CITY OF BOSTON ENERGY FORUM

City of Boston
- Christine Dennehy, Project Manager
- Todd Isherwood, Energy Manager
- Joseph LaRusso, Finance Manager

Hewlett-Packard
- Bill Kosik
- John Peterson
- Munther Salim

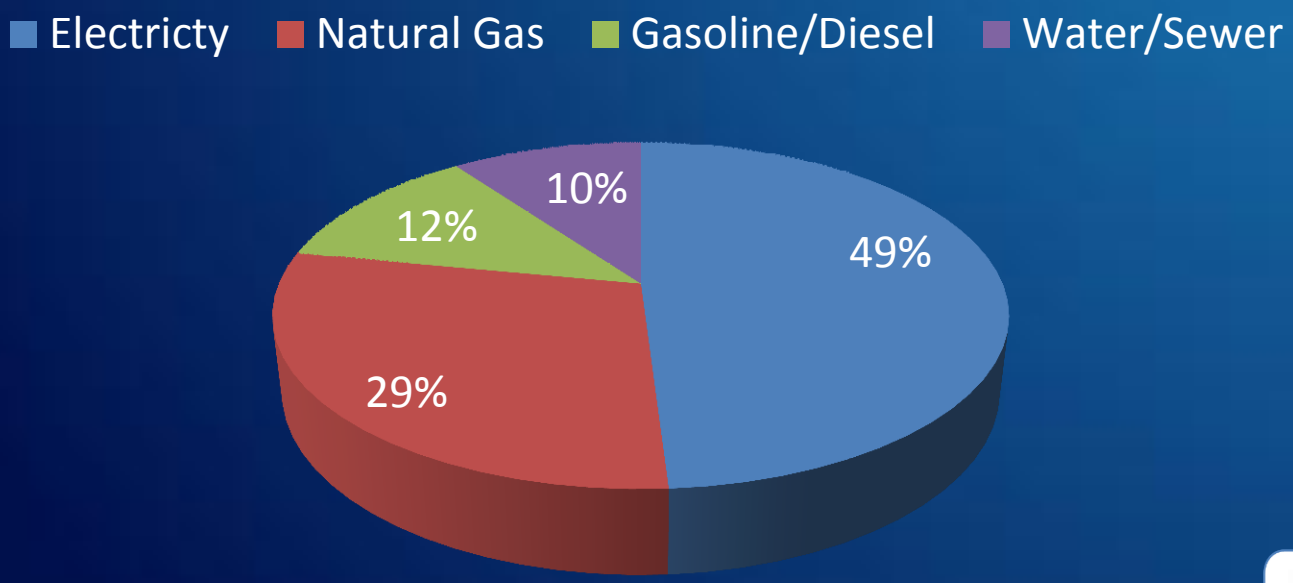
August 23, 2012

Enterprise Energy Management System (EEMS) Strategic Assessment Energy Forum Overview

- Welcome City of Boston Energy Stakeholders
- Overview
- Introductions
- Energy Forum Agenda

Fact:

The City budgeted $55 million for energy in fiscal year 2013



EEMS Strategic Assessment
Energy Forum Overview

Goal: Evaluate how the City consumes energy, what that consumption costs, and how Information Technology can lower the City's energy costs and greenhouse gas emissions.

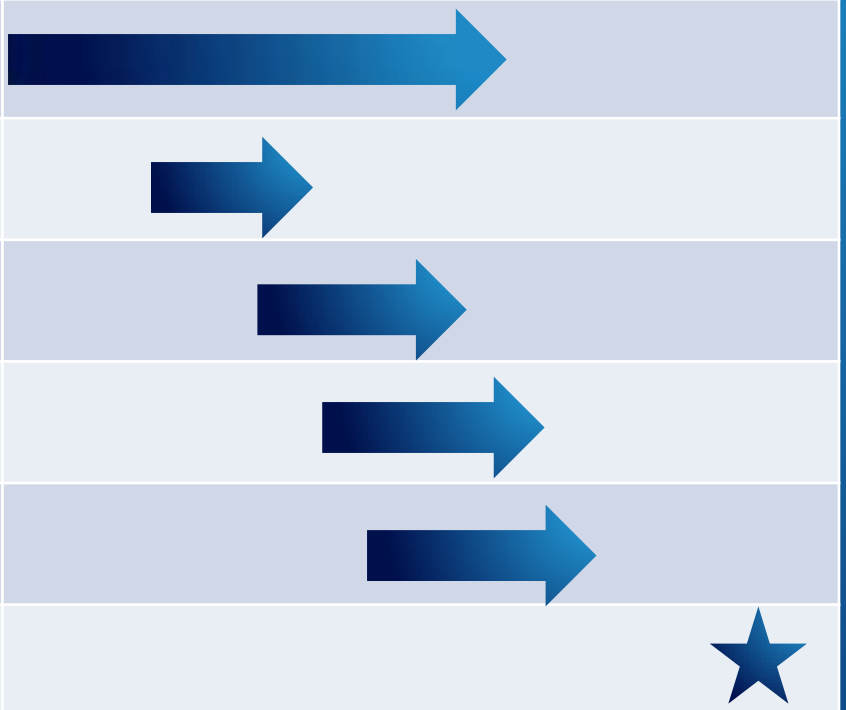
EEMS Strategic Assessment
Energy Forum Overview (cont.)

Approach:

- Conduct an energy review of up to 50 City owned buildings.
- Review other leading city and federal government implementations of EEMS and assess the costs and benefits of those systems.
- Assess technology requirements and develop a business case for a "system of record" to consolidate and manage the City's energy consumption and costs.
- Assess EEMS capabilities around data collection, analysis, management and reporting through standard energy reporting protocols.

EEMS Strategic Assessment
Project Activities and Schedule

Project Activity	Approximate Duration	Schedule April May June July Aug
Energy Consumption Analysis	3 months	
Benchmarking Analysis	3 weeks	
Market Assessment	3 weeks	
Business Case	3 weeks	
Functional Needs Assessment	1 month	
Energy Forum	1 day	



EEMS Strategic Assessment
Executive Leadership

Name	Affiliation	Contact Information
Brian Swett	Chief of Environment & Energy	**Brian.Swett@cityofboston.gov**
Meredith Weenick	Chief Financial Officer and Collector-Treasurer	**Meredith.Weenick@cityofboston.gov**
Bill Oates	Chief Information Officer	**William.Oates@cityofboston.gov**

EEMS Strategic Assessment Project Team

Name	Affiliation	Contact Information
Christine Dennehy	City of Boston – Project Manager	Christine.Dennehy@cityofboston.gov 617.635.0711
Todd Isherwood	City of Boston – Energy Project Manager	Todd.isherwood@cityofboston.gov 617.635.2518
Joseph LaRusso	City of Boston – Energy Finance Manager	Joseph.LaRusso@cityofboston.gov 617.635.3853
Margaret Muse	HP – Project Manager	Margaret.Muse@hp.com 916.932.6802
John Peterson	HP – Energy Analyst	jpeterson@hp.com 202.731.5835
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Munther Salim	HP – Global Energy and Sustainability Leader	msalim@hp.com 312.909.0028

Energy Forum Agenda

Executive Leadership Energy Forum Kickoff

Energy Management Unit Project Overview

EEMS Strategic Assessment Presentation

- High Level Assessment of Energy Consumption
- High Level Benchmarking of US Municipal/Federal Programs

10 Minute Break

- Market Assessments of EEMS Systems and Capabilities
- High Level Business Case for an EEMS System
- Functional Requirements Document

Next Steps

Q&A

EEMS Energy Forum
Executive Leadership Kickoff

- Brian Swett, Chief of Environment & Energy
- Meredith Weenick, Chief Financial Officer and Collector-Treasurer
- Bill Oates, Chief Information Officer

Environmental & Energy Services

Brian Swett
Chief of Environment & Energy

- Proven in the private sector
- Makes your job easier
- Building Level Prioritization
- Mayor's 2007 Executive Order on Climate
- Climate Action Plan
- Energy Disclosure Ordinance
- Energy Management Unit

