DRAFT BENCHMARKING PLAN FOR GOVERNMENT BUILDINGS

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EXECUTIVE SUMMARY

Energy efficiency is one of the most effective ways to cut costs. Understanding energy consumption is the first place to start when considering any energy efficiency effort. Energy use benchmarking is measuring a buildings energy use over time, and comparing it to other similar buildings. Energy benchmarking helps us understand our energy use, so that we can make changes that will help plan and prioritize limited resources in order to save money and save energy. According to ENERGY STAR® "Energy expenditures average more than $2 per square foot in commercial and government buildings, making energy a cost worth managing." ENERGY STAR® also notes that buildings that benchmark their energy use on a regular basis tend to reduce their energy consumption by 2.4% per year, on average. Government building benchmarking:

- provides objective data on energy use and the benefits of improvements;
- increases awareness, which may lead to behavior change;
- facilitates planning;
- provides a baseline for measuring improvements, and helps to develop a comprehensive energy management action plan

provides data to evaluate the business case for capital investments in energy retrofits. Several other communities in Texas, such as San Antonio, Fort Worth, El Paso, and Houston have already seen the benefits of benchmarking and managing the energy performance of their facilities. Therefore, has prepared this plan for benchmarking. The goal of this plan is to . To achieve this goal we propose benchmarking . We will benchmark . In order to achieve our goals, we will work with a number of stakeholders, including:

Name	Email Address	Phone Number

We will input the data into EPAs free Portfolio Manager tool, which can help us track the data and understand the results. The team will then analyze that data so that we can make informed energy management decisions and create a broader energy management strategy for our buildings. Throughout the process, we will communicate the results to the project stakeholders.

INTRODUCTION

Benchmarking is the process of measuring a building's energy performance and comparing it with its own energy baseline, and/or comparing the building's energy performance with the energy performance of similar types of buildings. The information gathered from benchmarking can be a first step in creating a Community Energy Strategic Plan (CESP). Local governments have the potential to reduce waste and provide savings to taxpayers by developing a CESP that focuses on energy use in their own buildings and operations (e.g., City Hall, public schools, wastewater treatment plants, streetlights, transportation fleet). A CESP can be used to reduce energy and water costs, reduce maintenance costs, and help identify mechanical issues before they become critical.[1] In addition, benchmarking studies can simply and quickly identify high performance buildings, so that best practices or efficient building technologies can be identified and shared with underperforming

facilities.

This draft benchmarking plan provides a suggested five-step process for communities to benchmark their buildings and to use that benchmark information to create a strategic energy management plan. The information in this plan has been built using the Texas State Energy Conservation Office on-line energy benchmarking planning tool.

STEP 1 – WORK WITH STAKEHOLDERS TO DEFINE GOALS

Successful benchmarking programs include multiple actively-involved stakeholders. The stakeholders typically come from many different departments in the community government and may even include external partners.[2] The initial list of stakeholders for is:

Name	Email Address	Phone Number

This list might be revised and refined after your first meeting with your internal stakeholders. Remember that it is important to involve technical, financial, and end-user stakeholders in the process.

Provide Information

Many of your stakeholders may not be familiar with energy benchmarking. Therefore, the first step is to explain why you are proposing the project, the benefits of energy benchmarking, and how that information can be used to prepare a CESP. When discussing the idea with your internal stakeholders, be sure that they understand why this program being proposed and make sure that there is buy-in. One resource that might help you build the case is the Institute for Market Transformation two-page fact sheet, "Energy Benchmarking and Transparency Benefits".[3] More detailed information can be found in the DOE Building the Business Case for EE.[4]

Establish Goals

Once you have commitment from the internal stakeholders to participate, work with them to develop the project goal. Establishing the purpose for benchmarking will influence the way data is collected and analyzed. Some of the goals for benchmarking include the following:

What to Benchmark

Once you have reached consensus on the project goals, work with stakeholders to create the project scope. First, develop an inventory of buildings in order to understand the building stock and as key stakeholders. The primary data you are looking for is:

- Building Address
- Building Square Footage
- Property Type
- Department
- Building Manager Contact Information

Other helpful data include:

- Building Age

- Building Occupancy
- Building Use

When developing the scope of your program, consider the energy savings potential. Use the building inventory to help you identify the building types and sectors that may provide the greatest saving opportunities.[7] From a review of Untied States Department of Energy (DOE) Building Performance Database (BPD) for Texas, lare users typically include: institutional settings, such as hospitals, prisons and universities, as well as data centers, grocery stores, and large commercial office.

