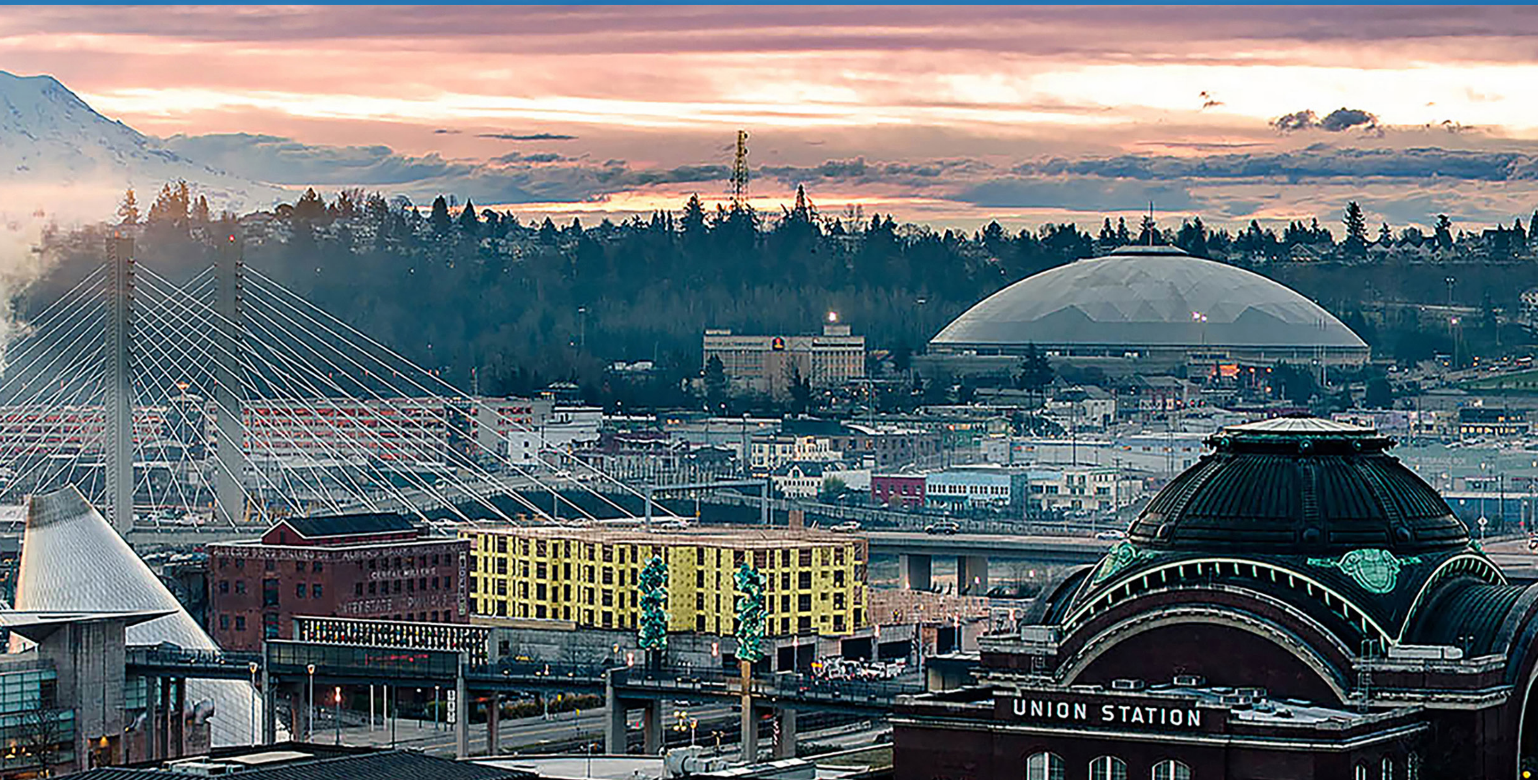
Community Strategic Energy Management

Implementation Guide



neea maalka ecoedge nbi new buildings institute

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The Northwest Energy Efficiency Alliance (NEEA) is an alliance of more than 140 Northwest utilities and energy efficiency organizations working on behalf of more than 13 million energy consumers. Through collaboration and pooling of resources, the region's utilities and stakeholders have harnessed their collective influence to drive market adoption of energy efficiency products, services and practices for the benefit of utilities, consumers and the region.

Eco Edge, and its sister company Open Spaces NW, provides consulting on better building through a belief in people, planet and prosperity. The focus is on people—gathering, guiding and inspiring. Protecting our planet is a shared belief across all projects that range from strategic energy management for commercial property portfolios and cities to LEED certification of over 100 homes, neighborhoods and commercial buildings. The purpose of our work is to generate greater prosperity for our clients, which we define that as well-being and return-on-investment. Based in the mountains of Idaho, Eco Edge brings a unique perspective to meeting and charrette facilitation, strategic planning and program development. Sustainability is a way of life.

Maalka is an open platform that is used by cities, asset managers, and banks across the United States to connect teams to customizable data-driven insights through energy and sustainability programs. A Department of Commerce NTIS Joint Venture Partner and Wells Fargo IN2 Company, Maalka works with national leaders like NBI, Architecture2030, and ZGF Architects to develop and deploy solutions that guide stakeholders towards achieving energy and carbon goals.

New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings. Throughout its 20-year history, NBI has become a trusted and independent resource helping to drive buildings that are better for people and the environment.

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VanDusen Botanical Garden Visitor Centre | Vancouver, BC | Photo: Nic Lehoux

Cover Photo: City of Tacoma

INTRODUCTION

Boise, ID | Photo: Bob Young

Many communities have or are considering policies and programs to address climate change. They understand that buildings represent a critical element of these policies, since buildings comprise more than 40 percent of energy use and account for more than 38 percent of U.S. carbon emissions.[1] Improving municipal building performance represents a unique opportunity to lead the community by demonstrating exemplary performance in the public building portfolio.

Leading by example involves a strategic approach to energy efficiency in public building portfolios. Decision-makers have a strong business case for investing in continuous energy management. Their actions can increase facility asset value, reduce operating costs, demonstrate sound fiscal management, and create local jobs while increasing comfort, productivity, and satisfaction for building occupants. Through better energy management in their own portfolio, public owners can manage potential risks of rising energy costs and the impacts of climate change.

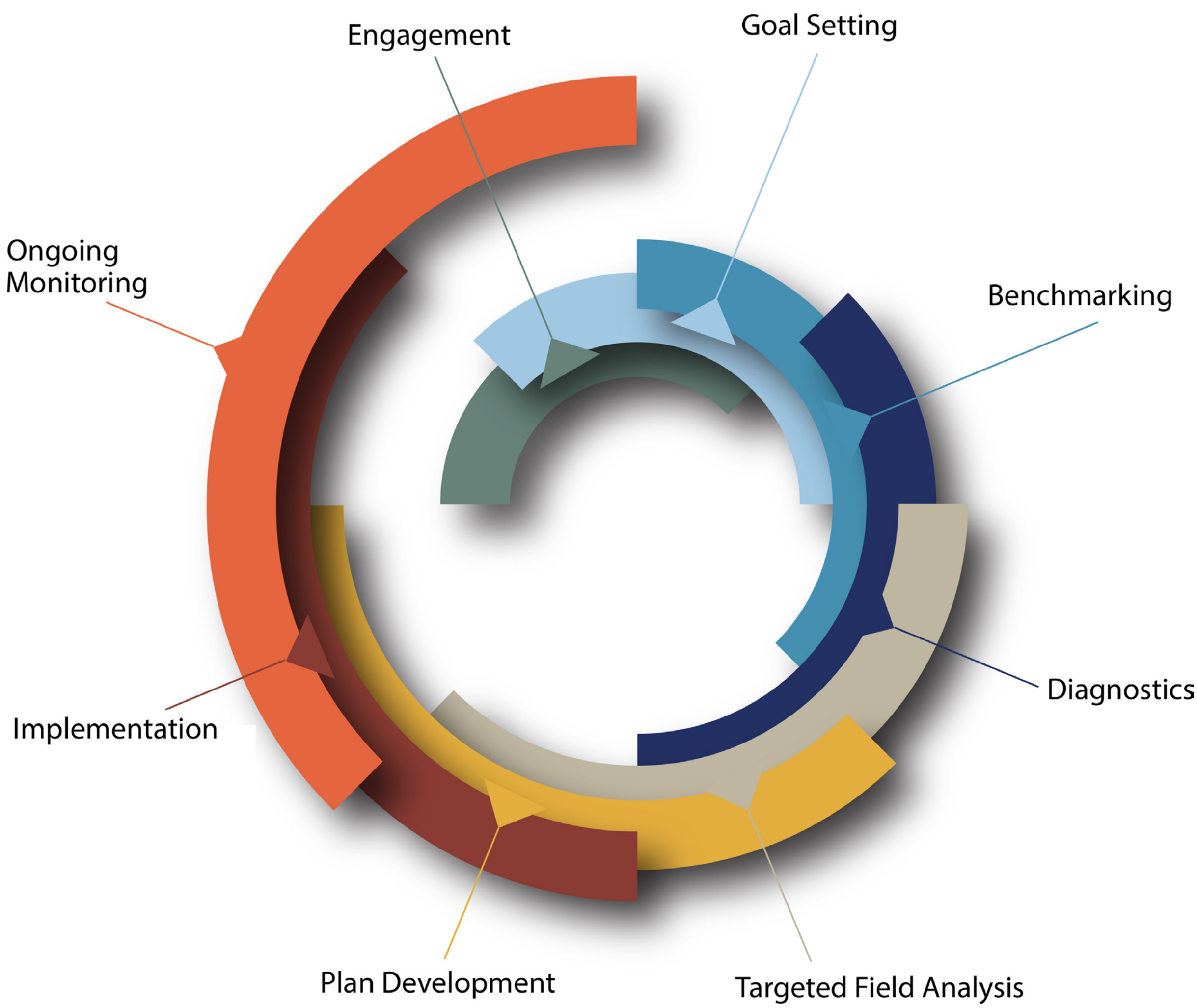
This Community Strategic Energy Management (SEM) Implementation Guide outlines a process to help staff engage stakeholders, set tangible goals, target opportunities, and develop a plan to achieve deep and ongoing energy reductions in public building portfolios. Community SEM coordinates activities across departments and establishes clear financial objectives and communication protocols. This framework is applicable to any city, county, regional government, state agency, or school district interested in saving on operating costs, reducing emissions, and leading-by-example in their community.

Hood River Middle School Zero Energy Music and Science Building | Hood River, OR
Photo: Michael Mathers

1 Energy consumption Information from U.S. Energy Information Administration (EIA). Frequently Asked Questions. Accessed Jan. 4, 2016. Greenhouse gas emissions data from EPA U.S. Greenhouse Gas Inventory Report: 1990-2013.

