLE

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Definitions:

Energy management software encompasses a wide variety of approaches and information technology systems. This page summarizes the different approaches in the marketplace.

Enterprise Energy Management System: EEMS systems provides a "system of record" of energy consumption and capabilities for in-depth analysis and management for enterprises. These systems aggregate and analyze energy data on an enterprise-wide basis; monitor, analyze, visualize, and benchmark energy consumption across operations; and track and manage energy consumption and emissions. In most cases, the data used in EEMS systems is derived from monthly utility billings, although most vendors are moving to accept real-time meter data.

Building Management Systems: A BMS is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. A BMS consists of software and hardware; the software program, usually configured in a hierarchical manner, is often proprietary, though vendors are also producing BMSs that integrate using Internet protocols and open standards. BMSs are primarily oriented around comfort (e.g., maintaining temperature and humidity set-points) and safety, not efficiency.

Definitions (page 2):

Bill Verification Systems: A BVS receives energy bills on behalf of a client directly from a utility, checks and verifies the bills, enters the data into the client's financial system.

Bill Process Outsourcing: BPO frees up in-house resources by allowing a service provider to manage the end-to-end bill processing function for all utility bills (electric, natural gas, water, sewer, propane, fuel oil, telephone, etc.). All BPO services should track basic bill details and check for financial errors. More advanced BPO services also track advanced bill details from any utility bill, check for errors, spot malfunctioning meters, find meter read errors, etc. These services measure and verify energy savings from energy conservation efforts; normalize consumption for changes in weather; and calculate and evaluate the carbon footprint from the energy building's consume. In most cases, the BPO service provider will manage the data download from the utility. These services tend not to track other consumptions such as vehicle fuel.

EPA Portfolio Manager: Portfolio Manager is an interactive energy management tool that allows you to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment. Whether you own, manage, or hold properties for investment, Portfolio Manager can help entity set investment priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance. Portfolio Manager is free of charge.

Process for Benchmarking Analysis:

- Review of publically available information.
- Review of market research reports (non public)
- One-on-one in-depth interviews with:
  - 6 Cities: Tulsa (OK), Las Vegas (NV), Philadelphia (PA), San Jose (CA), San Francisco (CA), Palo Alto (CA)
  - Counties of Santa Clara (CA) and San Mateo (CA)
  - Federal Agencies: General Services Administration, Department of Defense
- Outreach to vendors on case studies examples: C3, Hara, Energycap, CASoftware, SAP, Enablon, JCI, Siemens, Global Carbon Systems, Levementum, Tangible Software.

Key questions:

- Which municipal and federal facilities have implemented an EEMS?
- What level of energy savings have been achieved?
- What key lessons have been learned from those implementations?
- What technical challenges or difficulties have occurred during those implementations?
- What are the best practices of municipalities and Federal agencies in planning for and implementing an EEMS?

Which municipal and federal facilities have implemented an EEMS?

- Philadelphia (PA) implemented in 2009.
- Tulsa (OK) – Implemented in 2010 a Hara SaaS application
- Las Vegas (NV) implemented in 2009
- Palo Alto (CA) – implemented in 2009
- San Jose (CA) implemented pilot in 2009, but cancelled program in 2010 due to budget constraints.
- San Francisco (CA) implemented in 2010
- Counties of Santa Clara (CA) and San Mateo (CA) are currently implementing systems
- Federal Agencies: General Services Administration (prospectively), Department of Defense

Summary Overview of Implementation

Client	EEMS Product	SaaS – External Cloud	Supporting Software	Implementation Duration	FTE's in Implementation/On going (Staff)	Comments
Philadelphia	Hara	Yes	Stark – BVO Excel – Graphics and Reporting	6 months	5/1.2 Mayors Office of Sustainability	Next focus on EDI for data input
Tulsa	Hara	Yes	None	5 months - Top 200 Accounts	3/0.5 Implementation: External non-vendor consultants On-going: Mayor's Project Office	Used to identify and verify savings
Las Vegas	Hara	Yes	TriStem - BVO Excel – Data input management	12 months – lost key analyst	2/0.4 City Sustainability Office	Data input huge challenge – insufficient staff
Palo Alto	Hara	Yes	SAP - BVO Excel - Report preparation and Graphics	6 months including 5 years historic data	7/1.5 Implementation: Reps from all Depts. On-going: Mayors Office of Sustainability, Finance Dept, Public Works and IT Dept.	Historic data input at start created additional pressures