The proposed scope includes for this project is:

Benchmarking the resources:

- Whether to benchmark all of your government buildings or just a subset based on size of building and function.
- What building data will be benchmarked and how do you get that data? (Electricity, natural gas, water, waste)

Once the scope is complete, work with your stakeholders to develop schedule/time line for completion of initial benchmarking and ongoing benchmarking, along with plans for communication and quality assurance

Review the goals established for the benchmarking program to determine the data outputs required. Consider requirements as specified in energy policy, energy objectives, targets, action plans, as well as legal and other requirements. Typical values include:

- Gross Consumption—measuring the total energy use allows for tracking energy use reduction, typically converted to a common unit such as British Thermal Units (Btu).
- Demand—for some organizations, demand charges constitute a considerable portion of energy costs. A common unit for electricity demand is kilowatt (kW).
- Energy Use Intensity (EUI)—a measure of energy consumption per production or footprint such as Btu per square.
- Greenhouse gas (GHG) emissions—typically a calculated value based on the energy consumption of facilities measured in carbon dioxide equivalents (CO_2e)
- Energy cost —the measurement of purchase cost for energy and energy fuel sources.
- Per occupant or unit of productivity – for example decisions to co-locate in one office building and reduce consumption at another facility would result in lower energy use per employee.

It is also important to determine the granularity and frequency of the output metrics required. Select a level of detail and frequency that is achievable and that contains enough resolution for meaningful analysis. The output metrics should be appropriate for the audiences to whom the results are communicated.

- Granularity:
  - System level—monitors the energy performance of individual equipment or systems. System level provides granular data for more precise energy management. Sub-metering may be required for this level of detail.
  - Facility level—monitors the energy use of the building as a whole, gathered from utility meter data. Facility level data provides whole building information, which is useful for tracking progress of facility energy use and identifying buildings that require further

attention.
  - Account level—monitors the energy performance of multiple buildings that are all connected with a single meter. Account level monitoring is found at campuses where individual building data is not available (in this case, sub-metering is encouraged).
  - Sub-group data—aggregates energy performance of buildings by grouping multiple meters or accounts under a department. This higher level view can aid in identifying groups of buildings that require further attention, and for tracking progress more broadly.
  - Portfolio wide—aggregates energy use across all buildings or accounts within a portfolio. This high-level view provides a context for the building energy use of an organization as a whole and is useful for demonstrating the overall progress toward a goal.
- Frequency:
  - Interval—monitors incremental data, typically on 15-minute intervals. Interval data allows for in-depth analysis for time-of-use or load shaping.
  - Monthly—monitors monthly energy use, typically through monthly meter data. Monthly data allows for energy analysis incorporating weather or operating characteristics in addition to month-by-month comparison.
  - Seasonal – monitors the consumption based on heating or cooling seasons to better understand the energy use required in each season specifically.
  - Yearly—monitors the annual energy use. Yearly data allows for annual planning and course analysis with weather and operating characteristics.

STEP 2 – BENCHMARK BUILDINGS

Once you have worked with your stakeholders define the scope of work to meet your project goals it is time to benchmark your buildings. A common tool used for benchmarking is EPA's Portfolio Manager.

ENERGY STAR® offers several types of Portfolio Manager Training including:

- Express Videos (inset link)
- Recorded training (insert link)
- live training (insert link)

Work with your team to identify sources and collect the required data from both external and internal sources. Required Data for Portfolio Manager:

- Portfolio Manager username and password.[8]
- Building information required includes:[9]
  - Street address
  - Year built
  - Contact information
  - Gross floor area
  - Key operating characteristics for each major space type
    - Occupancy hours
    - Number of occupants
    - Number of computers
    - Percent of floor space that is air conditioned and/or heated.
- 12 consecutive months of utility bills for water and all fuel types used in the building.

Accounting or finance departments often have utility bill information. If this information isn't readily available, contact your utility provider(s) as most will be able to easily supply this historical

information.[10]

General services, engineering, risk management/insurance, or maintenance often have building size and design information.

It is important to establish a quality assurance/quality control (QA/QC) plan to verify the data as you move forward in your benchmarking process. The benchmarking information is only as good as the inputs that are used.