The Community Strategic Energy Management Process

Community SEM is a long-term approach to energy efficiency in public building portfolios. With the overarching community vision in mind, the process begins by engaging the right stakeholders and collecting information about current practices and policies in the city or district. Benchmarking allows for the comparison of the measured energy performance of buildings to themselves, their peers within the portfolio, or best in class buildings of that same type. Remote diagnostics can uncover opportunities and focus limited auditing resources on high priority and known problem areas across the portfolio. This is followed with targeted field analysis and the development of a strategic energy management plan prioritizes opportunities across the portfolio. Ongoing monitoring and communication of results help to ensure the goals and objectives of the plan are effectively tracked and results communicated back to key public decision makers. This document outlines key components of the Community SEM process as outlined in the spiral figure.



STAKEHOLDER ENGAGEMENT

2016 Getting to Zero Nation Forum | Denver, CO

The first step in the process is identifying and engaging municipal building stakeholders. This raises awareness and understanding of the value of energy management in a public building portfolio as well as the relationship of municipal building performance to broader policy goals. When high level officials, like City Council or School Board members, understand the benefits and the significance of energy costs in the general fund budget, they are more likely to support the effort by allocating resources to develop and implement the plan. When department heads and building operators have clear information about how well their buildings are performing and are given strategies to track and improve performance, they are more likely to manage their buildings more effectively.

The Energy Team and Energy Champion

A cross-departmental **energy team** can ensure that each aspect of Community SEM is addressed. Often, the Director of Sustainability or the Resource Conservation Manager serves as the **energy champion,** an overall point person who coordinates the SEM effort. An integrated team of stakeholders often includes representatives from each department including the following areas:

- Department decision makers (e.g., Police/Fire, Parks and Recreation, etc.)
- Public Works and/or Facilities (including building managers and maintenance staff)
- New Construction Master Planning
- Sustainability
- Information Technology
- Energy Policies and/or Codes
- Finance representative or decision maker
- Communications
- Executive representative (e.g., Mayor or City Manager's office)

Energy Team Meetings

Regular meetings with the energy team are important to discuss projects, compare lessons learned, and share success stories across departments regardless of traditional operational or budgetary divisions. Establishing this formal mechanism for conversations and communications among city departments and staff in the context of energy performance can lead to significant new initiatives, ideas, and approaches that support broad progress toward city goals.

Through this process staff members, some new to energy management, become empowered in efforts to reduce energy use. Those involved in facility management, renovations or new construction might share best practices that can be leveraged elsewhere in the city or school district. Involving the Information Technology (IT) group can lead to impactful reductions in energy consumption because networked devices, servers, and other IT equipment typically use a significant amount of energy and may offer scalable efficiency opportunities. The presence of the finance department is critical to help establish Return on Investment (ROI) criteria.

Many cities and other organizations have found that meeting monthly or quarterly is efficient and productive. In some cases, it may make the most sense to have a smaller group meet monthly and report out to a larger group quarterly or annually. When establishing meeting schedules and invitees, consider budget cycles and facilities master planning process timelines to ensure that energy is considered at the optimal time in the process to allow for effective implementation.

Gap Analysis

One useful activity is for the energy team is to conduct a gap analysis that compares existing policies and processes to best-in-class practices used by other cities, counties and school districts around the country. These might include procurement policies, equipment efficiency standards, benchmarking and disclosure policies, operational policies, and more. Operational policies are important because occupant behavior often is a major driver of building energy use. This comparison is often very useful to identify what opportunities exist, allowing jurisdictions to bridge the gap between current practice and best practice. Leveraging examples of other leaders offers the benefit of being able to follow an established path and learn from the experience of the trailblazers.

Communicating Results

Communicating results is a key responsibility of the energy team and champion. At least annually, the team should provide a progress report update to high level officials. In addition, representatives from the staff energy team might report back to others, such as external committees established to support livability, sustainability, and/or planning. For example, Ketchum, Idaho has a volunteer Energy Advisory Committee made up of citizens with expertise in energy, and Missoula, Montana has a Climate Smart Missoula initiative where city staff regularly participate along with private sector representatives.

Workshop Participants | Cambridge, MA

Stakeholder Drivers

Various stakeholders involved in the SEM process have different drivers that impact how they make decisions. Knowing these drivers is helpful to consider when developing a rationale that best resonates with key decision-makers. Following are some stakeholders and a short explanation of their priorities to consider:

Stakeholder	Driver
City Council Elected city council members are the primary decision maker for city facilities. They routinely seek input from the community, city staff, and a wide-range of consultants in decision-making and report back to the Mayor.	**Priorities:** Quality services, fiscal responsibility, citizen partnership, community pride, community partnerships, community livability Votes and support of City Council members represent final decisions critical to city operations, city budgets and facilities.
School Board Elected school board members are the primarily decision maker for school districts and school facilities. They routinely seek input from the community, students, staff, and a wide-range of consultants in decision-making.	**Priorities:** Education, 21st century skill development, fiscal responsibility, sustainability, positive school culture, social equity, community engagement, on time project delivery, accountability, student growth. Votes of school board members represent final decisions on many topics critical to school facilities.
Facilities Department The operation and maintenance of safe, healthy and functioning city buildings is the responsibility of the Facilities Director. The Facilities Director may manage a group of staff that generally includes a team of Facilities Managers who are deployed across the city to various facilities to address specific maintenance issues and custodians.	**Priorities:** Dependable operation, ease of maintenance & operations, avoiding or addressing deferred maintenance, meeting budgets, safe environments, healthy environments, staff availability and allocation. Typically, the Facilities Director participates on the Long Range Planning / Facilities Master Plan development as part of the Leadership Team, alongside other stakeholders. While they are interested in energy, they are more interested in maintaining healthy and safe built environments. Their buy-in on new systems is critical to energy outcomes.
Sustainability Director, Energy Manager Sustainability staff often work in association with staff and community members on a variety of "green" projects including energy efficiency upgrades. Some cities additionally have an energy manager that may work to tie the sustainability department to the facilities department through energy management and analysis.	**Priorities:** Energy/water conservation, emissions and waste reductions, healthy environments, upgrading facilities, reducing utility bills, social equity, community engagement, city pride, accountability, community growth, resilience. Sustainability managers and energy managers hold critical information to understanding savings that come from conservation practices. They are very important to bring into the conversation early.
Department Leads Department leads are responsible to council/Mayor on individual department performance and budgets. They may set building maintenance and upgrade priorities and/or deploy staff and building resources.	**Priorities:** Depend on the particular department (parks, fire, police, education, etc.), but generally they are focused on achieving department-level goals within allocated budgets. Department leads are responsible for making decisions related to day-to-day operational policies as well as capital investment planning for their facilities.

GOAL SETTING AND VISION

Zero Net Energy Center | San Leandro, CA | Photo: FCGA Architecture

Many communities have already defined their long term vision and goals. The vision may be regarding community livability, air quality or climate protection. If so, the aim of the Community SEM process is to identify the role and opportunity that the public building portfolio represents to help meet these goals.

More and more communities are establishing goals specifically related to climate. Sometimes they reference voluntary standards such as the STAR Communities program, the 2030 Challenge, or the Paris Accord (see Resources section). Others have their own reduction targets and timeline. For example, the City of Boise, Idaho has set a goal for all new construction and major renovations to be net zero by 2030 and for existing buildings to achieve a 50% reduction in energy use on average by 2030 compared to the baseline of 2010.

Setting more aggressive timelines for public buildings is a key demonstration of leadership-by-example. For example, the State of California also has “Big Bold Energy Efficiency Strategies” including: zero net-energy residential new construction by 2020, zero net-energy commercial new construction by 2030 and net zero in 50% of existing buildings by 2030. To demonstrate leadership-by-example, the timelines for these goals have been accelerated for state facilities. The California Department of General Services has a clear policy that all newly constructed state buildings and major renovations must be constructed to be zero net energy starting in 2017.

Goal Setting

Goals define the path to success. Goals should be specific as to whether they impact the portfolio or the community. During the Community SEM process, the energy team provides context on how public building energy consumption relates to the overall community goals. Part of the process is to understand how much energy savings is possible in public buildings and what proportion of savings this represents across the entire community.

Goals require clear ways to measure progress toward achievement, both in metrics (what) and methods (how). “SMART” (Specific, Measurable, Actionable, Realistic and Time-bound) is a helpful acronym to keep in mind when setting goals. In addition, interim targets break long timeframes into realistic segments and allow for celebrating successes along the way.

When working with the energy team to establish Community SEM goals, here is a list of considerations for discussion.

How will public buildings lead-by-example?

- Benchmark energy use for all buildings owned, leased or managed by the city, state, or school district.
- Adopt a portfolio-wide energy reduction target over a baseline year for energy and emissions savings
- Establish building specific energy targets for various building types in the portfolio
- Establish new construction standards and guidelines for existing building retrofits, both operational and capital for all public buildings
- Review plans, policies and practices to uncover opportunities to incorporate energy efficiency
- Establish financial Return on Investment criteria and consider life cycle costs in investment decisions
- Highlight buildings and processes that are already setting a good example

Community Engagement Workshop | Cambridge, MA

How can efforts build resiliency in the community?

- Aim for zero energy performance on your next new construction or major retrofit project
- Invest in electric vehicle charging stations
- Convert vehicle fleets to low-energy and alternative fuels
- Incorporate renewable energy sources into projects
- Support the de-carbonization of the grid

How will this engage the community?

- Publically disclose public building energy use data
- Report annually on progress toward climate goals.
- Educate the public on the Community SEM process
- Involve citizens in an Energy or Climate Advisory Group to consider how to further engage the community
- Celebrate success with leadership awards for buildings, individuals or teams that demonstrate exemplary performance in the community

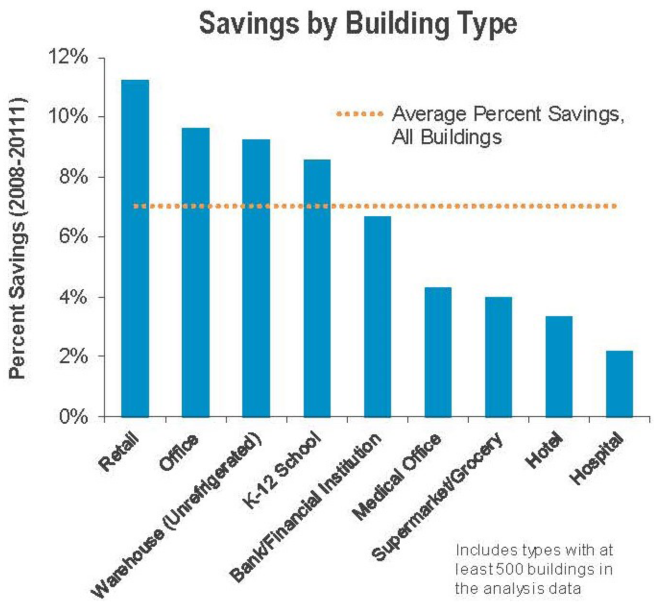
BENCHMARKING

West Berkeley Public Library | Berkeley, CA | Photo: Harley Ellis Devereaux

Building energy benchmarking can lead to energy and cost savings for building owners. Fundamentally, benchmarking involves tracking a building's energy performance over time, including grid-purchased electricity, onsite renewable generation, natural gas, district energy, and delivered fuels. Municipalities and school districts benchmark facilities in order to better understand their building stock, identify operational opportunities, and arrest performance drift. This can be done for individual buildings or at the portfolio level to compare energy use or gauge performance in the marketplace. Non-building assets, such as wastewater treatment plants, airports, swimming pools, and streetlights, can also benefit from benchmarking (see Resources section for further guidance on the energy impacts of these process-driven facilities).