Administration & Finance

Meredith Weenick
Chief Financial Officer and Collector-Treasurer

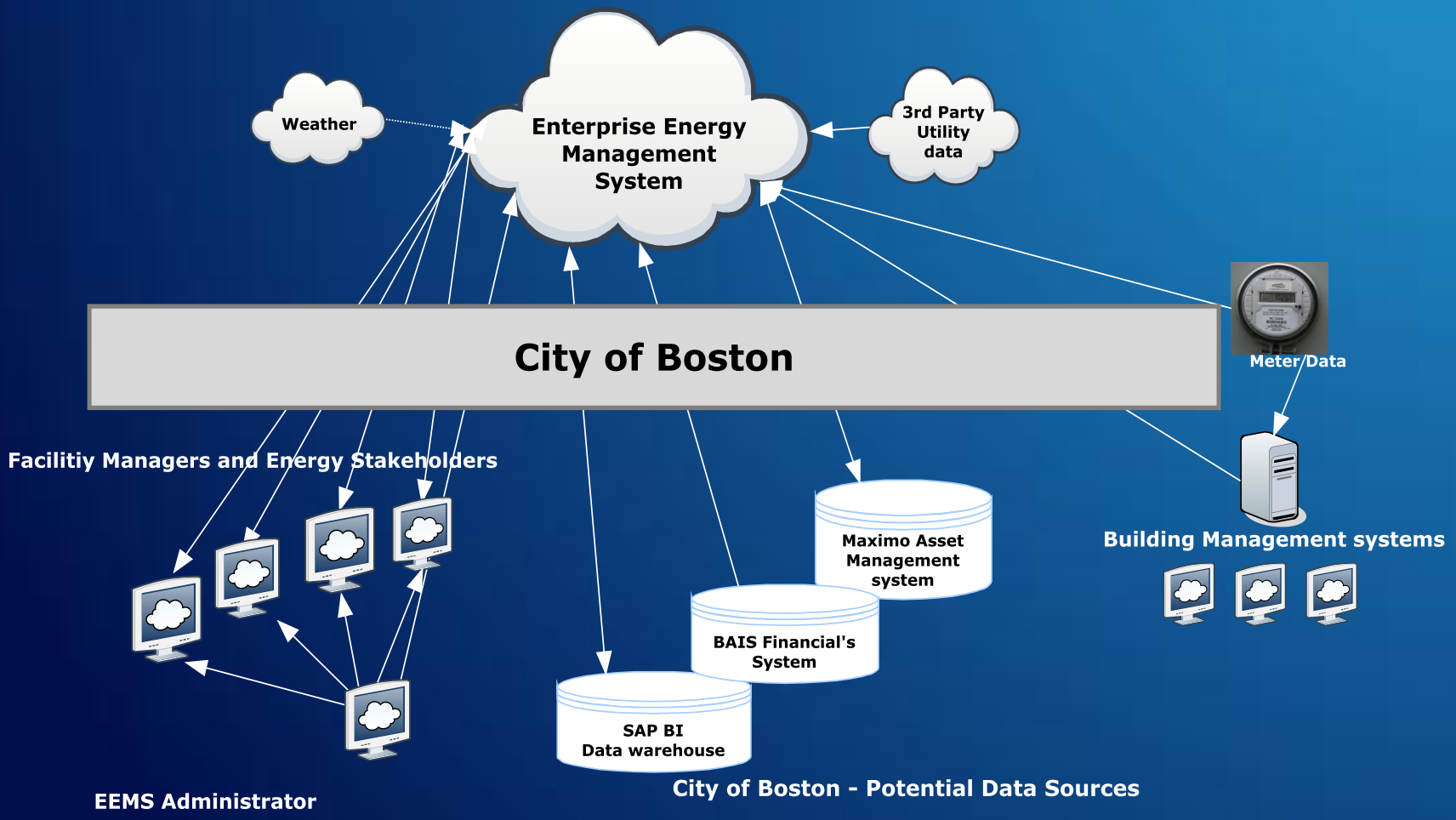
- An EEMS will help the City to maintain its high standards for financial and operational management.
- An EEMS will help to verify and validate the City's energy consumption and utility billing.
- An EEMS will complement the IT resources the City already has at its disposal, like the BAIS financial system, that are necessary to manage and maintain the City's $2.5 billion budget.

Dept. of Innovation & Technology

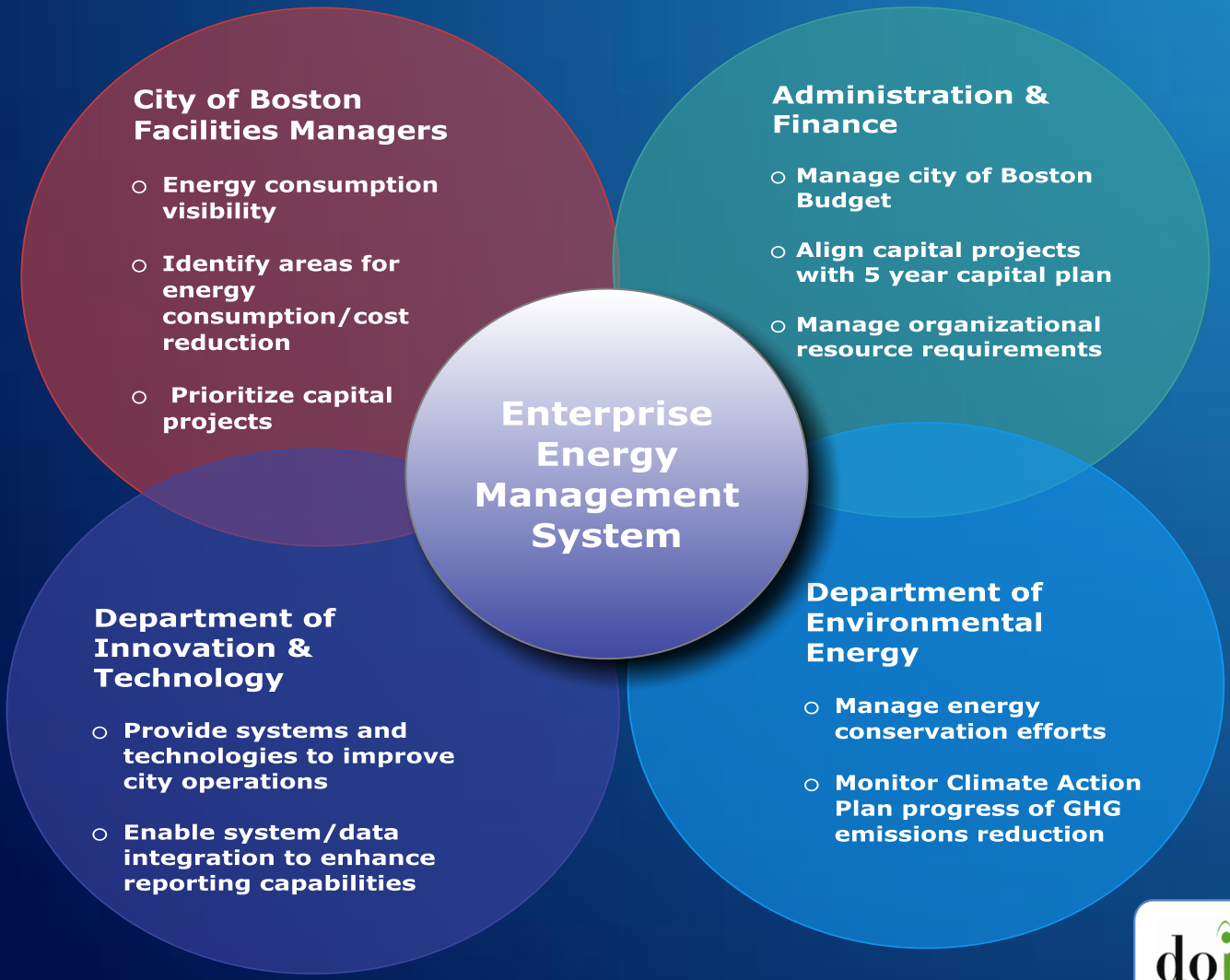
Bill Oates
Chief Information Officer

- EEMS aligns with DoIT's mission of providing technology to improve operations and to support strategic planning efforts.
- Economies of Scale – aligning IT strategy with enterprise-wide strategy.

EEMS Enterprise View



EEMS Enterprise View (cont.)



Energy Management Unit

Joe LaRusso
Energy Efficiency & Renewable Energy Finance Manager

- Energy Savings = Financial Savings
- Saving energy supports the delivery of services
- The City is obligated to maximize utility incentive payments
- An EEMS will help the City maximize energy savings
- An EEMS will allow the City to hold the line on energy consumption

Energy Management Unit

Todd Isherwood
Energy Efficiency & Alternative Energy Project Manager

- Finding energy efficiency opportunities
- Working with budget & finance and utilities
- Implementing projects under MGL chapter 25A
- Developing and energy strategy
- Enterprise energy management system

Question:

How much did the City budget for energy in fiscal year 2013?

$55 million

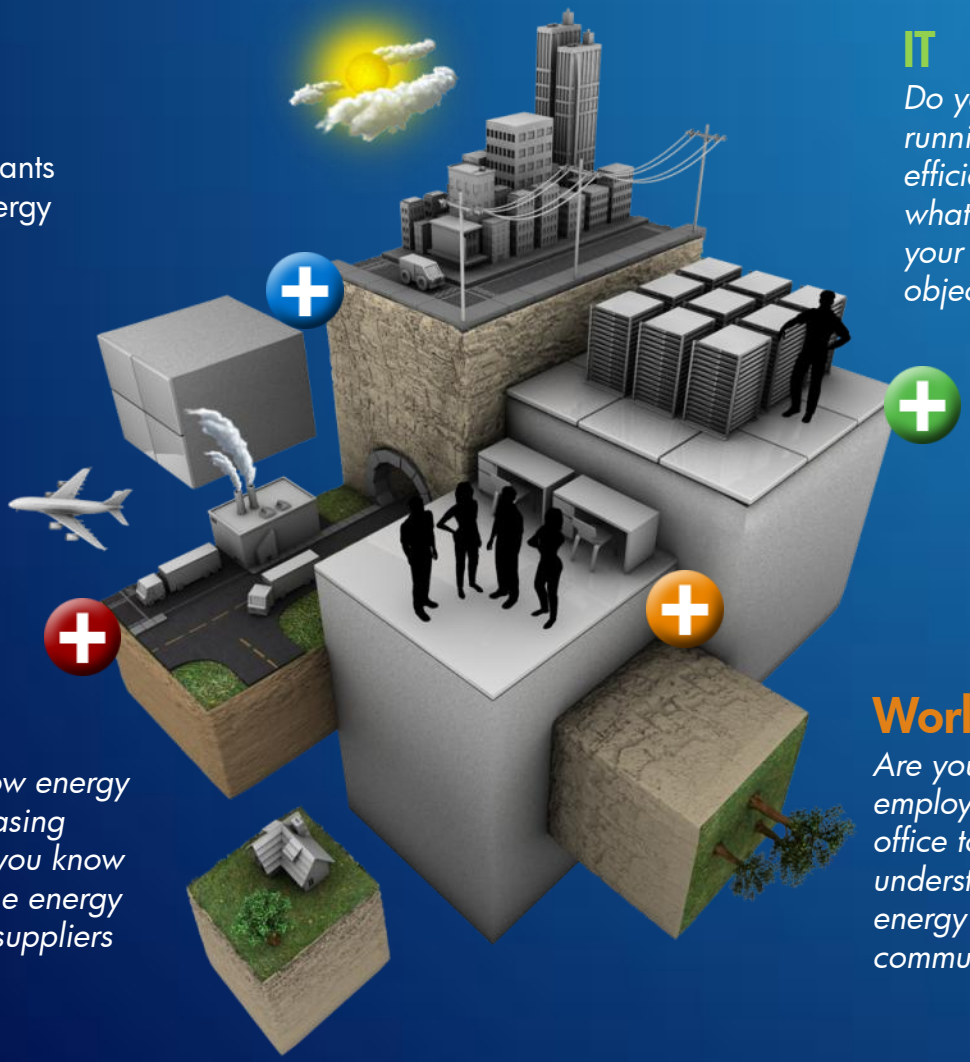
Energy is everywhere…

…but hidden from view

Plant

Wastewater treatment plants can use over 50% of energy consumed by some municipalities.