STEP 3 ANALYZING YOUR BENCHMARKING DATA

Once you have gathered your data an input it into Portfolio Manager, you can use the verification process to promote accurate and transparent reporting. Consider the following when developing a verification process:

- Identify the metering configurations for your inventory. These configurations vary. Campuses often have individual electricity meters for buildings, with a single site-wide water meter.
    - TIP: Ensure that each meter is assigned to the correct facility.
- Identify unusually high or low performance ratings or energy use intensity (EUI) [11]
- Compare the reported footprint with building inventory lists or real property data
- Check that the appropriate facility type is selected for facilities
- Scan for gross rounding of footprint values
- Ensure facility names appear appropriate and real (e.g., not "sample facility")
- Perform onsite verification (sometimes through a third party)
- Consider random sampling of utility meter data to allow for more in-depth spot checks
- Establish a protocol for filling in gaps in data as needed (since not all data will be perfect).[12]
- Ensure staff is trained to ensuring quality reporting.
- Use the 'alerts' and performance ratings in Portfolio Manager to quickly identify potential issues.[13]

Documentation of the energy consumption and cost analysis must be in a form that is meaningful and clear to all levels of the organization. It can be as simple as basic graphs of energy consumption or as complex as statistical models which identify the relevant variable(s) affecting energy consumption. Consider the following tips for analyzing building energy performance:

- Establish baseline of energy performance
- Benchmark and track facility energy consumption and EUI progress:
    - Compare against the baseline and use Portfolio Manager to see how a building's or facility's energy use compares against itself over time.
    - Compare with energy simulation/energy modeling—use an energy modeling tool to evaluate a building's energy performance versus potential performance.
    - Perform a statistical review—compare with Commercial Buildings Energy Consumption Survey (CBECS) data for national median EUI, Portfolio Manager's national energy performance rating, or DOE building performance database.
    - Compare across portfolio—evaluate the performance of individual buildings to similar buildings or the portfolio average.
    - Start high-level and zoom in for detailed analysis as required—review portfolio- or department-wide energy performance to identify low-performing groups of buildings; target buildings with high EUI's for further investigation.

STEP 4 COMMUNICATE RESULTS AND DEVELOP AN ENERGY STRATEGY

Just gathering benchmarking data will not result in change. The next step in the process is to clearly communicate the results of the benchmarking and use that information to make energy management decisions and create a broader energy management strategy for your buildings. The stakeholder group can use the benchmarking information to assist in creating a CESP. The DOE has created a Guide to Community Energy Strategic Planning, which is a step-by-step process for creating a robust strategic energy plan for your government and community.[14] Consider the following tips when communicating the benchmarking results and creating an energy strategy:

- Demonstrate the value—build a case for a CESP by showing the benefits of acting on the information.[15] The DOE CESP website, the Rocky Mountain Institute's "Business Case for Energy Efficiency Retrofit Renovation,"[16] and the American Council for an Energy Efficient Economy's "Local Energy Planning in Practice: A Review of Recent Experiences"[17] can help you build the case.
- Be clear about the program intent. Focus on finding opportunities to improve cost performance.
- Establish clear roles and responsibilities for the energy strategy team.
- Include third-party organizations, such as utility account representatives to assist with data access, incentive program information, or consultants to inform energy project timelines.
- Empower stakeholders to integrate benchmarking and strategic energy management into existing operations and provide training. For example, the City of El Paso, TX recently empowered its fire and library departments to take action and reduce energy consumption of their buildings.[18]
- Set timelines for deliverables—establish the program critical path and set an achievable progression of milestones and project checkpoints.
- Schedule check-ins and share results regularly—build momentum, assess status, and add accountability.

STEP 5 IMPLEMENT THE CESP

Once the community has created the CESP, it is time to implement the program. During implementation, continue benchmarking so that you can accurately measure progress toward your goals. Therefore, the team should set a schedule for regular appraisal of the benchmarked portfolio after the initial investigation or when new measures have been implemented. The benchmarking team should consider:

- What cycle of review is appropriate and feasible? Monthly, quarterly, annually, biannually?
- Are the metrics being tracked still valuable?
- Has the type of available data changed based on energy service provider, sub-metering, independent studies (e.g., GHG)?
- Is data being received and tracked in a timely way so as to be useful for planning and project execution?
- Have the building inventory or building use characteristics changed substantively?

It is also important to continue to keep the stakeholders involved. The stakeholders can help the strategic energy management plan evolve and guide the benchmarking team. The stakeholders should evaluate:

- Have processes been established that will allow for future benchmarking efforts to be completed easily? This could be a process for storing the consumption information from all

utility bills when they are paid.
- Does the benchmarking tool provide the appropriate information to assist in informed decision making?
- Is it accessible and usable to appropriate parties?
- Who is responsible for approving any changes to the CESP, and does that need to be updated?