Tracking building energy use over time can help identify the impacts of operational changes such as set points or lighting controls, maintenance work or capital improvements. Buildings benchmarked over a 3-year period showed an average of 2.4% annual savings in energy, according to information from the US EPA ENERGY STAR® Portfolio Manager™ (ESPM) program. Ultimately, benchmarking can lead to informed decision making for building owners and operators, portfolio holders, building tenants, and policy makers.

Benchmarking is the process of accounting for and comparing a metered building's current energy performance with its energy baseline. Benchmarking allows for comparison of a building's performance over time as well as with similar types of buildings whether they are within the portfolio or across the industry. Benchmarking is also useful to document and recognize top performers.



Benchmarking Gets Results

A study of 35,000 buildings that benchmarked energy data using the Energy Star Portfolio Manager tool showed an average percent savings of 7.2% over three years, or 2.4% per year. The impact was greater for certain building types, including offices and schools. Source: Energy Star Data Trends, Benchmarking and Energy Savings, October 2012.

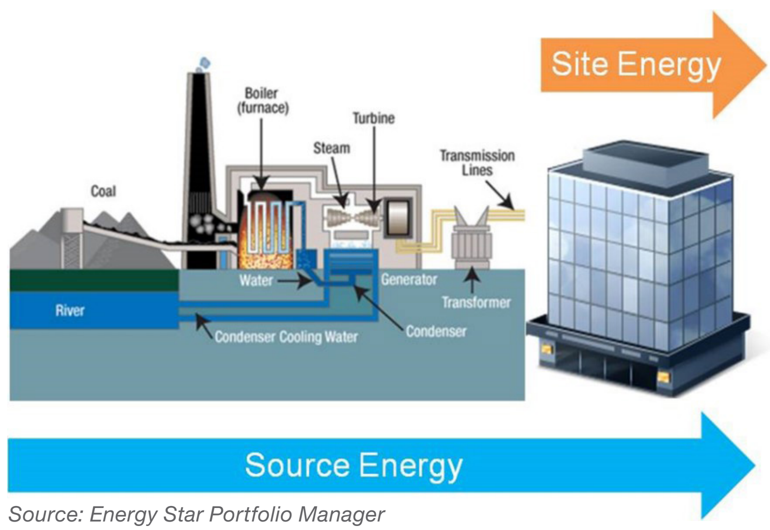
A variety of tools are available on the market for energy tracking and benchmarking. Energy Star Portfolio Manager has the greatest market penetration. ESPM is a free tool that can be used to track data, generate reports, set goals, and effectively overview any number of buildings across many different building types. Tracking with ESPM can extend beyond energy to water, waste and greenhouse gas emissions (although not, as of 2018, street lights). Commercial buildings in cities with disclosure ordinances typically mandate ESPM to report and track energy consumption.

Energy Use Intensity (EUI) is a metric that defines in the total energy use per building square foot. This includes energy consumption from all sources (grid-delivered and onsite-generated electricity, natural gas, district energy, and delivered fuels) in thousands of British Thermal Units (kBtu) per year and is divided by the building size in gross square feet. The metric for EUI is written as kBtu/sf/year.

Note that there are two types of EUI: **Site EUI** and **Source EUI.** The difference has to do with whether the generation, transmission, and distribution losses associated with delivering usable energy to the site are included or ignored.

Site EUI is calculated with the total energy use of the building at the meter, regardless of the source. Natural gas, electricity, and solar PV are all converted to one unit (kBtu) and counted together.

Source EUI takes into account the total upstream energy the building consumes, which means it's always larger or equal to the site EUI. The exact difference between the site and source EUI is a function of the fuel mix delivered to the building, as well as the building's location. Different regions of the country have varying energy sources.



Source: Energy Star Portfolio Manager

Example: US Median Office Building EUI
Source EUI: 148 kBtu/sf/year
Site EUI: 67 kBtu/sf/year

Benchmarking with ESPM involves the following steps:

1
Set up a Portfolio Manager Account

a. Create a user profile.

b. Review the Benchmarking Starter Kit and other Portfolio Manager Training Materials.

2
Collect Required Data on Buildings in the Portfolio

a. Inventory all buildings and key characteristics.

b. Identify where energy data will come from (utility bills, spreadsheet, automatic upload)

c. Identify energy meters and match them to each building. Seek out and identify cases with multiple meters per building or multiple meters on site.

d. Gather data for delivered fuels, if any (e.g. fuel oil).

3
Enter Building Characteristics and Energy Data for all Properties

a. Add property data and building characteristics for each building. Review the Technical Reference Guide for more information about data entry and building parameters.

b. Energy data may be entered using a batch upload or one building at a time. Portfolio Manager provides excel templates for batch uploads. Alternately, users can enter data directly online. Finally, some utilities can transfer data directly from the utility to PM.

4
Evaluate Results and QC

a. Once building data is complete, ESPM will graph building energy use and show the EUI and Energy Star Score.

b. Confirm that energy usage patterns are accurate and that information is correct. This typically includes linking meters to properties, checking for energy and building characteristic data errors, gaps, and abnormalities, and aligning ESPM to the master building list. Maalka, a Community SEM partner company, has developed an open source Data Quality Tool to help communities with this task.

c. Using these monthly and annual comparisons, identify baselines of energy use to help in formalizing energy goals and tracking progress.

Energy Data Collection

Establishing a process for collecting energy data often requires significantly more effort than originally expected. Ultimately, the energy champion is responsible for ensuring that the building list is complete and that benchmarking data is accurate. By working with individual department directors, the champion can ensure that all buildings in the portfolio are listed on the building inventory.

An Energy Manager or other sustainability staff member can coordinate with the local utility to collect bill information. However, if there isn't an Energy Manager on staff, this role might be filled with a committed energy team member or an intern. The Americorps Energy Corps and Volunteers in Service to America (VISTA) programs (see Resources) are good resources for cities interested in finding medium-term volunteer staff.

It is critical to have the utility on board during the early stages of the Community SEM process. Utility staff can be helpful in gathering and transferring utility bill data into tools like ESPM. Many utilities have an automatic data transfer protocol. However, even when this is the case, care must be taken to ensure that meters are associated with the correct building and that all meters in that building are represented. Having utility staff involved can also be critical to staying up to date about current incentives and other utility resources. In one case, a city discovered during an energy team meeting that the local utility's lighting incentives were being discontinued, which gave them a limited time opportunity to submit all lighting upgrade incentive applications.

Fire Station 8 | Boise, ID
Image: Cole Architects

Community Strategic Energy Management Success Story

Boise, ID

City Size: 64 Square Miles
City Population: 228,930 (2016)
Median Income: $54,535
Number of City Facilities: 53
ASHRAE Climate Zone: 6B

Since 2006 Boise has implemented a number of approaches to reduce energy consumption in their own city operations. Many of the early energy conservation measures were "low-hanging fruit," such as LED street lights, interior lighting retrofits and fleet improvements. As time went on, it became increasingly clear that existing buildings with aging equipment and infrastructure represented a tremendous opportunity for energy savings. The city realized that more carefully managing their own building portfolio would be the way to demonstrate leadership-by-example in their community.

Master Facility Equipment List

Creating and maintaining a master list of all facility equipment helps department heads, facilities and operations staff, and planners anticipate future needs and align building upgrades with maintenance requirements. Centrally tracking existing equipment, including age and condition, enables and streamlines the implementation of equipment efficiency and performance standards.

Replacing equipment before it fails can yield benefits and avoid major problems. Utility HVAC incentive programs often pay substantially higher incentives for early replacement (that is, replacement of equipment that is still working) as opposed to replacement on burnout. This provides a financial incentive to replace (and upgrade) equipment that is near the end of its life rather than waiting for units to fail. Replacing units early can minimize maintenance and repair cost and also avoids last-minute expensive emergency equipment repairs and replacements. Key components of a facility equipment list are:

- Existing Equipment
  - Location (facility)
  - Type, model, description, etc.
  - Capacity (e.g. tons of cooling, kBtu/hr of heating)
  - Unit Age or date installed
  - Anticipated Life (total and remaining)
- Anticipated Replacement Equipment, by facility
  - Location (facility)
  - Type, model, etc.
  - Capacity
  - Efficiency/Performance Level
  - Scheduled Installation

In some cases, if a building is a good candidate for a deep retrofit that includes a change in the HVAC system type (e.g. rooftop units to radiant distribution systems), planned replacement equipment may not be one-for-one.

Turkey Foot Middle School Rainwater Catchment System | Edgewood, KY
Photo: Piaskowy and Cooper Architects

This is the kind of equipment often included in a Facility Equipment List:

- Rooftop HVAC Units and air handlers
- Boilers, furnaces, air conditioners
- Pumps and fans
- Building management systems and other controls

With help from the Northwest Energy Efficiency Alliance (NEEA), the City of Boise took a comprehensive approach Community SEM approach to improving energy efficiency in the city's municipal portfolio. The team created a community SEM plan that laid out clear tracking metrics, including Energy Use Intensity (EUI) targets by building type.

The team used Energy Star Portfolio Manager to benchmark a total of 50 buildings. As a result of these efforts, the city is now focusing on 17 high-priority buildings.

Driven by cultural and organizational evolution, the city has established formal mechanisms for communications among city departments and staff in the context of energy performance. The city has committed about 1.5 FTE to work on Community SEM efforts on an ongoing basis. Additionally, City Council went beyond the previous target of LEED Silver and established an aggressive EUI target for their new fire station: 27 kBtu/sf/year. Fire Station 8 is now in operation and performing well. The building is prepared to add solar as funds become available.