Summary Overview of Implementation (Cont'd)

	EEMS Product	SaaS – External Cloud	Supporting Software	Implementation Duration	FTE's in Implementation/ on-going	Comments
San Mateo/Santa Clara	Hara	Yes	None	18 months total, 8 Cities first 9 months, 10 Cities second 9 months	1 FTE per City Implementation and on-going: City and County staff in offices of Sustainability or Mayors Office	Multi jurisdictional, multi-year, combined with Climate Action Plans of each entity.
GSA	N/A	N/A	Complementary to MS Windows	Contract 1 yrs FFP, +1 option yr	N/A	
DOD	Tangible	No	Client software	16 months implement pilot; plus 12 months ops	N/A	Commercial Consulting for operations/DOD personnel for operations

Case Study #1 – Philadelphia, Pa

1500 Utility Accounts – electricity, natural gas, steam, water
Energy Budget: $80 million

- What level of energy savings have been achieved?
  - Energy savings have resulted from the process of taking the bills and putting them in system and looking across time.
  - $160,000 in net savings from utility billing errors.
  - $60,000 net water savings
  - Consumption reduction not summed for city
- What key lessons have been learned from those implementations?
  - Transparency has dramatic governance and process impacts.
  - Identify key user needs and develop small set of reports which are created monthly.
  - Track savings and investments at the facility, Departmental and Fund levels and by granting facility
  - Advanced system analytics are often complex – it may be easier to filter data and move into MS Excel workbook to generate automatic reports.

Case Study #1 – Philadelphia, Pa
(Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - System was unable to deal with weather (HDD) to normalize results
  - Few Departments able to use and generate reports on ad hoc basis
  - Bill processing – vetting data to put into system highlighted errors but bill processing itself a challenge
  - Couldn't breakdown charges – demand charges, distribution charges, etc.
- What are the best practices of municipalities in planning for and implementing an EEMS?
  - Manual data import must be avoided – work with utility to ensure automated data flow.
  - Limit reporting super users to a few– those from the largest energy consuming departments – these users issue reports to senior management.
  - Ensure that energy savings remain within Department in order to create organizational incentives.

Case Study #2 – Tulsa, OK

1100 Utility Accounts – Electricity, gas, water, liquid fuels, steam
Energy Budget $10 million

- What level of energy savings have been achieved?
  - Energy savings have resulted from the process of taking the bills and putting them in system and looking across time.
  - Consumption reduction not summed for City – focus has been on base lining.
- What key lessons have been learned from those implementations?
  - System much more capable that users – employ KISS principals
  - Don't include ALL meters, focus on 100-200 largest users (95% of energy use)
  - Work with utility providers up front – understand their actual automated data capabilities – not just what they say they can do.
  - Insist on on-going training from either consultant or vendor.
  - Ensure training meets real needs – not sophisticated "cool stuff" vendor offers.
  - IT departments must be involved – energy managers can't always understand technical capabilities.
  - Develop process for consistent data entry – else results will be arbitrary.

Case Study #2 – Tulsa, OK
(Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - Gas and Electric utilities overpromised ability to provide accurate electronic bill data.
  - Utilities billing data had significant errors, and considerable time required by City to sort out errors.
  - Energy is cheap in OK (Electricity = $.06 / KWH) which reduces any incentive of government to conserve.
- What are the best practices of municipalities in planning for and implementing an EEMS?
  - Reach out to utility providers, ascertain their ability to provide regular electronic data. Test their deliverable promises.
  - Ensure that roles and responsibilities within City government for data provision, analysis and presentation are clear and unambiguous.
  - Develop realistic training program involving IT departments, software vendor and consultants (if used). Focus on developing practical reports, not complex capabilities.
  - Plan for more resources used in the beginning to help track down data, verify accuracy and develop initial templates.