How does your footprint compare?



IT

Do you know if your IT is running at maximum energy efficiency? Do you know to what degree it is supporting your corporate energy objectives?

Purchasing

Have you considered how energy costs impact your purchasing choices and costs? Do you know the risk you bear from the energy cost embedded in your suppliers and logistics?

Workforce

Are you empowering your employees in the plant and in the office to save energy? Do you understand and can you control the energy impact of travel, commuting, and communication?

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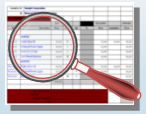
Goals of Energy Forum

1. To define “Enterprise Energy Management System” (EEMS)
2. To summarize the City’s Strategic Assessment of EEMSs
3. To review EEMS Strategic Assessment deliverables

Project Process & Deliverables

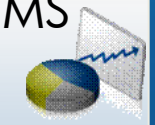
EEMS Strategic Assessment

- High Level Assessment of Energy Consumption



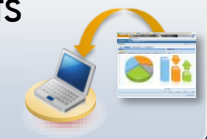
- High Level Benchmarking of US Municipal/Federal Programs

- Market Assessments of EEMS Systems and Capabilities



- High Level Business Case for an EEMS System

- Functional Requirements Document



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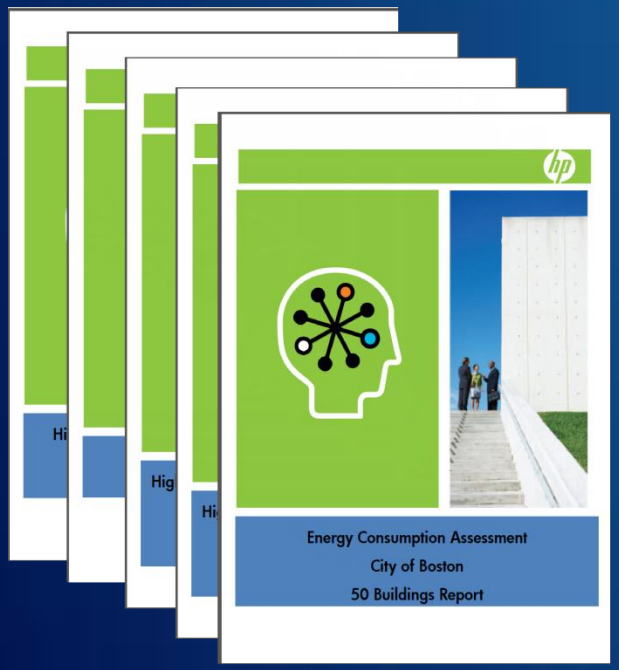
Project Process & Deliverables (cont.)



Detailed reports and summary documents are available at:

http://www.cityofboston.gov/environment/EEMS.asp

High Level Assessment of Energy Consumption

"You can't manage what you don't measure."

High Level Assessment of Energy Consumption

- Performed a rapid and high level assessment of the complex and diverse nature of energy use across the City's operations
- Compiled data to develop a baseline to analyze the applicability of various EEMSs to the City's needs
- Used available meter data provided either by the City or its utility providers

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Facts:

The City used 171 million kWh in 2011.

City Hall used 13.7 million kWh in 2011.

The average single-family home in Massachusetts uses 6,000 kWh per year.

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Assessment of City Buildings

- Selected 50 buildings with the highest energy cost to the City in fiscal year 2011
- The data was based on a monthly billing cycle
- Electricity, natural gas, steam and water consumption were reviewed

Data sources

- City of Boston
- Mass Energy Insight – utility billing and use
- City Personnel – building information
- National Grid – natural gas
- NSTAR – electricity

50 City of Boston Buildings

4 Building Categories

Administration . . . . . (8 buildings)
Public Safety . . . . . (5 buildings)
Library . . . . . (2 buildings)
Schools . . . . . (35 buildings)

Building Assessment and Benchmarking

Benchmarking provides a general magnitude of the opportunities available toward improving performance

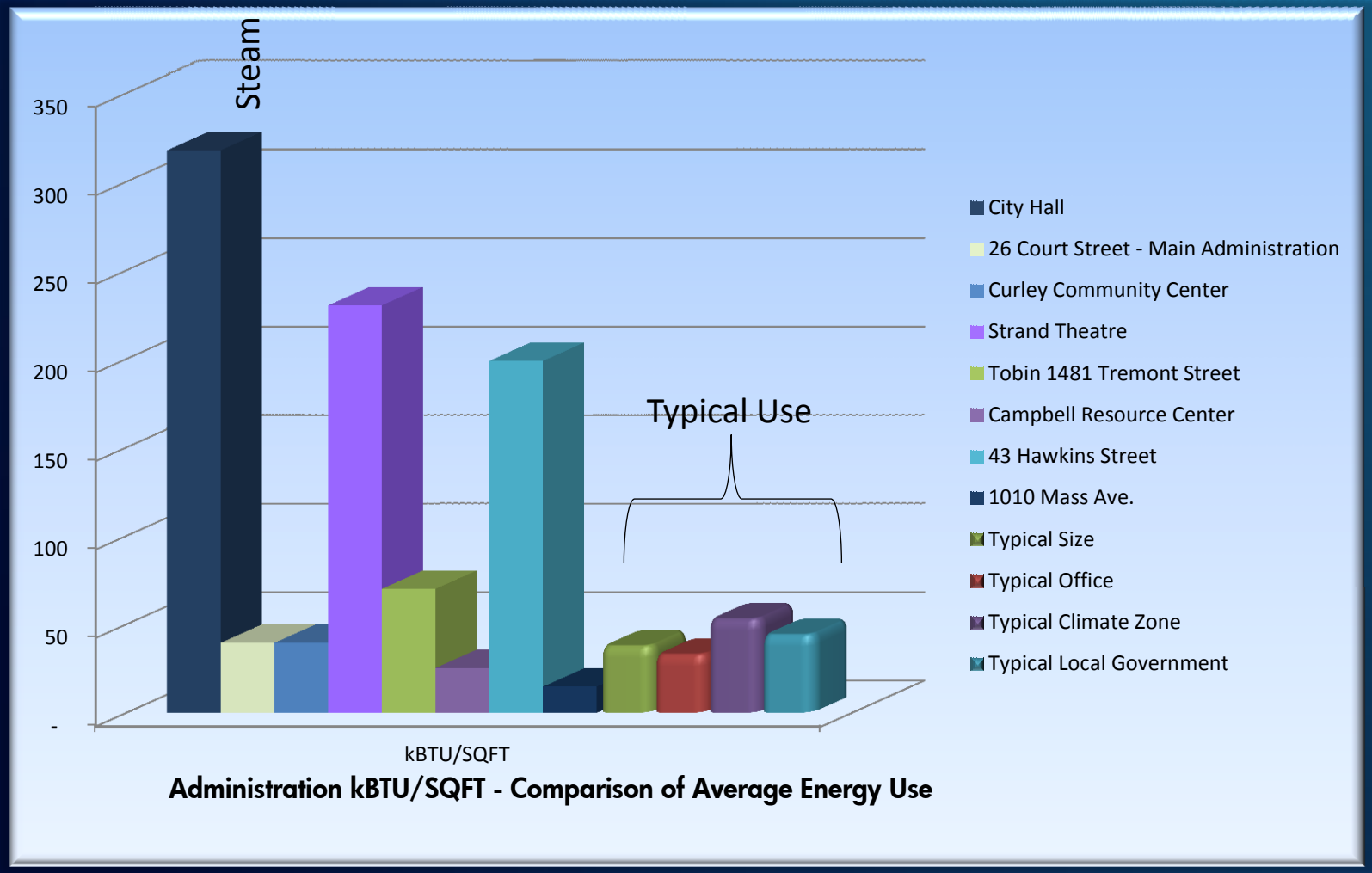
Benchmarking Data Sources - National Averages

- Consumer Buildings Energy Consumption Survey (CBECS) – comparisons for benchmarking buildings
- Building Owners and Managers Association (BOMA) – building energy consumption source

The 50 City buildings reviewed according to 4 criteria:

- Size (square feet)
- Primary building activity
- Climate zone – Northeast
- Other government buildings – Local Government