DIAGNOSTICS AND DATA VISUALIZATION

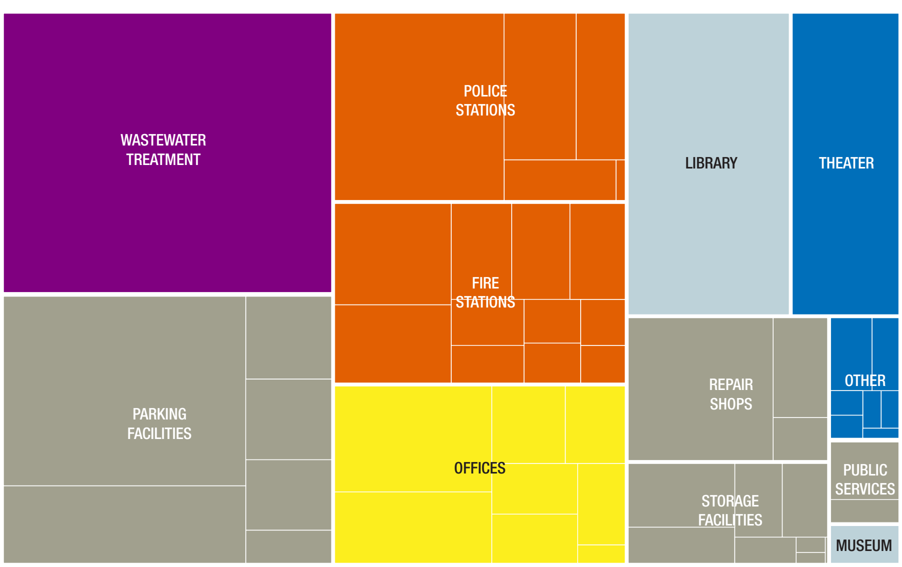
Diagnostic Analysis

Simply benchmarking a group of buildings, in and of itself, will not achieve energy and emissions reduction goals. Visualization and analytical tools can help transform this data into actionable information – and provide insights to inform the Community Strategic Energy Management Plan. The conceptual framework of this approach starts with a broad view of energy across the portfolio, zooms into individual buildings, and brings building-level diagnostic results back up to the portfolio level.

Portfolio-Level Data Visualization

Gathering energy use and building data in one place – that is, benchmarking a group of buildings – enables simple, easy-to-understand portfolio-level data visualization. The following charts show a few of the many ways to visualize portfolio-wide energy data.

The treemap diagram below shows the proportion of total city energy consumption by various individual buildings and building types. This quick snapshot of building energy use helps the energy team understand the relative impact of different facility types and departments on total portfolio building energy use. Diagrams like this help with evaluating upgrade opportunities with potential to achieve the most significant energy-use reductions.

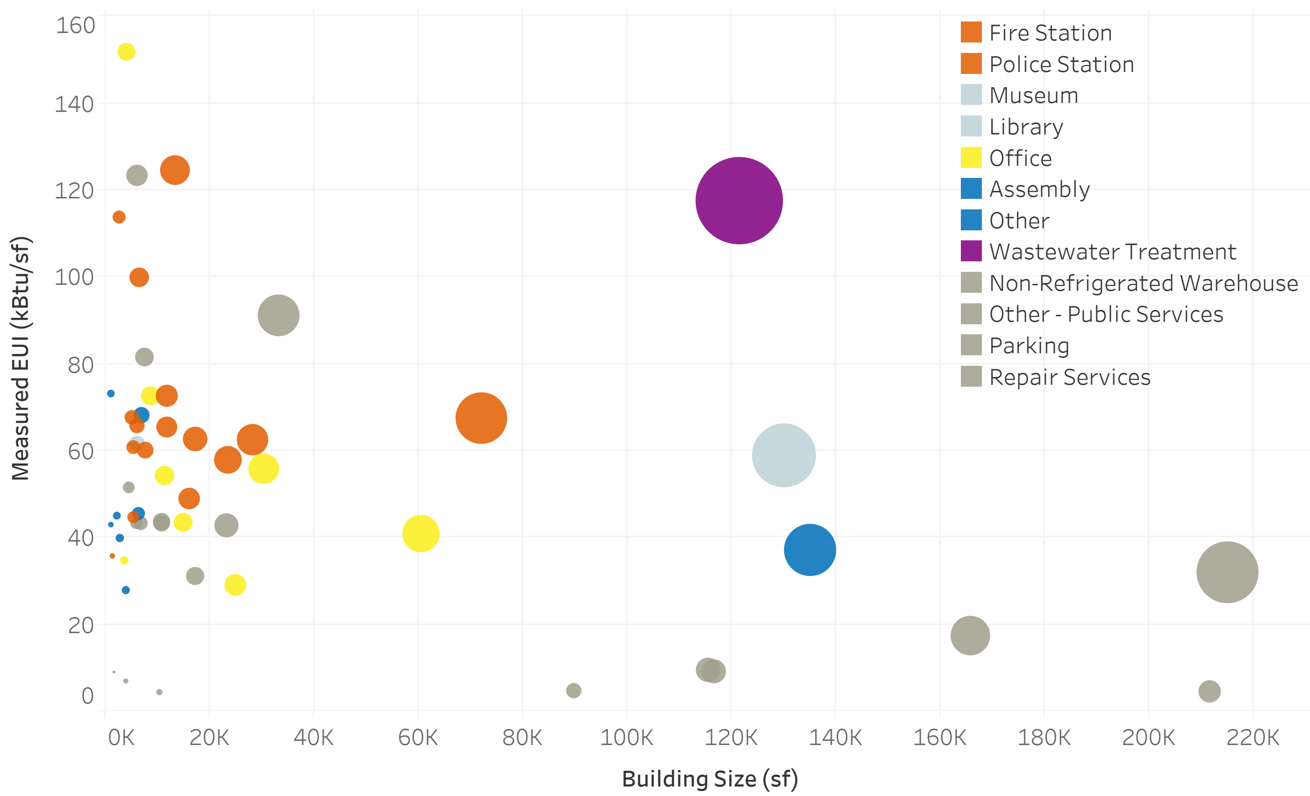


Relative Energy Use of Buildings in a Sample City Portfolio

Each small rectangle in this treemap diagram represents a single building. The size of each rectangle is representative of that building's share of all energy use portfolio-wide. Buildings of the same type are color-coded into a shared box. In this case it is immediately apparent that the wastewater treatment plant (upper left, purple) and the parking facilities (lower left, grey) together account for about a third of total energy consumption across all city buildings.

Adding building size and relative energy intensities into the visualization can help bring the picture into clearer focus. The following chart shows building size, annual energy consumption, and Energy Use Intensity (EUI) for the same group of buildings that is shown in the treemap on the previous page. Analyzing buildings based on their relative EUI can help:

- Identify poor performers
- Identify exemplary performers
- Determine to what extent building size is driving energy use
- Recognize the relative impacts of potential improvements in particular buildings
- Compare building performance to national, regional, or customized benchmark EUIs

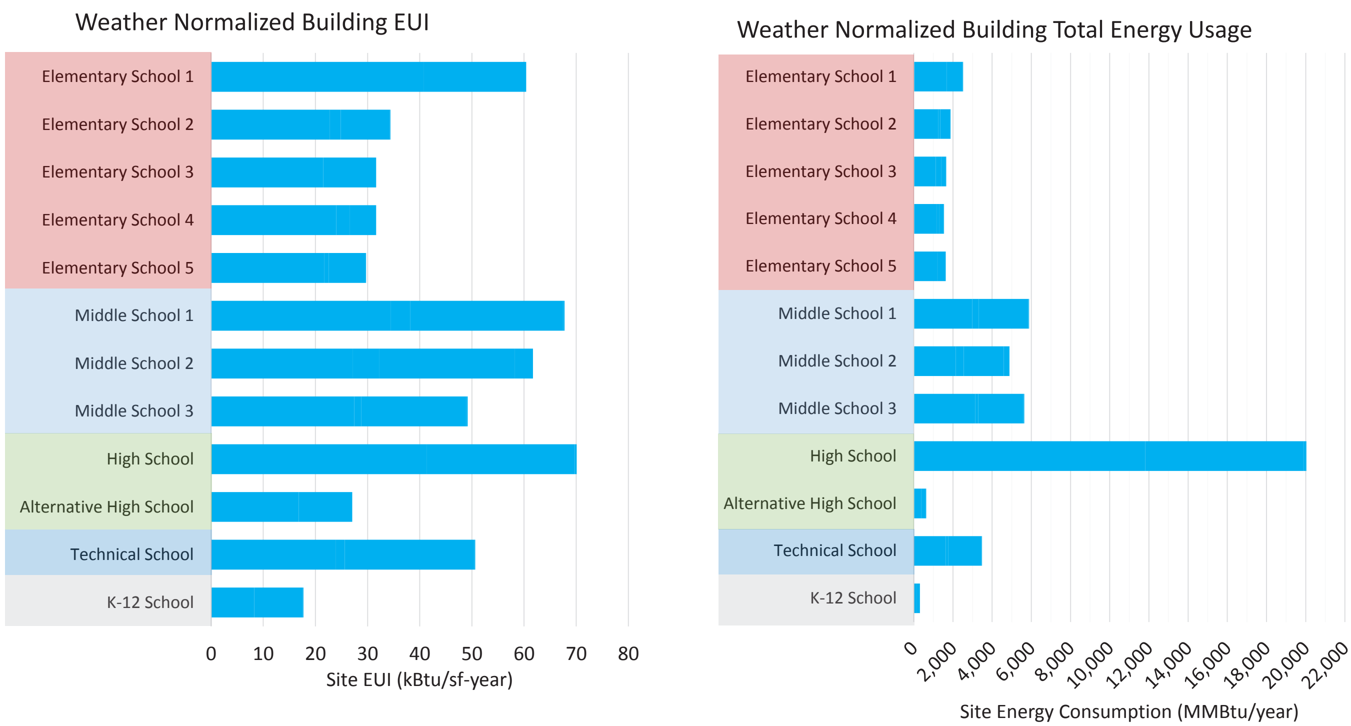


Energy Use Intensity, Size, and Total Energy Use of Buildings in City Portfolio

This bubble chart shows three building performance characteristics for each building. Larger buildings are to the right side of the figure (x-axis), and more energy-intensive buildings are farther up on the figure (y-axis). The size of each bubble indicates its total energy consumption: buildings with larger bubbles, such as the wastewater treatment plant (purple), have higher energy consumption.

Weather normalization is a process used to adjust energy usage data to account for yearly differences due to weather. This is important when comparing data from one year to a preceding or following year, as is common when tracking performance against a goal. It is also helpful to compare one city's buildings to a peer group in another climate zone.

The preceding two charts showed one year's metered energy usage across a portfolio of buildings. The following chart shows another way to look at the same basic data. In this case, we see both weather normalized EUI and weather normalized total energy consumption for all facilities in a sample school district. The EUI chart (left) can help identify buildings that are not performing as well as their peers. The total energy use chart can help identify which buildings account for the largest shares of total energy use. Looking at both these data points at the same time is very helpful to identify top energy consumers and potential candidates for upgrades.