Case Study #3 – Palo Alto, CA

600 Utility Accounts + 600 Vehicle Accounts – Electricity, natural gas, water, waste, paper, vehicle fuels + Community Emissions
Energy Budget $5 million

- What level of energy savings have been achieved?
  - 10% savings on total energy spend in 2010 or roughly $580,000 (goal of 5% savings)
  - 27% energy savings in 2012 (goal of 20%)
  - 15% reductions in Community Greenhouse Gas Emissions
- What key lessons have been learned from those implementations?
  - Obtain senior level (Mayor or City Manager) support for implementation and the governance impacts. Ensure senior officials speak publically in support of project.
  - Work internally with IT and Finance staff to ensure bill payment and verification processes are consistent with capabilities of chosen system.
  - Map each meter to physical address, Departmental responsibility and ERP asset identifier (i.e. SAP or Peoplesoft) to fix all billing and allocation errors up front.
  - Regular reports to Council promote engagement at all levels
  - Government can link operational efficiency and Community policy goals (i.e. emissions) to maximize impact.
  - Utilize cross functional team of all departments reporting back to senior manager in charge of implementation to ensure broadest stakeholder engagement.

Case Study #3 – Palo Alto, CA
(Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - Staff did not foresee the governance changes of system implementation. The system requires non-siloed approaches and reporting and the resulting transparency provides opportunities for new processes, roles and responsibilities.
  - Data came from multiple systems – Utility provider, City IT Department, Purchasing Manager and Fleet Manager. One senior staff member has to take the responsibility of ensuring all departments input data correctly and on time. This person must fully comprehend the data issues and also be able to enforce timely updates by data providers.
  - Putting every meter and every vehicle in system for 5 years as baseline intensified initial startup phase without meaningful increase in insight.
- What are the best practices of municipalities in planning for and implementing an EEMS?
  - Departments must be responsible for their own energy use, data input and be prepared for transparency.
  - Ensure that energy savings remain within Department in order to create organizational incentives. If incentives are absorbed into overall budget incentives are lost.
  - Consider EEMS a long-term process improvement – not short term.

Case Study #4 – Las Vegas, NV

5000 Utility Accounts + Vehicle Accounts – Electricity, natural gas, water, vehicle fuels. Energy Budget: $15 million

- What level of energy savings have been achieved?
  - Savings on total energy spend in 2012 were net $1.5 million
  - Savings on total energy spend in 2011 were net $1.0 million

- What key lessons have been learned from those implementations?
  - Implement key performance indicies for all departmental
  - Use the system to support economic arguments, within the community and with the City organization for long-term buy-in.
  - Use single point of responsibility to drive system implementation with support from stakeholders.
  - After implementation drive responsibility and reporting down to department levels.

Case Study #4 – Las Vegas, NV
(Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - Overly broad initial implementation – too many accounts overwhelmed limited City staff.
  - When key members of staff left, the City was not able to effectively use system.
  - Insufficient focus on primary energy consumptions.
- What are the best practices of municipalities in planning for and implementing an EEMS?
  - Implement key performance indicies for all departmental managers to ensure adoption
  - Maximize cross departmental transparency in energy use – set up competitive environment.
  - Establish a communications and rewards strategy to maintain momentum.
  - Departments must be given responsibility for imputing and maintaining accurate data, even if utility is source, and reporting data.
  - Departments and facility managers must also be given the responsibility for meeting reduction targets since they have the ability to impact results through efficiency measures.

Case Study #5 – San Mateo/Santa Clara Counties

5,000 Accounts + Community
Total Energy Budget: Approx $30 million

- What level of energy savings have been achieved?
  - Just beginning baseline with focus on Climate Action Plans
  - Goals of zero% growth in 2020 and 80% reduction in 2050-.
- What key lessons have been learned from those implementations?
  - Focus on driving EEMS system approach from Cities, through Counties and ultimately to State Level.
  - Systems too sophisticated for answers government requires – focus on key energy users, especially in initial stages.
  - Aggregate together small energy users, such as streetlights into one amalgamated data point per month.
  - Start with top 100 energy users, implement in Year 1. Move to next 100 in Year 2.