Department Energy Consumption Assessment

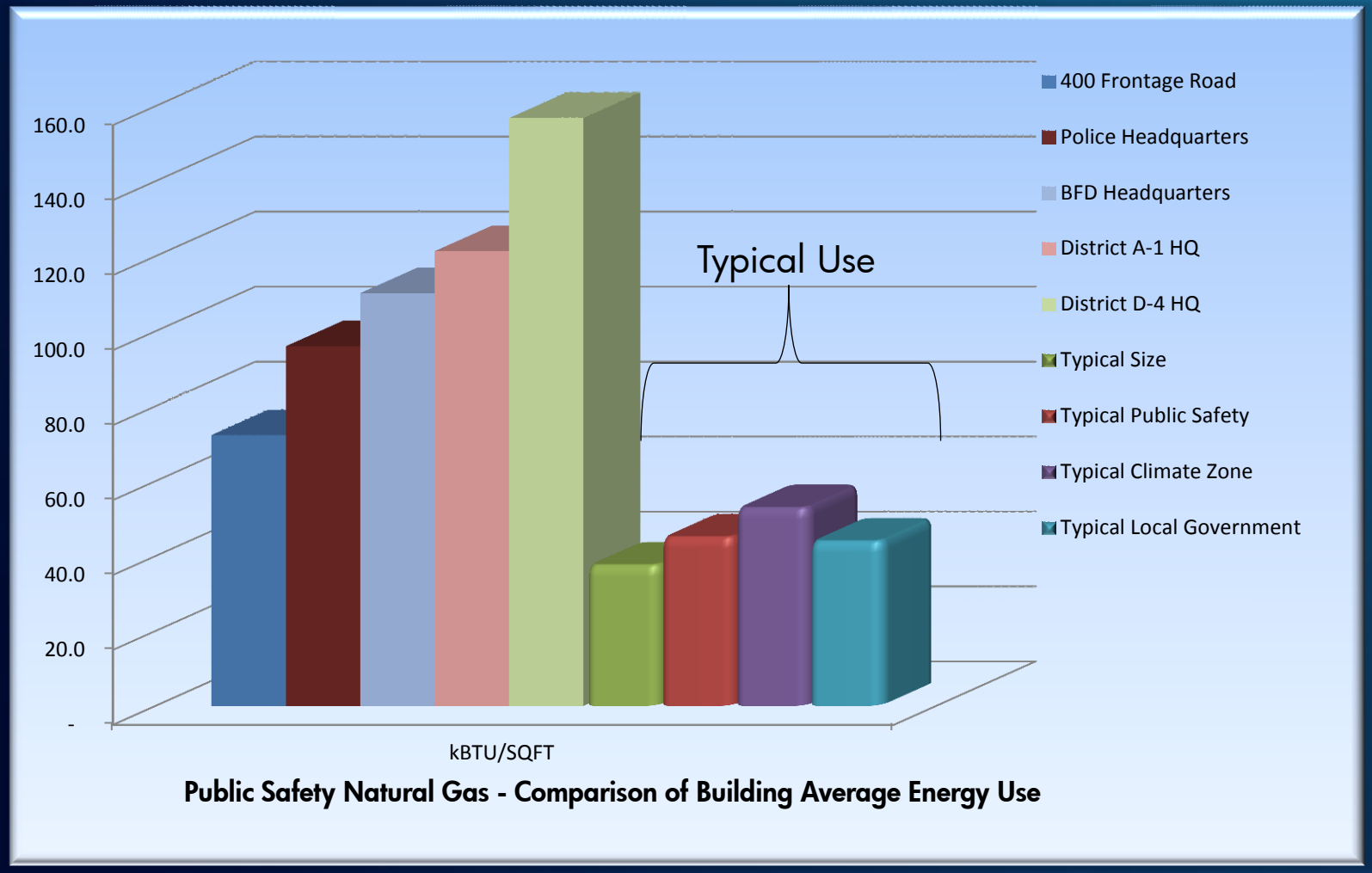


Administration kBTU/SQFT - Comparison of Average Energy Use

Administration – Steam and Natural Gas Use

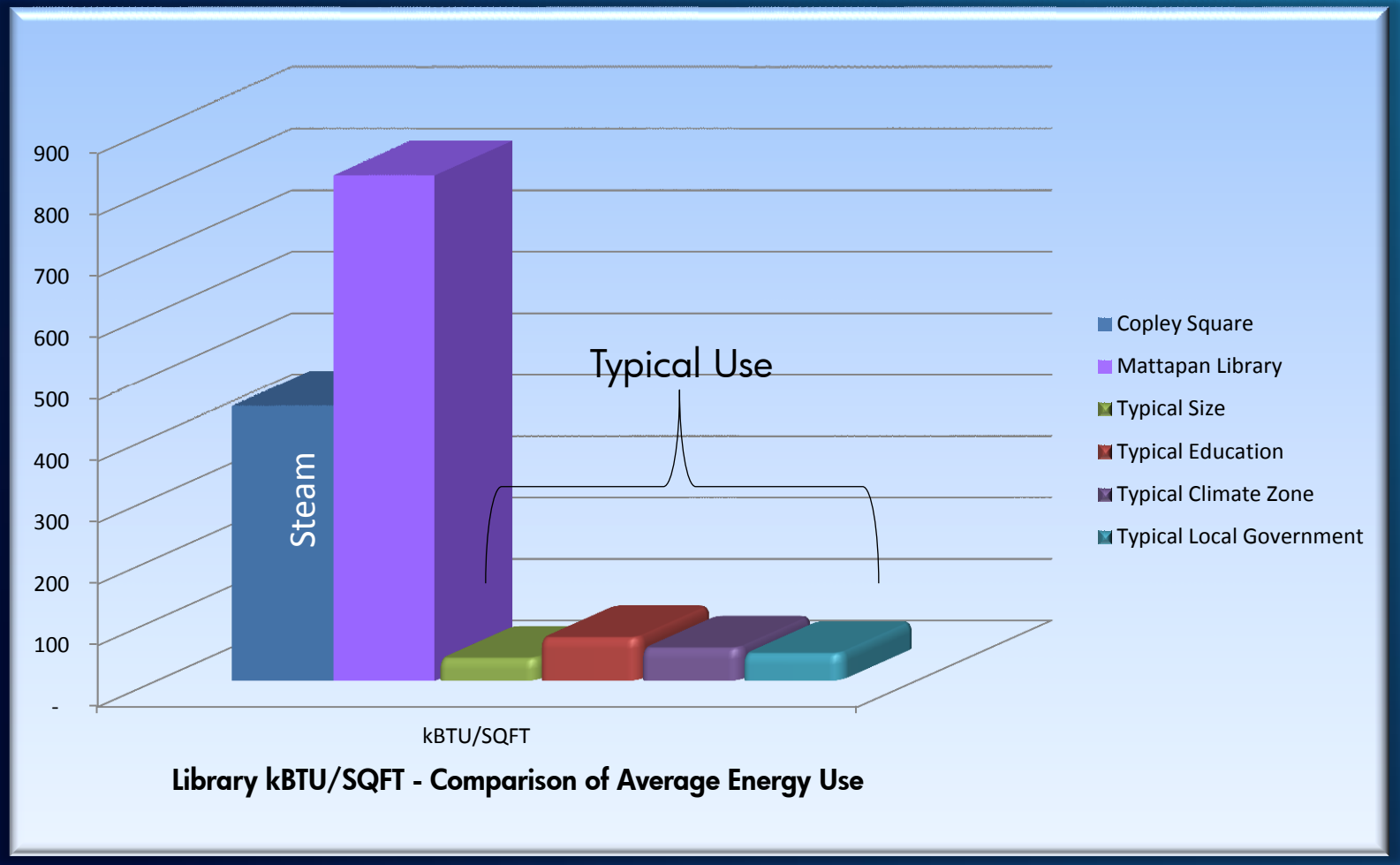
Note: For brevity, only steam and natural gas consumption is depicted

Department Energy Consumption Assessment



Public Safety – Natural Gas Use

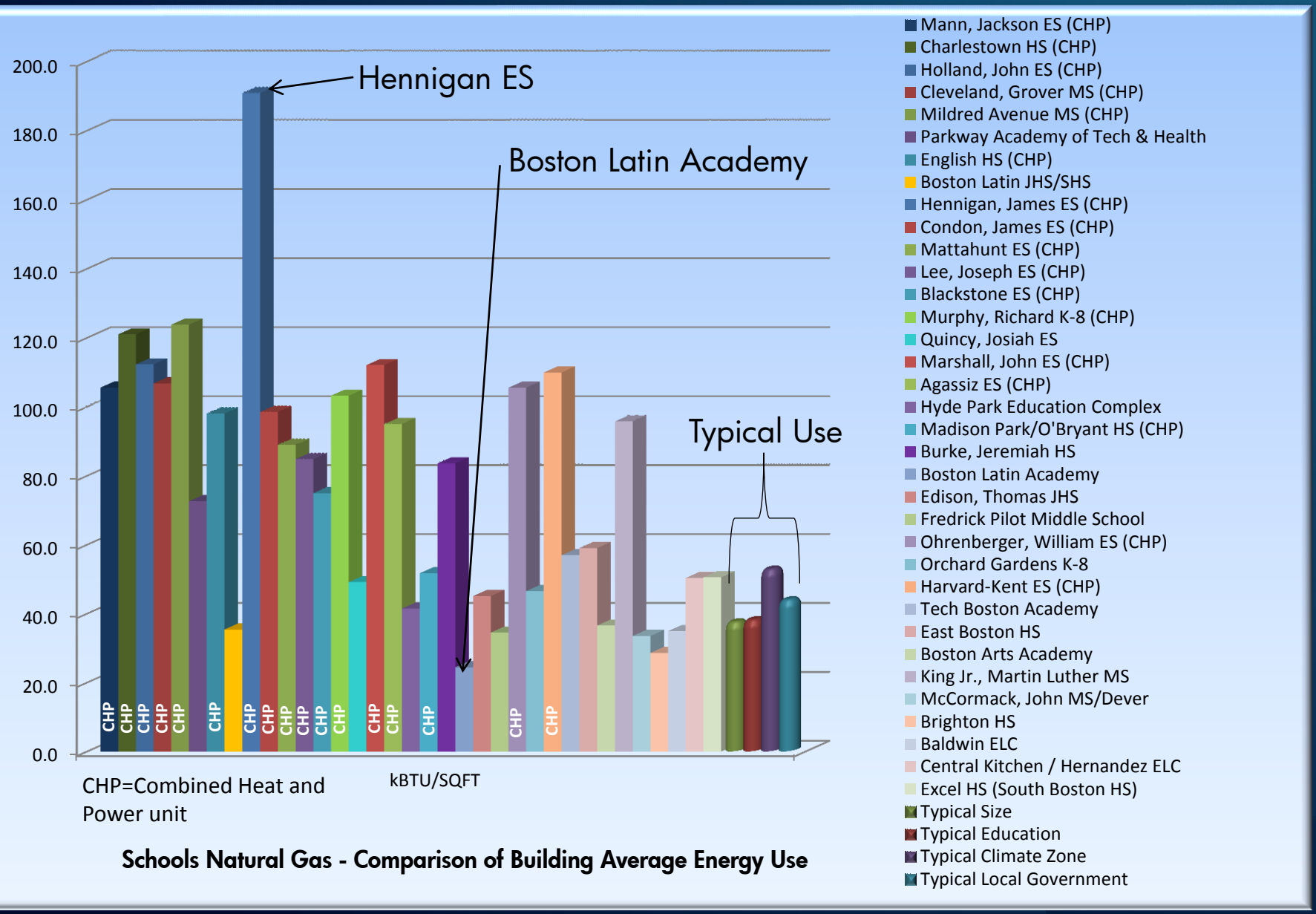
Department Energy Consumption Assessment