Relative and Total Energy Use for Buildings in a School Portfolio

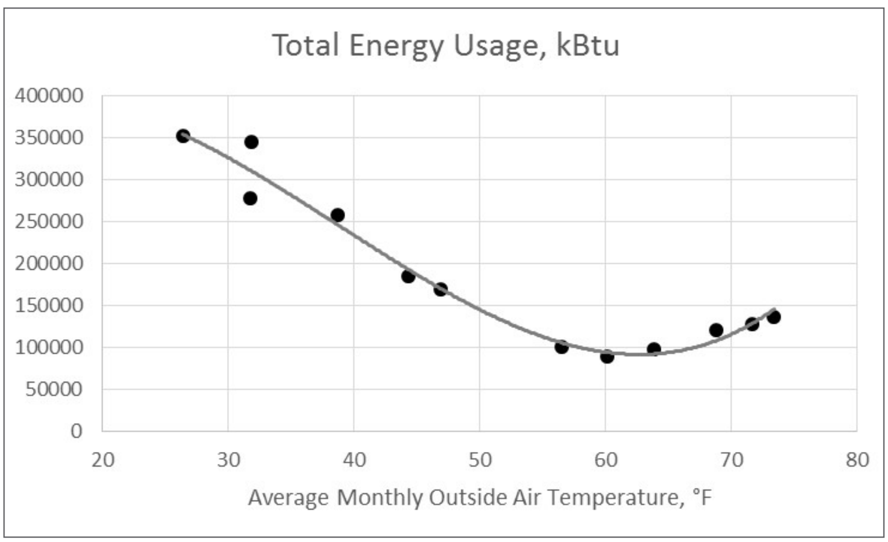
These charts show EUI (left chart) and total energy consumption (right chart) for all schools in a school district. Elementary School #1 has a significantly higher EUI than the other elementary schools, but is responsible for a relatively small amount of the total district-wide energy use. On the other hand, the High School has far and away the highest overall energy consumption and also has the highest EUI.

Building-Level Diagnostics

Remote diagnostics offer a way to further analyze benchmarking data in each building to uncover high priority opportunities for energy improvements without expensive sub-metering.

Energy Signatures

One useful way to visualize and evaluate energy patterns and trends is to use a graph called an Energy Signature. An energy signature is a plot of energy use at various outside air temperatures that provides a rough idea of how energy is used in the building at various weather conditions throughout the year. As expected, buildings use more energy when it is very cold or very hot outside than they do in more temperate conditions. Energy signatures can be developed using basic information: monthly utility bills, building size, and basic weather data. This chart shows an energy signature generated by plotting total energy usage (electric and gas are combined here) against the average outside air temperature for each month of the year.



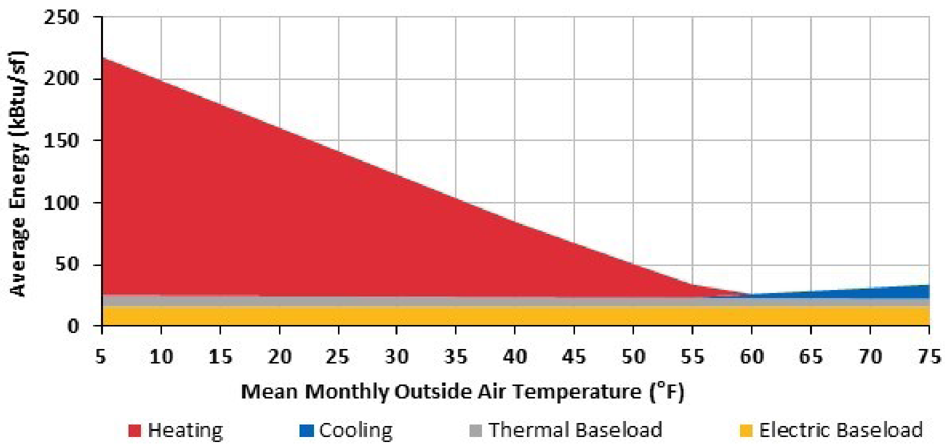
Building Energy Signature

This energy signature converts one year's worth of utility bill data (kWh for electricity and therms for gas) into common units of kBtu, then plots total monthly kBtu energy usage against the average outside air temperature for each month.

A variety of software tools, including NBI's FirstView,® can be used to remotely disaggregate benchmarking data into energy end uses and identify building-level opportunities. These virtual energy audits have become an important low-cost tool to define a prioritized list of buildings that deserve a walk-through building assessment. FirstView uses an algorithmic multivariable regression analysis to generate a physical model of the building and identify how much of the building's energy consumption is associated with weather-dependent end uses (heating and cooling) or weather-independent end uses (lighting, plug loads, water heating, etc.). By comparing each building to reference benchmark values based on a large database of previously analyzed buildings, automated diagnostic recommendations are available to help identify areas of opportunity by end use in each building.

Disaggregated Energy Signature

This FirstView output chart shows disaggregated energy by end use for a sample building. In this case, heating clearly accounts for most energy use in the colder months of the year, while cooling is a significantly smaller load overall, even in summer. The month of lowest consumption based on meter data is used to estimate electric and natural gas (thermal) baseloads.



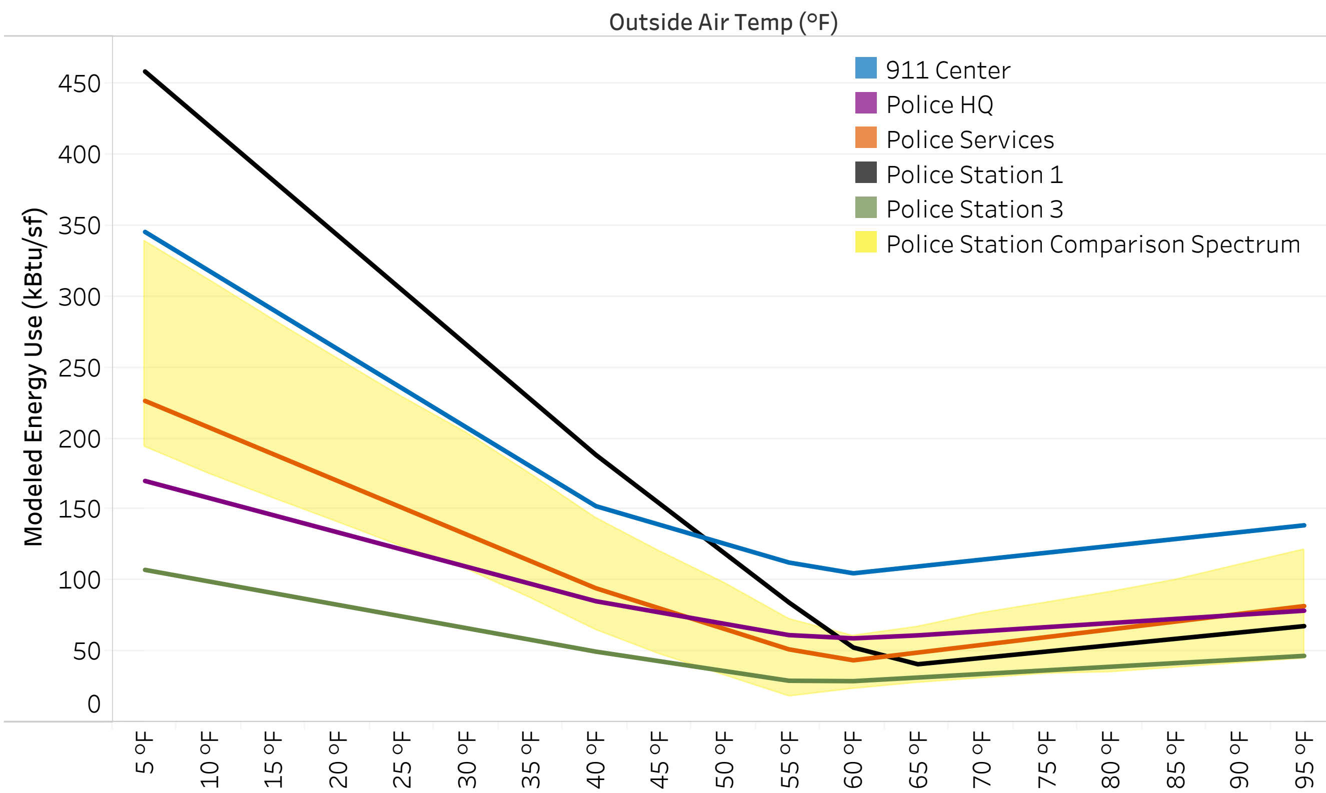
Portfolio-Level Diagnostics

Once buildings across the portfolio have been evaluated, and opportunities for operational and capital improvements have been identified, it is helpful to combine the results of those analyses into a broader view at the portfolio level. It can be useful to evaluate groups of similar buildings or city departments, as well as to evaluate all buildings across the entire portfolio.

Peer Building Comparisons

Building type and use influence energy use enormously. It is helpful to compare buildings to their peers: libraries can be compared to other libraries, fire stations to other fire stations, etc. In many cases these comparisons can be conducted at the department level. Many municipal departments include groups of peer buildings (e.g. fire stations). Cities, school districts, and other public building owners often have separate decision-makers for individual departments. Therefore, department-level comparisons can be helpful because they help streamline the analysis for a particular decision-maker.

This chart shows the energy signatures of five police stations compared to the range of typical performance for police stations based on NBI's database. The yellow shaded area shows the middle two quartiles for police stations. This is known as a comparison spectrum.