Case Study #5 – San Mateo/Santa Clara County
(Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - Monthly data upload through EDI very much error prone from utility sources.
  - Middle layer of data verification of utilities data required for accuracy.
  - Utilities often have multiple systems themselves and sometimes have difficulties in meeting data needs.
- What are the best practices of municipalities in planning for and implementing an EEMS?
  - Upload data through EDI or other electronic format 3 months after initial bill posting ensures data verification since most errors would be corrected by then.
  - Maintain close contact with utility to encourage responsiveness. Forging EMS with other communities or at State level puts greater pressure on utilities to cooperate.

Case Study #6 – GSA – Smart Building Procurement
(Scheduled award May, 2012)
Federal "landlord," 9,213 buildings, multi-tenant agencies – Electricity, natural gas, water, waste, paper, vehicle fuels.

- What are the objectives of the Enterprise Energy Management System (EEMS) acquisition?
  - Improve energy efficiency, operational effectiveness, reduce energy cost and improve occupant satisfaction.
  - Provide transparency of energy consumption and spend at the building, regional and enterprise level
  - Eliminate overlapping controls that have built-up over the years
- What key lessons have been learned from their acquisition strategy?
  - Government ownership of the intellectual property for EEMS solutions developed by commercial firms may limit competition.
  - Carefully plan the phasing-in of buildings to allow sufficient time to address legacy building management systems.
  - Scope work effort to be realistic and allow for lessons learned to be leveraged when scaling .

Case Study #6 – GSA
(Cont. pg 2)

- What technical challenges are required by this procurement?
  - Establish an infrastructure that requires a centralized product and management configuration at the enterprise level while permitting decentralized control and operational capability at the local building level.
  - Mapping and normalizing data points for a minimum of 1,000 points per building and polling frequency for data collection every 5 minutes.
  - Identify patterns that traditional building management systems often overlook, notify stakeholders, and correct issues in building mechanical and control systems automatically.
- What are the best practices reflected in requirements for an EEMS?
  - Provide flexibility to propose solutions data center-based or Cloud delivery.
  - Require open protocols and common industry communication drivers (e.g, BACnet and LonTalk).
  - Maximize stakeholder involvement, communications and Executive Sponsor support.

Case Study #7 – Department of Defense

High energy user of refrigeration, 270 locations globally – 2012 pilot results for 4 locations extrapolated across the enterprise.

- What level of energy savings have been achieved?
  - Annual utility bill average $250,000, leveraged savings of $3.3 million across enterprise for minimum 3 percent energy reduction realized.
  - Elimination of manual data collection for information required by FDA (10 hrs per wk per facility), leveraged savings $3.5 million and 67 FTE across the enterprise.
  - Reduced maintenance for service calls, leveraged savings $101,000 across the enterprise.
  - Elimination of alarm monitoring, leveraged cost avoidance $100,000 across the enterprise
- What key lessons have been learned from those implementations?
  - Need top organizational commitment with an Executive Sponsor.
  - Provide mechanism to enforce policy across the entire organization.
  - IT /Energy/Facility management must collaborate to be successful.
  - Identify systems and devices not worth integrating into an enterprise energy management systems.

Case Study #7 – Department of Defense (Cont. pg 2)

- What technical challenges or difficulties have occurred during those implementations?
  - Integrating disparate and aging systems that lacked documentation into one energy platform with 2-way communication and managed from a remote location.
  - Provide security that meets DOD requirements for secure access down to the device level effectively.
  - Optimizing analytics to reduce operating cost by reducing dependence on a third party maintenance organization
- What are the best practices in planning for and implementing an EEMS?
  - Establish a baseline of energy consumption to validate improvements in performance, ROI, and stakeholder/management support.
  - Use EEMS (and not point solutions) to determine best and worst performing assets to maximize limited resources.
  - Use transparency, eg, dashboards and kiosks, and other incentives to affect cultural change within the organization in support of energy efficiency.

Interview List:

Kristin Sullivan, City of Philadelphia
Brett Fidler, City of Tulsa
Debra van Duynhoven, City of Palo Alto
Kara Goss, Joint Venture Silicon Valley
Julie Benebente, City of San Jose,
Kathleen Hannon, City of San Francisco
Demetrie McBride, County of Santa Clara
Kim Springer, County of San Mateo
Tom Perrigo, City of Las Vegas
Phil Klokis, General Services Administration
Anonymous, Department of Defense

* *Report does not necessarily reflect the views or opinions of the listed sources.*

APPENDIX

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