Library kBTU/SQFT - Comparison of Average Energy Use

Library – Steam & Natural Gas Use

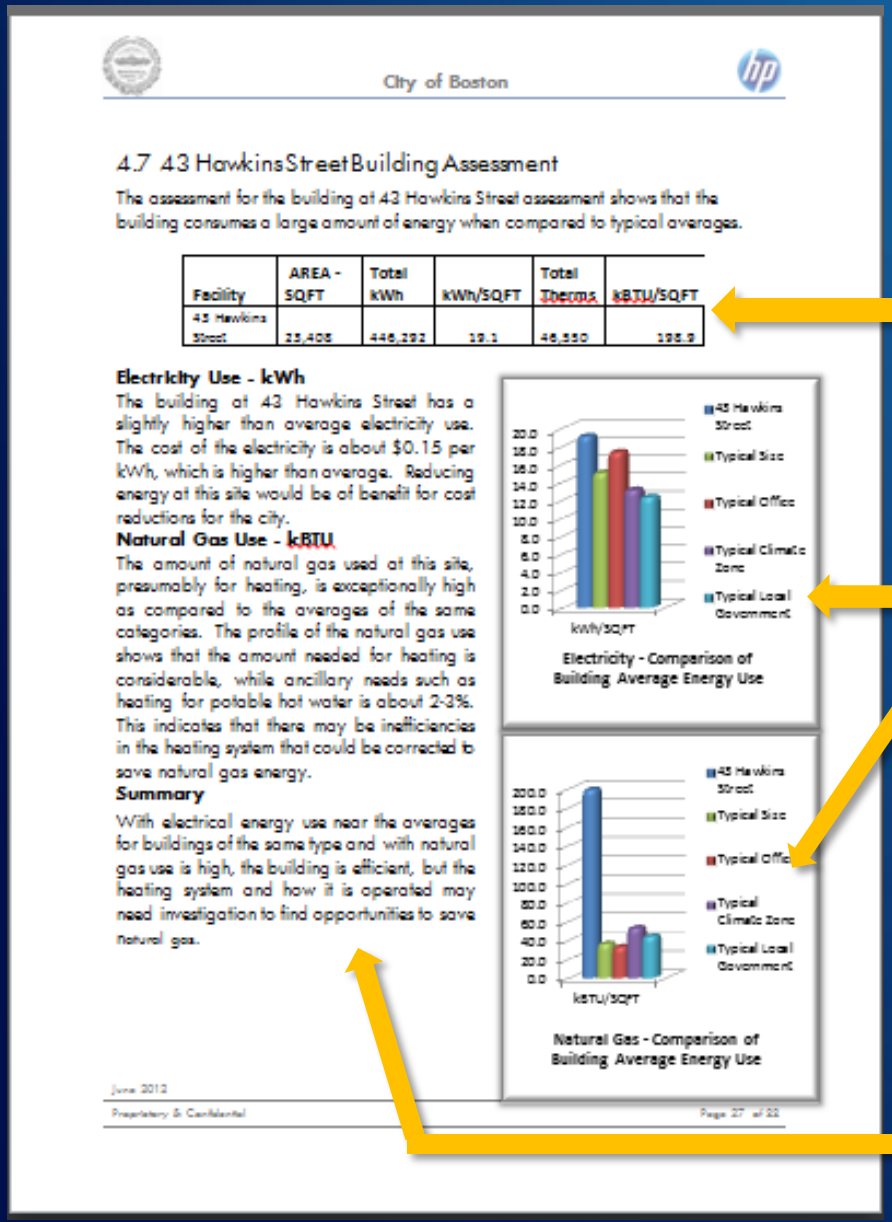
Department Energy Consumption Assessment



Schools Natural Gas - Comparison of Building Average Energy Use

Schools – Natural Gas Use

Energy Assessment Example



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4.7 43 Hawkins Street Building Assessment

The assessment for the building at 43 Hawkins Street assessment shows that the building consumes a large amount of energy when compared to typical averages.

Facility	AREA - SQFT	Total kWh	kWh/SQFT	Total Therms	kBTU/SQFT
43 Hawkins Street	23,406	446,292	19.1	46,550	198.9

Electricity Use - kWh

The building at 43 Hawkins Street has a slightly higher than average electricity use. The cost of the electricity is about $0.15 per kWh, which is higher than average. Reducing energy at this site would be of benefit for cost reductions for the city.

Natural Gas Use - kBTU

The amount of natural gas used at this site, presumably for heating, is exceptionally high as compared to the averages of the same categories. The profile of the natural gas use shows that the amount needed for heating is considerable, while ancillary needs such as heating for potable hot water is about 2-3%. This indicates that there may be inefficiencies in the heating system that could be corrected to save natural gas energy.

Summary

With electrical energy use near the averages for buildings of the same type and with natural gas use is high, the building is efficient, but the heating system and how it is operated may need investigation to find opportunities to save natural gas.

Electricity - Comparison of Building Average Energy Use

Natural Gas - Comparison of Building Average Energy Use

June 2012

Proprietary & Confidential

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For each building:

Overall summary of energy use

Evaluations against CBECS comparables

Energy performance narratives

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Conclusions and Recommendations

- Each of the 50 buildings was benchmarked against Department of Energy data for electricity, natural gas, steam, and water use.
- While many of the buildings exceeded the energy consumption of comparable benchmarks, many were equal to or less than those comparables.
- Current City energy conservation programs have been effective in reducing energy consumption.
- An EEMS solution would allow the City to leverage the current efficiency programs to realize greater savings.

Question:

How many kWh did the City consume in 2011?

171 million kWh

Enough electricity to power 28,500 homes for one year.

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High Level Benchmarking of U.S. Municipal and Federal EEMS Programs

"Get ahead of the pack!"

High Level Benchmarking of U.S. Municipal and Federal Programs

- Examples of other municipal or federal facilities that have implemented an EEMS
- The level of energy savings those municipalities have achieved
- Key lessons-learned from those implementations

Fact:

City LED street light retrofits saved
11.3 million kWh in fiscal year 2012.

Process for Benchmarking Analysis

1. Reviewed publicly available information.
2. Reviewed market research reports (non-public).
3. Outreach to vendors on EEMS case studies.
4. One-on-one interviews with:

   Six cities: Tulsa, Las Vegas, Philadelphia, San Jose, San Francisco, and Palo Alto

   Two counties: Santa Clara and San Mateo

   Two federal agencies: General Services Administration and the Department of Defense

Example of Governments Using EEMS

- Philadelphia - implemented in 2009
- Tulsa - implemented in 2010
- Las Vegas - implemented in 2009
- Palo Alto - implemented in 2009
- San Jose - implemented pilot in 2009
- San Francisco - implemented in 2010
- Santa Clara County
- San Mateo County
- General Services Administration
- Department of Defense

Representative Findings Overview

- The comments were positive on the success of the EEMS implementation.
- Material energy reduction and cost savings were reported, including reduction in billing errors.
- Strong theme about driving the responsibility and reward to the departmental or facility level. This builds accountability and generates transparency in the governance process.

Representative Findings Overview

Las Vegas	• Energy cost savings: $1.0 million in 2011; est. $1.5 million in 2012
Philadelphia	• $160,000 in net savings from utility billing errors; $60,000 net water savings
Palo Alto	• 10% savings on total energy spend in 2010 or roughly $580,000 ; 27% energy savings in 2012; 15% reductions in Community Greenhouse Gas Emissions

Conclusions and Recommendations

1. Based on the information gathered, begin to develop functional requirements for an EEMS for the City.
2. Operational functionality and cost savings are critical components to the success of an EEMS.
3. Invite EEMS vendors to demonstrate their solutions and provide detailed case study data.

Question:

Which City energy conservation measure yielded the greatest electricity savings last year?

LED Street Light Retrofits

10 minute break

Market Assessments of EEMS Systems and Capabilities

"Get the right tool for the job!"

Market Assessments of EEMS Systems and Capabilities

- Provide a review of the EEM systems on the market, including information on vendors' clients, primary capabilities, and target markets.

- Present "real-world" implementation summaries to provide additional guidance.

Fact:

There are 50+ EEMS vendors in the marketplace today.