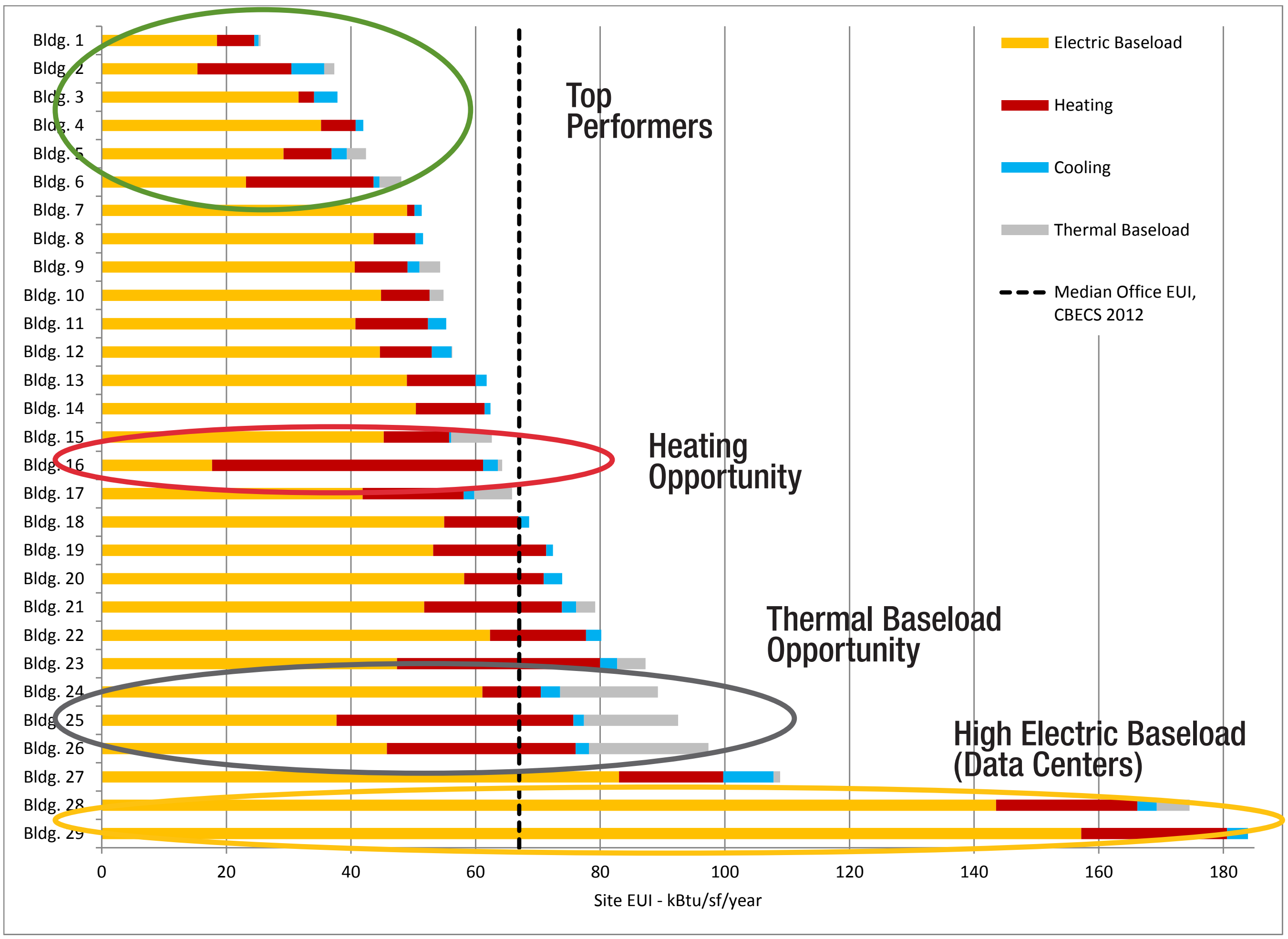


Energy Signatures and Comparision Spectrum

These five police stations' energy signature lines tell a story of widely varying energy performance among the department's facilities. The steep slope of the Police Station 1 energy signature (black line) indicates that the building is more sensitive to cold weather than its peers. FirstView and similar remote energy auditing tools can help flag potential problems with the building's air-tightness, insulation, heating system, or ventilation rates. On the other hand, Police Station 3 (green line) uses less energy than the comparison spectrum throughout the year. As a top energy performer year-round, this building may be a good place to look to find exemplary operations, practices and equipment.

End Use Disaggregation at the Portfolio Scale

The following graph shows the results of energy end-use disaggregation for a portfolio of office buildings. Potential opportunities at the building level stand out quickly. For instance, one building (circled in red) has an EUI very near the portfolio median value, and would likely not stand out on an EUI basis alone, but apparently has a much higher heating load than its peers. Similarly, three buildings (circled in grey) show unusually high thermal baseload usage and it may be worth looking for drivers of year-round natural gas usage in those buildings (hot water recirculation or HVAC reheat, for instance). The purpose of this analysis is to help prioritize building assessments in order to be strategic about energy efficiency investments.



Disaggregated Energy End Use Data across the Portfolio

Examining disaggregated energy end use data for a group of buildings can help identify candidates for further investigation, including building assessments, and can improve the effectiveness of building assessments by identifying likely areas of opportunities.

TARGETED FIELD ANALYSIS

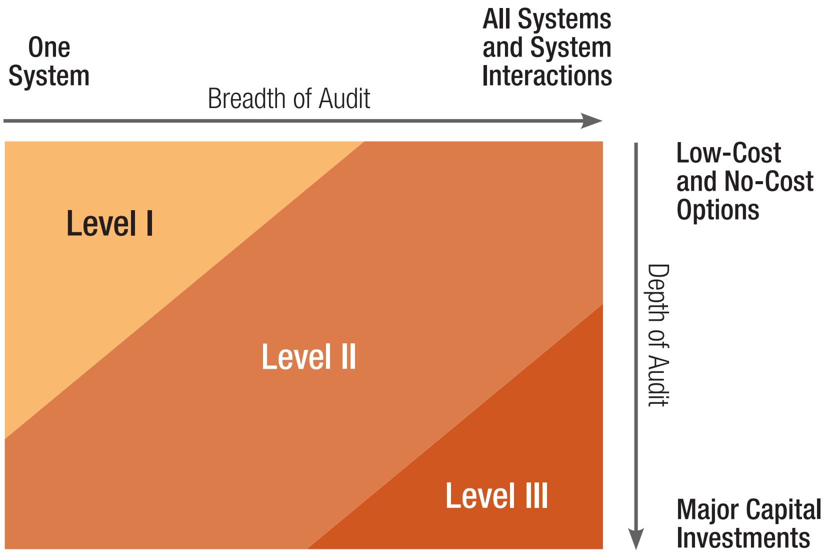
West Berkeley Library | Berkeley, CA | Image: Harley Ellis Devereaux

Once a portfolio of buildings has been analyzed and trends identified, the next step is to prioritize candidates for further investigation. Many considerations, not all related to energy consumption, influence the timing and scope of potential energy upgrades. System maintenance and replacement issues, comfort and life safety issues and other factors can trigger opportunities for ECMs. Combining energy performance analysis with broader issues can leverage funding to serve multiple needs in the portfolio, and make energy upgrades more likely and cost-effective when combined with other projects. There are prime opportunities for rolling ECMs into other projects such as deferred maintenance, equipment end-of-life, new construction or major renovations.

Using diagnostics to target specific buildings and subsystems can substantially reduce the scope and cost of building assessments. Generally speaking, it is a more efficient and effective use of time and money to target a limited number of buildings based on the priority levels rather than conducting in-depth assessments of every facility in a portfolio. This strategic prioritization can help decision makers determine where to perform building assessments that will identify concrete, actionable improvements at the facility level.

Here is the basic recommended approach:

1. Identify top candidate buildings/ assets for assessment
   a. Identify top candidates for deep retrofits (bringing up the rear)
   b. Identify top candidates for zero energy retrofits or new construction (leading the way)
2. Perform deeper facility assessments (e.g. energy audits) across prioritized buildings
3. Upgrade buildings based on deeper facility assessments



Energy Audit Levels

As the depth and breadth of an audit increase, so do the costs. Consider results from benchmarking data analysis as well as other factors when deciding what type of energy audit to perform in each targeted facility. Source: Advanced Energy Retrofit Guide for K-12 Schools (2013).

Facility Assessments

While it is sometimes possible to identify energy savings opportunities based only on the diagnostic tools described in the Diagnostics section above, in many cases the next step is an in-depth targeted assessment. Facility assessments vary in depth, and ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) provides well-respected standards for three levels of building audits, which can be an important analysis tool when scoping major building retrofit projects:

- Level 1 is a simple walk-through to identify low-cost/no-cost energy conservation measures (ECMs).
- Level 2 involves a detailed building survey, breakdown of energy use, and savings/cost analysis of ECMs.
- Level 3 focuses on capital-intensive projects and includes more rigorous engineering analysis with a higher level of accuracy on cost and savings calculations.

The goal of diagnostics is to identify the subset of buildings that are good candidates for this level of effort, rather than spending significant resources auditing a wide range of buildings. ***It is also common that there are cost-sharing opportunities for energy audits through entities such as local utilities.*** Advanced energy audits can also include building an energy model of the building. This can be useful if major upgrades are being considered and there is a desire to weigh multiple options to determine those upgrades that have the best return on investment.

Targeted Submetering

Submetered Circuits | University of California at Merced

After a facility assessment is conducted, in some cases an energy auditor or other technical expert may recommend targeted submetering. This typically involves the installation of on-site system-level monitoring equipment, as well as deeper performance analysis to identify specific system failures that are driving poor performance issues. Potential applications of targeted submetering include identifying specific equipment that may be driving high energy usage (for instance, HVAC unit controls and sequencing problems) or investigating performance issues in specific systems. It is important to first investigate obvious issues in any system suspected of causing poor performance. For example, in a rooftop HVAC unit these might include broken actuators or other components, stuck dampers, frozen coils, dirty filters, obvious leaks, or missing insulation.

Submetering should be mainly reserved for buildings with issues that cannot be resolved through analysis and remote diagnostics. Because this work tends to be relatively costly and time consuming, potential submetering instances should be discussed and approved by the energy team or another jurisdictional decision maker. Submetering equipment such as flow meters, power and temperature loggers may be available from a tool lending library at a local utility or from the Integrated Design Labs in the Pacific Northwest.

PLAN DEVELOPMENT

Bishop O'Dowd High School Center for Environmental Studies | Oakland, CA | Photo: David Wakely Photography

The purpose of gathering data, benchmarking, performing analytics, prioritizing opportunities, and performing targeted facility assessments is to build an informed, coherent, and reliable basis for the Facility Improvement Plan. The template plan provides a solid beginning, but each city, county, school district, or other jurisdiction will have unique goals, targets, facilities, and considerations. The process should ensure that decision makers feel ownership and are committed to implementing the plan. This can go a long way toward ensuring that the effort is successful.

Integrating Facilities Master Planning and Decision Makers

Building energy benchmarking and analytics are not done in a vacuum. Cities, counties, school districts, and other jurisdictions generally have existing master facilities plans, budgets, planning teams, and other existing framework elements. It is important to consider this framework at the jurisdictional, not just departmental, level. Developing a simple organizational chart (org chart) can be helpful to clarify who is responsible for budget and decision-making for specific buildings.

Just as the energy team may begin a new series of meetings or may use existing meetings and add agenda items, the Strategic Energy Management Plan may be a new document or may be a feature added into existing master planning and other framework elements. In either case, it is important that the plan be based on reliable data (e.g. benchmarking data) and help the jurisdiction set and achieve their Specific, Measurable, Actionable, Realistic, and Time-bound goals.

Target Setting

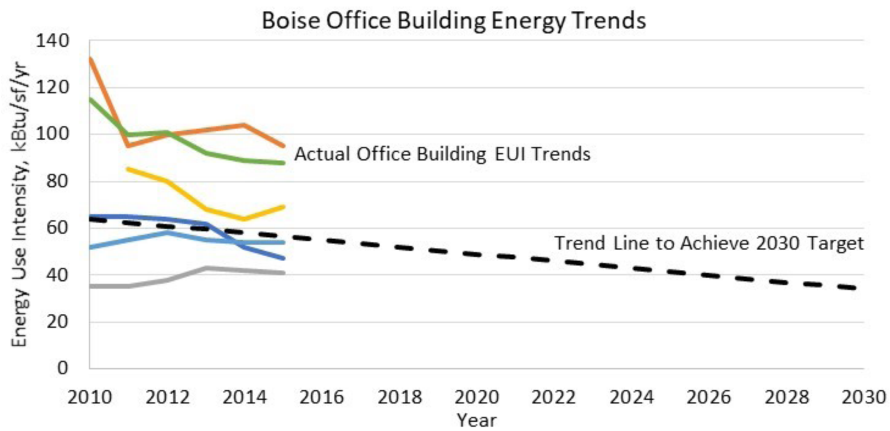
A common and often successful way to align broad organizational goals and specific facility-level operations is to set EUI-based targets by building type (police stations, fire stations, offices, community centers, etc.) across the portfolio.