Four Key Trends in EEMS Development

Expansion of consumption tracking

- carbon reporting
- energy spend
- pollution and natural resources management

Expansion of viewpoint

- moving from individual facilities
- encompass the entire enterprise
- entire purchasing value chain measurement

From descriptive to predictive analyses

- sophisticated capabilities
- automatically identifying anomalies
- initiating alerts for faster response
- financial savings and the avoidance of risk

Service and Software-as-a-Service (SaaS)

- becoming much more integrated
- customers seek out the most cost effective approaches
- implementation and energy management

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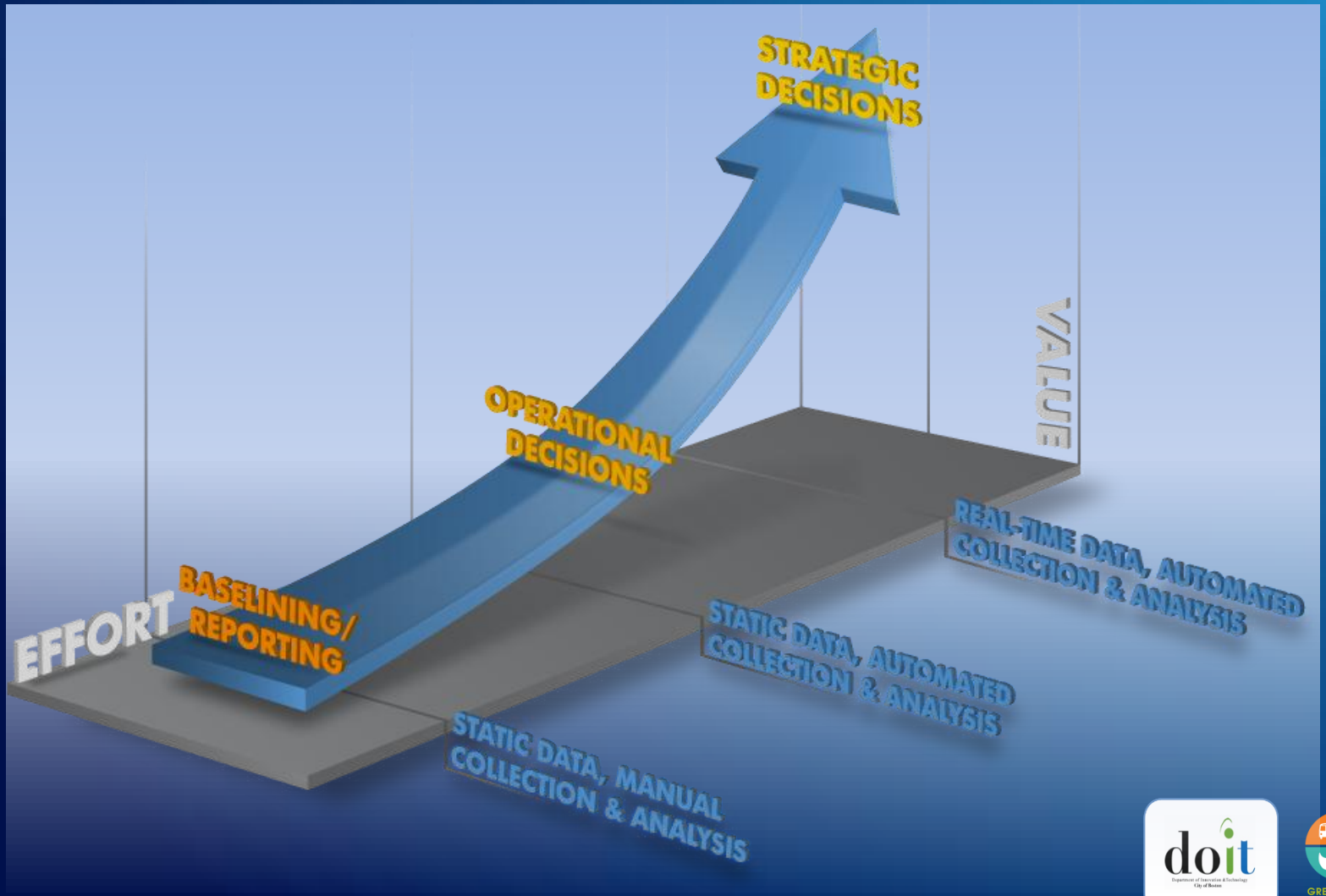
Integration of Systems Key to Strategic Value



Roles Involved in Procurement and Implementing EEMS

Administration and Finance

Manage CAPEX and OPEX, verification of results, impact on General Fund expenditures

Environment and Energy

Drive policy, reporting and energy efficiency goals

Facilities and Public Works

Operate facilities and vehicles, implement efficiency projects

Information Technology

Manage data flow, oversee Data Centers

Market Assessment of EEMS Vendors

EEMS Vendor Profiles

3.5 Comverge

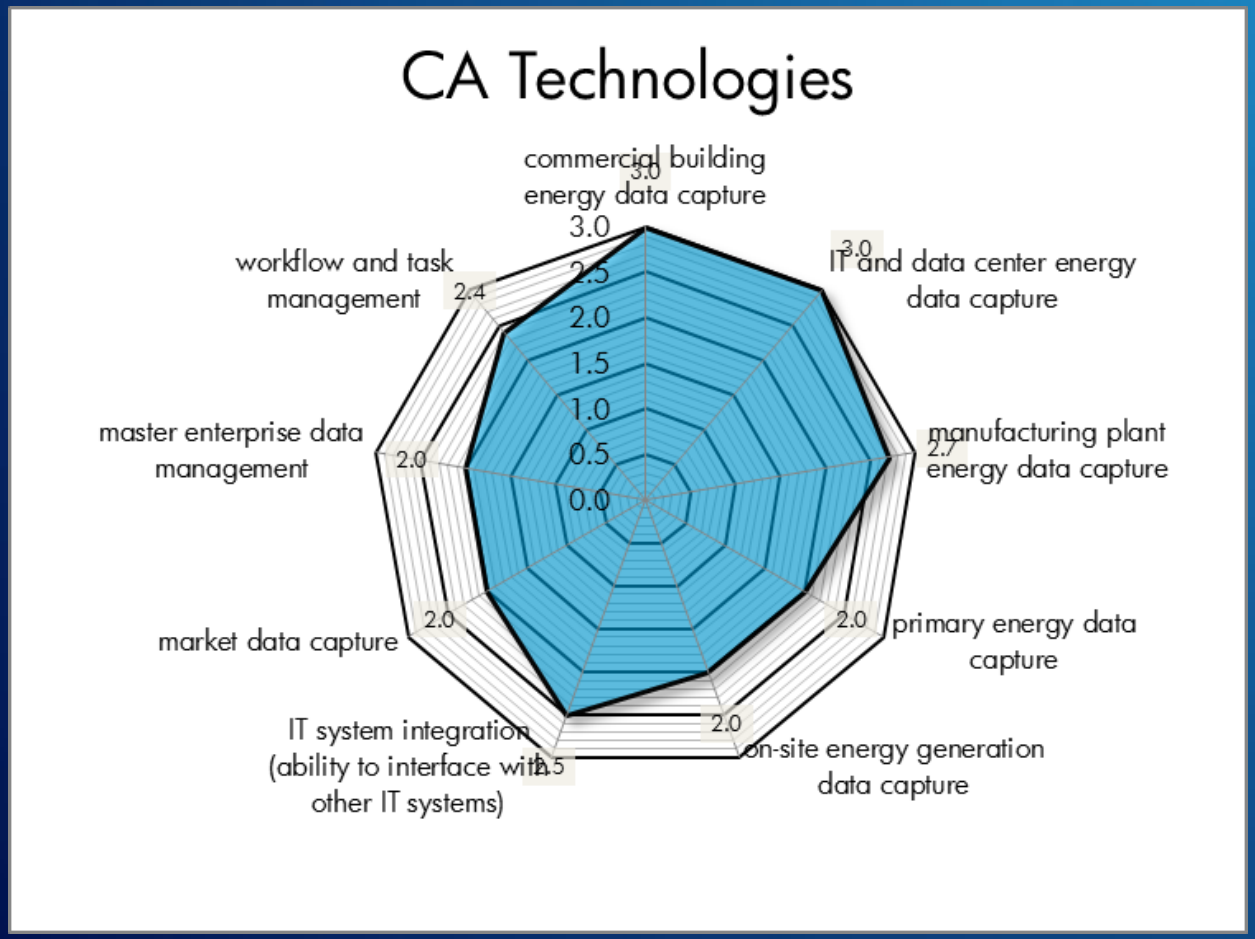
Comverge is a publicly traded demand response vendor that also sells an EEMS product. Their focus is building management systems, utility programs and demand response. Intelligent energy management solutions build upon demand response, enabling two-way communication between providers and consumers – giving everyone the insight and control needed to optimize energy usage. Beyond just reducing the energy load, this new approach cuts costs, integrates other systems, and allows for the informed decision-making that will power the smart grid.

Intellisource is an energy management solution built upon demand response, enabling two-way communication between providers and consumers – giving everyone the insight and control needed to optimize energy usage. Beyond just reducing the energy load, this new approach cuts costs, integrates other systems, and allows for the informed decision-making that will power the smart grid.

An end-to-end intelligent energy solution delivers:

- Two-way, real-time communication between utilities and customers
- Better energy control
- Insights into problem areas that require maintenance
- More predictable energy loads
- Rapid and flexible responses to changing conditions
- Automated energy management
- Faster, easier service changes
- Improved management across the grid
- A bridge to the promise of the smart grid

Example of Analysis: CA Technologies



Comparative Matrix of EEMS Vendors

	Building IQ	CA Technologies	C3 Energy	Credit 360
URL	www.buildingiq.com	www.ca.com/ecoSoftware	www.c3-energy.com	www.credit360.com
Headquarters	Sidney, Australia and San Mateo, CA	Islandia, NY, US	San Mateo, CA	Cambridge, UK
Tagline	Next Generation Energy Management	energy. sustainability. agility.	A 360 Degree View on Your Sustainability Performance	A 360 Degree View on Your Sustainability Performance
Estimated number of employees/revenue	40 employees/-	-/$4 B revenues	100 employees/$3m revenues	40 employees/$3m revenues
Financing events in last 3 years	$1.2 million	Publicly traded company	No outside investment reported	No outside investment
Sales channel	Direct and through selected resellers	Direct and Partnerships	Direct and through selected resellers and utilities	Direct and through selected resellers
Product names	Predictive Energy Optimization	CA ecoMeter, CA ecoGovernance, CA ecoDesktop	C3 Energy , C3 Sustainability , C3 Mitigation , C3 Incentives, C3 Foundation	Energy and Carbon
Pricing /business model	Annual software license for SaaS software	Software license or subscription	Annual software license for SaaS software	Annual software license for SaaS software
Implementation Methodology	External SaaS	-	External SaaS	External SaaS
Sell proprietary hardware?	No	No	No	No
Estimated number of customers	Unknown	~ 50 Energy & Sustainability customers	10	95
Target customers	Municipalities, facility management companies	Large companies, Midsized companies, Small-to-large Service Providers,	large companies. Over 80 dients with revenues >$1B	large companies. Over 8 clients with revenues >$1

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Conclusions and Recommendations

This study provided a high level overview of the leading EEMS systems.

The strengths and weaknesses of each system must be weighed and evaluated vis-à-vis the City's:

- goals
- existing energy and financial management systems
- cost
- depth of team involved both in the implementation and day-to-day operation of the EEMS

Question:

How many EEMS vendor are there in the marketplace today?

50+

High Level Business Case for an EEMS

"Strategically investing in our future."

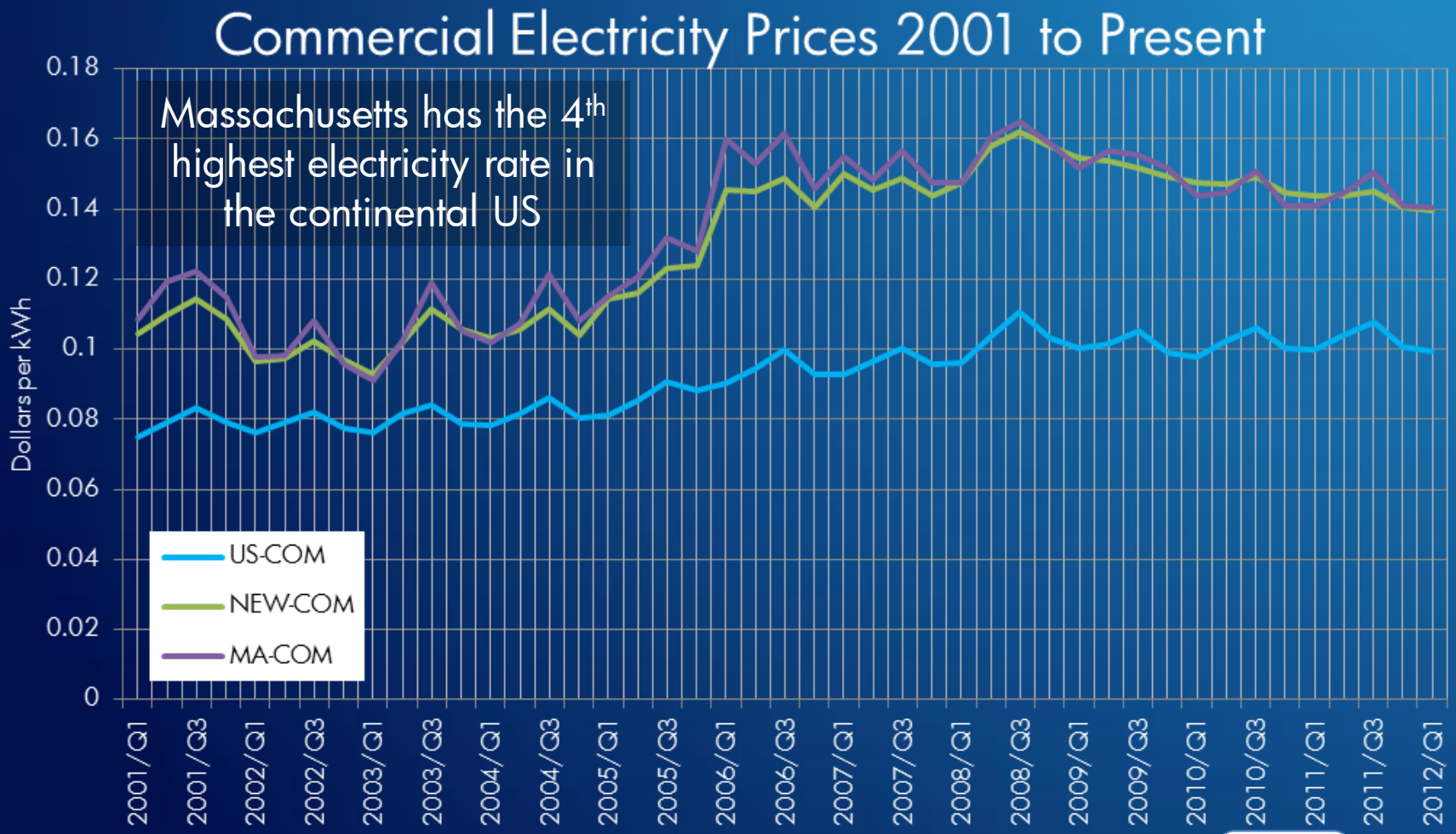
High Level Business Case for an EEMS

- Understand energy outlook
- Discuss ongoing energy consumption costs for the City operations
- Develop projected energy costs for a "business as usual" scenario for 5 years including "low," "expected," and "high" forward price scenarios
- Estimate initial up-front cost estimates for an EEMS including licensing fees, installation costs, City staff resource requirements, and on-going maintenance costs
- Projected energy cost savings based on ranges observed in other EEMS implementations

Fact:

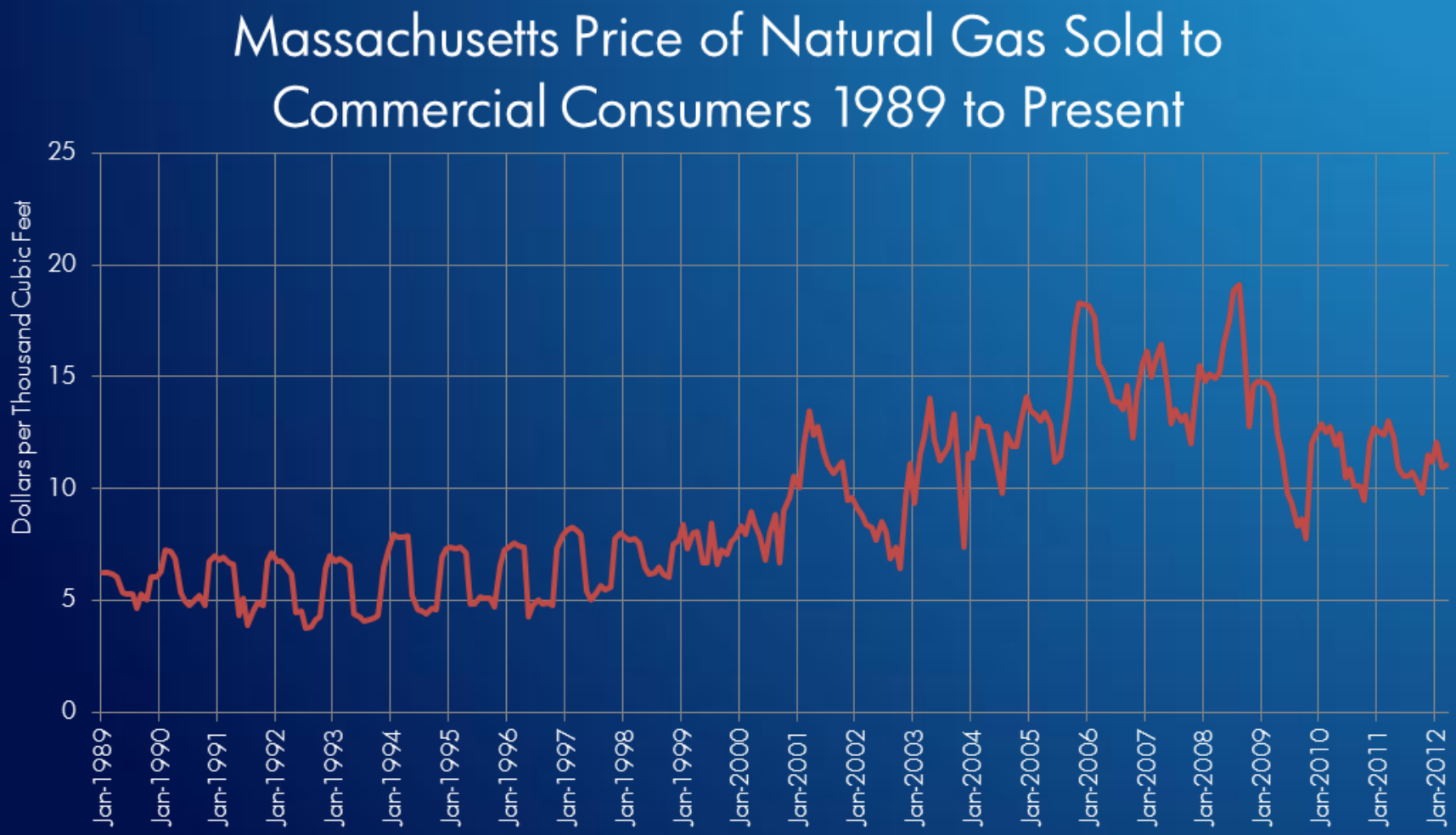
Boston Public Library and City Hall energy conservation measures saved 1.3 million kWh in fiscal year 2012.