ASHRAE Standard 100 (see Resources) is a good resource for EUI targets differentiated by building type and climate zone. Setting performance goals by department can help ensure apples-to-apples comparisons by building type. It also allows for comparisons between departments, which is typically how jurisdictions such as cities structure management.

Intermediate milestone targets at two to five year intervals are often helpful in maintaining and measuring progress.

Target Tracking

This graph shows how a selection of buildings in a portfolio are performing compared to overall energy reduction targets.



The framework for measuring progress against these targets will influence how progress is measured. If reductions are based on site energy (e.g. EUI), simply tracking utility bills can suffice to measure whether goals are achieved. If reductions are based on carbon emissions or source energy, some minor calculations will be required. These types of ongoing tracking and reporting tasks can be automated by web-based platforms, ideally the same platforms used to track benchmarking data.

Goals and Targets

This table shows existing departmental or jurisdictional buildings goals and targets for a sample city.

SAMPLE Goals for Existing Buildings	2015 Target	2017 Target	2020 Target	2025 Target
Upgrade city facilities to maximize energy savings and reduce loads	10% reduction	30% reduction	50% reduction	Carbon Neutral
Install on-site renewable energy	0%	0%	10%	15%
Purchase renewable energy credits				5%
Cumulative energy savings	10%	30%	40%	80%

Most energy reporting disclosure ordinances around the country use Energy Star Portfolio Manager as the main data repository and reporting tool, and public and private entities around the country have embraced ESPM as a way to track the performance of their buildings. Consider add-on tools such as Maalka (a Community SEM development partner, at www.maalka.com) to augment the capabilities of ESPM or other platforms in terms of data visualization, tracking performance against goals, embedded analytics, and automated reporting.

Prioritization

It is helpful to schedule a prioritization group meeting with key Energy Team members including decision makers and knowledgeable facilities/planning representatives in which results of benchmarking data analysis are summarized. The prioritization can be accomplished in several ways. The Master Buildings List spreadsheet template includes a column for tracking facility assessment suggestions and priority levels.

Factors to consider when prioritizing buildings include:

- Facilities Master Planning
  - Existing facility renovations, upgrades, and use type retrofits
  - Removal of facilities (tear-downs)
  - New construction plans
- Budgetary and financial considerations
  - Deferred maintenance requirements
  - Funding cycles and timing
  - Utility incentive availability
- Non-Energy considerations
  - Facility and equipment assessment
    - » Maintenance requirements
    - » Equipment service life remaining
  - Occupant comfort, safety, health or productivity impacts
  - Maintenance burden impacts
  - Equipment service life (Note that for most utilities, equipment replacement incentives apply only to replacements of functional equipment; once the equipment fails the incentive opportunity is significantly lower)
  - Community Access
  - Resiliency
- Benchmarking results and trends
  - Buildings with high annual energy usage, energy cost, and/or demand charges
  - Buildings with high EUI relative to their peers (see Resources section for comparison EUI sources)
  - Buildings showing an increase in energy consumption over time
- Results of remote energy diagnostics
  - Building-level energy upgrade opportunities
  - Buildings with high heating, cooling, or baseload relative to their peers
  - Diagnostic findings and recommendations
- Already-completed upgrades
  - Operational and behavioral upgrades such as scheduling, reducing plug loads and thermostat settings
  - Low-hanging fruit (e.g. lighting) upgrades and retrofits
- Load-reduction opportunities (to help reduce HVAC equipment capacity needs)
  - Weatherization, air sealing, and insulation
  - Plug load reduction opportunities

Address operational opportunities first, then budget for capital upgrades.

Criteria for Existing Building Upgrades

Energy is an important consideration for cities when evaluating and justifying building upgrades, but in many cases it takes a combination of energy and non-energy considerations to gain approval for capital projects. Just as in the prioritization process, energy savings should be considered alongside considerations such as:

- Occupant comfort, health, safety, and productivity
- Maintenance requirements and costs
- Equipment end-of-life replacement opportunities

Asking specific questions about proposed projects during energy team meetings can be a helpful way to identify key criteria and be sure that existing building upgrades under consideration are evaluated as holistically as possible. This is not an exhaustive list by any means, and each jurisdiction will have unique priorities and requirements.

1. Have operational and behavioral upgrades such as scheduling, reducing plug loads and thermostat settings been completed?
2. Have load reduction upgrades such as air sealing and better insulation been completed or considered before larger capital investments? Load reduction can reduce the size of equipment needed.
3. Are capital improvements strategic and well planned to calculate ROI over the life of the equipment not just the upfront price?
4. Is the emphasis on achieving heating efficiencies through more efficient HVAC systems, sizing and distribution?

Installing a new HVAC unit | Vancouver, WA

IMPLEMENTATION

Boston Carpenters Training Center | Boston, MA

The implementation of the Community SEM Plan is where the rubber meets the road. Specific energy team members, or other individuals (for example, department heads) will typically have responsibility for and oversight of specific facility improvement opportunities, including capital upgrades as well as operational improvements. These projects, prioritized and described in the Community SEM Plan, must be evaluated from a financial perspective. Typically, upgrade projects are included in department-level master plans and capital budgets. This generally requires active planning participation and approval from department heads and/or finance staff. Energy team members typically must obtain approval from decision makers for these investments and include all significant expenditures in the budgeting process.

Identifying Roles and Responsibilities

For each step along the way, a specific person or team must be responsible for delivering or completing each task. This table shows key responsibilities and typical primary and supporting responsible parties. This example is for a city; a school district, county, or other jurisdiction may be organized differently.

Task	Potential Primary Responsible Parties	Potential Supporting Role
Initial Data Collection	Energy Manager, Sustainability Director, Analyst, or Intern	Utility Account Reps, Intern(s), Consultant
Benchmarking System Setup	Sustainability Director, Analyst	Consultant
Benchmarking Data Maintenance	Sustainability Director, Analyst	Consultant
Create Master Buildings List	Consultant, Sustainability Director, Analyst	Department Heads
Building and Portfolio Diagnostics	Consultant	Sustainability Director
Building Performance Reporting	Energy Manager, Analyst	Sustainability Director
Building Performance Report Review	Department Heads, Sustainability Director	Analyst
Develop Strategic Energy Management Plan	Consultant, Sustainability Director	Analyst, Department Heads
Departmental Performance Tracking	Department Heads	Sustainability Director
Financial Evaluation	Sustainability Director, Executive Branch staff	Accounting staff
Budgeting	Executive Branch staff	Accounting staff
Reporting to Policymakers	Sustainability Director	Department Heads
Reporting to Public	Sustainability Director	Communications staff

Operational Policies

A building designed to high standards of performance relies on efficient operation to reach its potential. An operational policy across buildings, at the department or the jurisdictional (city, school district, etc.) level, can help maintain a high standard of operations and keep performance drift in check. It is important to find the right balance between energy efficiency and occupant comfort and productivity. Energy efficiency is not freezing in the dark!

Sample Operational Policy

Temperature Setpoints and Natural Ventilation	Plug Loads	Lighting	Staff awareness recommendations & policies
• Occupied Temperatures: 76°F (summer) and 69°F (winter) • Unoccupied Temperatures: 80°F (summer) and 55°F (winter) • Doors and operable windows may only be opened only when the thermostat for that area reads between 70°F and 75°F	• Computers, printers and miscellaneous office equipment shall use networked energy saving settings and shall be turned off when not in use • Office equipment and appliances must be Energy Star rated or equivalent, and Energy Star settings shall be enabled in this equipment • Refrigerator coils must have adequate airflow and shall be cleaned annually	• Lighting shall be turned off or dimmed when sufficient daylight available or the area is not in use • Fluorescent or LED task lighting should be used in place of overhead lighting where possible • Incandescent lights should be replaced with CFL or LED bulbs • Staff may request lighting level adjustments	• Adjust blinds or curtains for sunlight and heat gain • Dress in appropriate clothing and layers • Fan of less than 8” allowed as needed • 100W Foot warmers available from facilities, no plug-in space heaters Orientations for newly hired staff shall include a review of this policy.

Tracking Energy Efficiency Upgrade Impacts

Tracking the impacts of energy efficiency projects as they are implemented helps decision makers see the benefits of spending limited time and money on energy efficiency. It also helps sustainability managers and other staff communicate success stories both internally (within the city, school district, or other jurisdiction) and externally (to the community at large).

As projects are completed in individual buildings, performance data and the date of project completion should be tracked. The impact of specific operational and physical upgrades should be tracked by establishing a pre-upgrade period and comparing pre-upgrade energy use to post-upgrade energy use. These time periods are often one year, although if targeted submetering equipment is used the time periods may be on the order of weeks rather than years. Several software tools are available to weather-normalize energy data and improve the accuracy of pre/post comparisons. When feasible, it is good practice to track non-energy impacts, such as occupant comfort and productivity. The Center for the Built Environment has developed and standardized tools and methods for measuring building occupant satisfaction (see Resources).

Establishing a robust benchmarking program is an important first step to be able to track the energy savings impacts of whole-building upgrades. When utility incentives are obtained for a project, savings estimates are often evaluated by a third party; these results can provide useful validation of project impacts. At a more basic level, simple spreadsheet-based calculations can demonstrate the impact of an upgrade for some upgrade projects. For example, the approximate impact of a lighting retrofit can be estimated as: (pre-retrofit total installed lighting kW minus post-retrofit total installed kW) times building hours of operation. At a minimum, monthly energy data should be logged for at least one year before and after upgrades are completed.

ONGOING MONITORING AND CONTINUOUS IMPROVEMENT

Zero Net Energy Center | San Leandro, CA | Photo: FCGA Architects

Occupant Engagement: Help building occupants and visitors understand the impact their choices have on building energy use and what they can do to help achieve energy and climate goals.

Community Engagement Options:

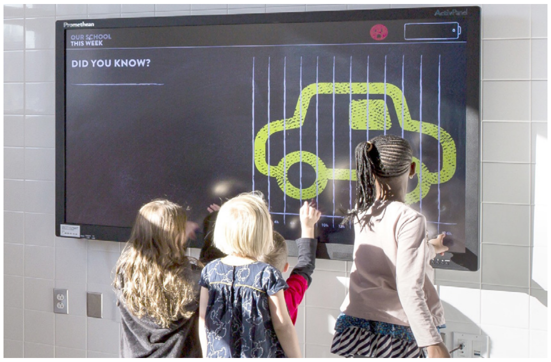
- Citizen advisory group
- Student government
- Email newsletter
- Website dashboard
- Dashboard in buildings
- Benchmarking data in curriculum (for schools)
- Incentives
- Disclosure ordinance outreach
- Neighborhood or business associations
- 2030 Districts

Organizational goals inform and help define energy and climate targets. Tracking performance against those goals, at the organizational level as well as the facility level, is key. Clearly assigning responsibility for facility energy performance target tracking and reporting helps ensure that the Community SEM Plan is a living document and is fully implemented. Energy team members, department heads, or facilities staff may play some or all of these roles.