Energy Outlook - Electricity Costs



From EIA

Natural Gas Costs



From EIA

Drivers of ROI Analysis

Increase in administrative efficiency	• In the analysis, auditing and cost allocation to the different departments and agencies within the City
Identification of additional energy efficiency projects	• Based on analysis of KPIs associated with the different departments and buildings
Reduction of on-going energy costs	• As a result of the energy efficiency upgrades, this constitutes a significant annual savings of energy and cost.
Monitor and maintain	• Reduced levels of energy in buildings where energy efficiency projects have been completed

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Summary of ROI Analysis

SaaS Cloud (all ECM projects implemented)						
Period	0	1	2	3	4	5
EEMS One-Time Cost	-$100,000					
EEMS Annual Fees		-$71,429	-$68,027	-$64,788	-$61,703	-$58,764
Annual Energy Efficiency Project Cost		-$125,778	-$119,788	-$114,084	-$108,652	-$103,478
Annual Utility Incentives and Rebates		$61,809	$58,866	$56,062	$53,393	$50,850
Annual Energy Savings		$0	$142,599	$271,617	$388,025	$492,730
Discounted Costs		-$197,206	-$187,816	-$178,872	-$170,354	-$162,242
Discounted Savings		$61,809	$201,465	$327,680	$441,418	$543,580
Total discounted benefit flow		-$135,398	$13,649	$148,808	$271,063	$381,338
Total cumulative discounted benefit flow		-$235,398	-$221,749	-$72,941	$198,122	$579,461
ROI		21%	54%	89%	124%	158%

SaaS Cloud delivery method has the fastest ROI:

3.3 years.

SaaS Hosted (all ECM projects implemented)						
Period	0	1	2	3	4	5
EEMS One-Time Cost	-$100,000					
EEMS Annual Fees		-$95,238	-$90,703	-$86,384	-$82,270	-$78,353
Annual Energy Efficiency Project Cost		-$125,778	-$119,788	-$114,084	-$108,652	-$103,478
Annual Utility Incentives and Rebates		$61,809	$58,866	$56,062	$53,393	$50,850
Annual Energy Savings		$0	$142,599	$271,617	$388,025	$492,730
Total Discounted Costs		-$221,016	-$210,491	-$200,468	-$190,922	-$181,830
Total Discounted Savings		$61,809	$201,465	$327,680	$441,418	$543,580
Total discounted benefit flow		-$159,207	-$9,027	$127,212	$250,496	$361,750
Total cumulative discounted benefit flow		-$259,207	-$268,234	-$141,022	$109,474	$471,224
ROI		19%	50%	81%	112%	143%

SaaS Hosted delivery method has the fastest ROI:

3.6 years.

On Premise (all ECM projects implemented)						
Period	0	1	2	3	4	5
EEMS One-Time Cost	-$375,000					
EEMS Annual Fees		-$57,143	-$54,422	-$51,830	-$49,362	-$47,012
Annual Energy Efficiency Project Cost		-$125,778	-$119,788	-$114,084	-$108,652	-$103,478
Annual Utility Incentives and Rebates		$61,809	$58,866	$56,062	$53,393	$50,850
Annual Energy Savings		$0	$142,599	$271,617	$388,025	$492,730
Discounted Costs		-$182,921	-$174,210	-$165,915	-$158,014	-$150,489
Discounted Savings		$61,809	$201,465	$327,680	$441,418	$543,580
Total discounted benefit flow		-$121,112	$27,254	$161,765	$283,404	$393,091
Total cumulative discounted benefit flow		-$496,112	-$468,857	-$307,092	-$23,688	$369,403
ROI		11%	36%	66%	98%	131%

On-Premise delivery method has the fastest ROI:

4.1 years.

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Conclusions & Recommendations

- EEMS allows facility managers to know more about the cost of heating, cooling and powering their buildings.
- EEMS dashboards and analytics will simplify and reduce the time required to assess, develop, budget, implement and track energy efficiency projects.
- Investing in an EEMS will result in on-going savings by reducing energy consumption, and increasing administrative efficiencies.
- An EEMS will expedite energy conservation projects.

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Question:

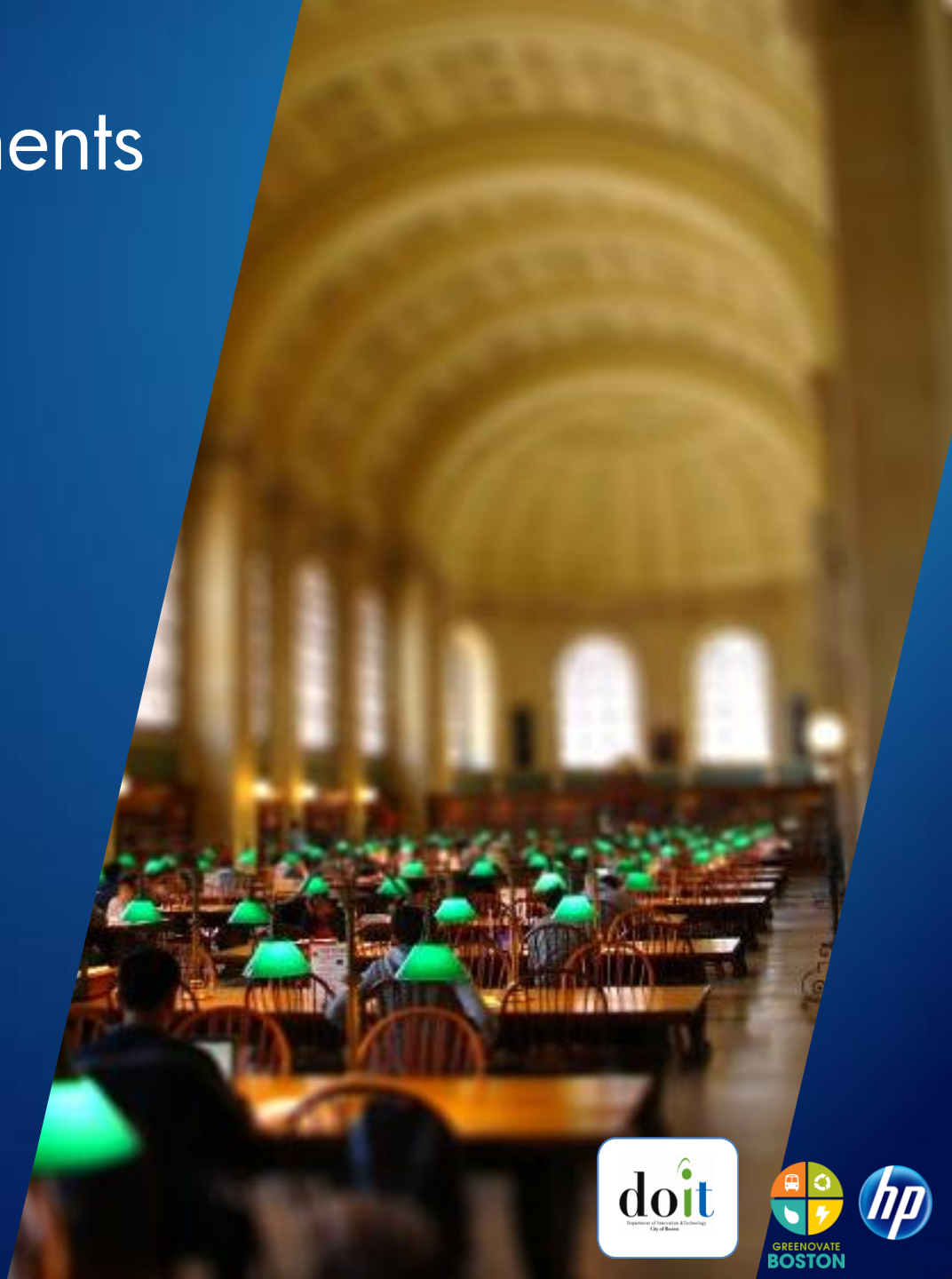
How many kWh did the Boston Public Library and City Hall City energy conservation measures save in 2012?

1.3 million kWh

= $163,000 in savings annually

Functional Requirements Document

"Form follows function."



Functional Requirements

Objectives for EEMS deployment

Identify primary and secondary characteristics required by the City to meet climate and energy goals, and energy reduction and budgetary goals

The requirements document will provide information on:

- Setup and support
- Functionality and analytics
- Data sources and structure
- Development and deployment (including options for customization)
- Technology platform and scalability

Fact:

The Mayor's 2007 executive order relative to climate action in Boston set three greenhouse gas reduction goals:

✓ 7% reduction by 2012

25% reduction by 2020

80% reduction by 2050

Objectives for EEMS deployment

Streamline Resource Consumption and Cost Data Entry

Eliminate disparate spreadsheets facilitating one time data entry (automated and manual)

Facilitate Bill Validation and Auditing

Validate utility bills more efficiently

Establish Tracking and Reporting Capabilities

Track consumption and costs related to electricity, natural gas, water, steam, and fuels by meter, account, facility, and agency

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Objectives for EEMS deployment (cont.)

Standardize Greenhouse Gas Emissions Calculations

Incorporate a reliable carbon calculator that will measure progress to help the City achieve its Climate Action policy goals

Integrate Energy Management Data with Enterprise-Wide Data

Automate data transfer between purchasing, human resource, and energy software platforms

EEMS Strategic Assessment Summary

- City energy use is above national averages.
- Municipalities that have deployed EEMSs have realized significant financial savings and GHG reductions.
- The EEMS market is mature and offers a number of possible solutions for the City.
- Business case proves a return on investment within a favorable time period (3.3 years).
- Requirements documents position the City to move forward with the procurement of an EEMS.

Question:

What is the Mayor's greenhouse gas reduction goal for the year 2020?

25%

…and 80% by 2050

How do we make this happen?

Next Steps

- Form an EEMS working group
- Identify business process requirements
- Prepare and publish RFP
- Evaluate submitted proposals
- Evaluate vendors demonstrations
- Select vendor
- Assemble implementation team
- Roll out set up, support and training

How will an EEMS meet City objectives?

- ✓ Tool to reach Mayoral Policy 25% by 2020 - Yes
- ✓ Better facilities management operations - Yes
- ✓ Maximize financial savings - Yes
- ✓ Measure and validate progress – Yes
- ✓ Monitor, track and report on energy consumption - Yes

Questions?

Thank You!