Reporting is essential to communicate the progress of Community SEM, to share successes and lessons learned, and to ensure transparency with the public. Consider the following audience for reporting:

- Administration (Mayor, City Council, and department heads) – interim reports on progress towards goals
- Decision Makers (City Council) – annual report just before budget season
- Community – annual energy report

Consider the format and frequency of reports, both external and internal. Most organizations tend to report on performance against targets and goals monthly, quarterly and annually. What level of detail is meaningful to each audience? For example, management may want quarterly reports that show year-over-year comparisons of energy use and cost per building and for the entire portfolio. Facility staff may want monthly reports that show daily variations as well as overall trends year-over-year. External reports such as annual city planning reports intended for citizens often publicize goals, projects, incentives and metrics such as EUI and shows rankings of buildings with a percentage change in energy use or cost versus the prior year(s). Rather than creating a standalone energy report, consider adding energy and climate targets as a standing agenda item or line item in an established regular reporting structure, for instance a Sustainability or Livability Report.



Kathleen Grimm School of Leadership and Sustainability | Staten Island, NY Photo: James Ewing

FINANCING

Franklin High School | Portland, OR | Image: DOWA-IBI Group

Securing financing for projects is often a major challenge to achieving the climate and energy efficiency goals of any city, school district, or organization. A range of financial analysis and financial tools are available to help decision makers and others fully understand the cost, benefits, and financial implications of Community SEM.

ROI Analysis for Capital Investments

Return on Investment (ROI) analysis presents a more comprehensive picture than simple payback to evaluate and prioritize upgrade opportunities. Many leading cities require ROI analysis as a key part of Requests for Proposals (RFPs) when seeking bids for work on buildings. ROI analysis should reflect financial and environmental priorities for the organization and is typically based mainly on simple payback. A more comprehensive approach includes simple payback, opportunity cost, maintenance savings, occupant satisfaction, comfort, waste reduction and other factors. Life Cycle Costing Analysis (LCCA) is a very useful tool to evaluate the true costs and benefits of long-lived public assets like building components and systems.

Financing Mechanisms

A wide range of funding opportunities are available and project budgeting will depend on a community's accounting processes. It is important to begin with a solid understanding of current processes before considering new and innovative approaches. Critical questions to ask include:

- Are budgets managed centrally or at the department level?
- Are utility bills managed centrally or at the department level?
- Will project funding be transferred out to the department who then manages the funds and potentially the project or will central management of the project implementation be maintained?

Incentives, often from utilities and energy efficiency program implementers, and grants are available. These not only help to reduce costs but can also serve as good indicators of which projects are cost effective because most utilities are required to analyze the cost effectiveness of a measure before being able to provide an incentive for it.

Financing Mechanism Examples:

Utility Rebates and Incentives

Bonds

Performance Contracting

Grants

Revolving Energy Funds

Revolving Energy Funds (REF), also known as Revolving Loan Funds (see Resources) can be a very powerful tool to help institutionalize energy upgrade projects across an organization. REFs can use either internal or external funding sources. In an internal REF, a fixed pool of capital is set aside to pay for energy upgrades. Some or all of the utility cost savings from those projects are used to fund additional projects. Some mechanisms often used to create internal REFs include:

- Establishing a budget line item for a fixed number of payments into the Energy Fund
- Contributions from Capital Budgets of all departments that will benefit from use of the fund
- Establishing a fixed or percentage "utility surcharge" that all departments must pay in addition to their utility bill

Many external REFs are administered by states: more than 30 states have established loan funds for energy efficiency and renewable energy upgrades. The benefit of using an external REF is that budget dollars do not need to be set aside to launch the Fund. However, interest rates and terms vary significantly among external REFs. In some cases, projects have had success leveraging internal funding with external REF resources by using the internal funding as a credit enhancement.

Revolving Energy Funds

Three examples of Energy Funds from cities around the nation. Source: Allegheny Science & Technology.

City	REF Formed	Initial Funding	Sustaining Funding	Managed By	Model	Project Criteria	Repayment Basis
Ann Arbor, Michigan	1998	$100k/year for 5 years, from City's General Fund	80% of projected (energy audit) avoided costs for 5 years	Energy Office; Committee oversees project selection	Grant	3 funding categories: 70% Direct savings, max 5 year payback 20% educational 10% data gathering (e.g. audits)	Projected avoided cost*
San Jose, California	2005	$200k utility incentive rebate; $60k from city depts.	100% of projected (audit) avoided costs for 2 years; utility incentive rebates	Environmental Services Department	Grant	Projects must have payback ≤ 5 years	Projected avoided cost
Hillsboro, Oregon	2010	$28k prior energy efficiency project; $23k facilities management budget	50% of projected (energy audit) avoided costs in year 1, 25% in years 2 and 3	Sustainability Manager; Committee oversees project selection		Projects capped at $25k, larger projects must demonstrate avoided costs	In-house cost avoidance calculations

** Repayment was originally based on actual avoided costs but was changed to projected avoided costs. The city cited both difficulties in measuring savings and delays in accounting processes resulting from waiting for actual energy performance data as reasons for making this change.*

CONCLUSION

NREL Research Support Facility | Golden, CO | Photo: Dennis Schroeder

Cities and states are increasingly primary drivers of progress in achieving energy efficiency and climate goals. As the saying goes, change starts at home. By focusing on public building portfolios, cities, counties, regional governments, state agencies, and school districts can lead by example and make a real difference. By taking a strategic approach to building energy management, jurisdictions can avoid increases in operating costs, demonstrate sound fiscal management, and create local jobs while increasing comfort, productivity and satisfaction for building occupants.

This Community Strategic Energy Management Guide is one of many tools available to help public building portfolio holders lead by example. A wide variety of tools, guides, and other resources are listed in the following section to help cities and other public building portfolio holders transform the built environment.

Discovery Elementary School | Arlington, VA
Photo: VMDO Architects

RESOURCES

West Berkeley Library | Berkeley, CA | Photo: Harley Ellis Devereaux

Stakeholder Engagement

Schools stakeholder guide. https://newbuildings.org/resource/zero-energy-schools-stakeholder-engagement-guide/

ZNE Charrette Toolkit. https://newbuildings.org/resource/zne-charrette-toolkit/

Goal Setting and Vision

NBI's Action Paths. https://newbuildings.org/wp-content/uploads/2015/12/nbi_Codes_10ActionPathsZNE_2017.pdf

C40 Cities Good Practice Guide: Municipal Building Efficiency. https://c40-production-images.s3.amazonaws.com/good_practice_briefings/images/8_C40_GPG_MBE.original.pdf?1456789018

2020 Leadership Agenda for Existing Commercial and Multifamily Buildings by the State and Local Energy Efficiency Action Network. https://www4.eere.energy.gov/seeaction/system/files/documents/SEEAction_Leadership%20Agenda-finalv4.pdf

2030 Districts homepage. http://www.2030districts.org/

Architecture 2030. http://architecture2030.org/

Star Community Index. http://www.starcommunities.org/

PV Watts® Solar Calculator. http://pvwatts.nrel.gov/

Transition to Sustainable Buildings: Strategies and Opportunities to 2050. https://www.iea.org/publications/freepublications/publication/Building2013_free.pdf

Benchmarking

Learn About Benchmarking, Energy Star Portfolio Manager. https://www.energystar.gov/buildings/about-us/how-can-we-help-you/benchmark-energy-use/benchmarking

The Benefits of Benchmarking Building Performance, Institute for Market Transformation. http://www.imt.org/resources/detail/the-benefits-of-benchmarking-building-performance

US Building Benchmarking and Transparency Policies, Institute for Market Transformation. http://www.imt.org/resources/detail/map-u.s.-building-benchmarking-policies

Americorps Volunteers in Service to America (VISTA) program. https://www.nationalservice.gov/programs/americorps/americorpsvista/

Building Energy Use Benchmarking, Department of Energy. https://www.energy.gov/eere/slsc/building-energy-use-benchmarking

NBI and National Grid Benchmarking 101 Webinar. https://newbuildings.org/webinar/benchmarking-101/

NBI and National Grid Benchmarking 102 Webinar. https://newbuildings.org/webinar/national-grid-presents-benchmarking-102/

Maalka Data Quality Tool. https://dataquality.maalka.com/

Diagnostics and Data Visualization

NBI Advanced Benchmarking recorded training modules. https://newbuildings.org/module-1-introduction-to-advanced-benchmarking/

NBI A Diagnostic Review of Building Energy Performance. https://newbuildings.org/wp-content/uploads/2015/12/nbi_fv_FAQ_2017.pdf

Targeted Field Analysis

PNNL Guide to Energy Audits. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20956.pdf

Department of Energy Building Analysis Tools: https://energy.gov/eere/buildings/analysis-tools

Plan Development

Building Commissioning Association: Sample Owners Project Requirements Template. https://www.bcxa.org/knowledge-center/best-practices/cx-application-tools/#item-1

NBI Sensitivity Analysis. https://newbuildings.org/resource/sensitivity-analysis-comparing-impact-design-operation-and-tenant-behavior-building-energy-performan/

NBI topical webinars (National Grid series): Existing Building Retrofits, Small HVAC, Office Buildings, Benchmarking 101-102. https://newbuildings.org/webinar/

Template Strategic Energy Management Plan and Template Master Building List spreadsheet. www.newbuildings.org/community-sem

EUI targets by building type. Source: ASHRAE Standard 100. https://www.ashrae.org/resources--publications/bookstore/standard-100

Submetering of Building Energy and Water Usage, National Science and Technology Council, 2011. http://www.allianceforwaterefficiency.org/uploadedFiles/Resource_Center/Library/submetering/NIST-2011-Submetering-of-Energy-and-Water-Use.pdf

Metering Best Practices: A Guide to Achieving Utility Resource Efficiency, Release 3.0, US DOE 2015. https://energy.gov/sites/prod/files/2015/04/f21/mbpg2015.pdf

Implementation

Daylight Pattern Guide. http://patternguide.advancedbuildings.net/

Heat Island Compendium. https://www.epa.gov/heat-islands/heat-island-compendium

NREL Advanced Energy Retrofit Guide for K-12 Schools. https://www.nrel.gov/docs/fy14osti/60913.pdf

ASHRAE 189 "High Performance Building" Specifications. https://www.ashrae.org/resources--publications/bookstore/standard-189-1

ASHRAE Standard 100. https://www.ashrae.org/resources--publications/bookstore/standard-100

Ongoing Monitoring and Continuous Improvement

Plug Load Guide. http://newbuildings.org/resource/plug-load-best-practices-guide/

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VanDusen Botanical Garden Visitor Centre Green Roof | Vancouver, British Columbia
Photo: Nic Lehoux

Hood River Middle School Music and Science Building | Hood River, OR | Photo: Michael Mathers

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