The benchmarking team should compile the feedback received from the re-appraisal process, evaluate current capabilities, and evaluate the need for additional training or staffing. The team should also review other tools and service providers that may enhance your benchmarking activities. Finally, identify gaps and update the benchmarking plan as appropriate to support the goals of the CESP.

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- US EIA. *"2012 CBECS Survey Data."* https://www.eia.gov/consumption/commercial/data/2012/index.cfm?view=consumption (Accessed: February 25, 2016)

CASE STUDY INFO

- Best Practice: Benchmarking City Properties City of Houston Case Study & General How-To Guide for Citieshttp://www.harc.edu/sites/default/files/Project_Documents/Case%20Study%20%232%20Benchmarking%20Best%20Practices.pdf
- ENERGY SAVINGS PERFORMANCE CONTRACTING TO IMPROVE CITY FACILITIEShttp://www.harc.edu/sites/default/files/Project_Documents/Texas%20City%20Efficiency%20Leadership%20Council%20Best%20Practice.pdf
- EL PASO'S ENERGY SAVINGS CHALLENGEhttp://www.harc.edu/sites/default/files/El%20Paso%27s%20Energy%20Savings%20Challenge.pdf

FOOTNOTES

1

For example, after the City of Philadelphia implemented its Greenworks plan, municipal energy use was reduced by 4.9% over the first two years, avoiding nearly $4 million in energy costs. (Greenworks Philadelphia Update and 2012 Progress Report: www.phila.gov/green/pdfs/GW2012Report.pdf)

2

External partners may include non-profit organizations, universities, and others that can provide information and support for program development.

3

Download at: http://www.imt.org/uploads/resources/files/IMTBenefitsofBenchmarking_Online_June2015.pdf

4

http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/business_case_for_energy_efficiency_retrofit_renovation_smr_2011.pdf

5

The US Department of Energy (DOE) Guide to Community Energy Strategic Planning is a step-by-step process for "creating a robust strategic energy plan for your government and community. This

online tool can be found at: http://energy.gov/eere/slsc/guide-community-energy-strategic-planning.
In addition, the DOE eGuide Lite can be used to understand the basics of better energy
management. This tool can be found at: https://ecenter.ee.doe.gov/EM/SSPM/Pages/home.aspx

6

The U.S. Department of Energy (DOE) provided an overview of the EM&V process for energy
efficiency projects through its webinar Developing an Evaluation, Measurement, and Verification
Plan for Municipal Building Energy Efficiency Projects.
http://energy.gov/eere/wipo/developing-evaluation-measurement-and-verification-plan-your-energy-efficiency

7

Check out CBECs or
https://www.eia.gov/consumption/commercial/data/2012/index.cfm?view=consumption or the DOEs
Building Performance Database - https://bpd.lbl.gov/#explore

8

You can create an account here: https://portfoliomanager.energystar.gov/pm/signup

9

This information can be collected on this worksheet
http://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-add-properties-spreadsheet

10

Some ways communities get their data include:

- The city of Houston gets its data from the finance department. This department takes the bills
  and places the data in a spreadsheet that is shared it with the Mayor's Office.
- Fort Worth getts its data from the JCI the manager of their energy initiatives.
- In the deregulated market it is possible to have the REPs provide the data in a spreadsheet
  format on a monthly basis.
- Smart Meter Texas can provide electricity data in areas with that service
- Some have their finance department scan in the bills as a .pdf and share them with the
  benchmarkers, sometimes as an email and sometimes placing it a shared drive like drop box.

11

Portfolio manager, DOE BPD, and the Commercial Buildings Energy Consumption Survey (CBECS)
can all provide information for comparison

12

One method to address gaps is to average the previous two years for the same time period and use that value.

13

Check the 'space use alerts' and 'energy use alerts'

14

This online tool can be found at:
http://energy.gov/eere/slsc/guide-community-energy-strategic-planning

15

One way to present this information would be to calculate the projected savings if underperforming buildings were able to meet external or internal average performance metrics.

16 http://www.rmi.org/Content/Files/RMI_Retrofit_Guide_BuildingTheCase_1.1.pdf

17

Mackres, E. and B. Kazerooni. 2012. "Local Energy Planning in Practice: A Review of Recent Experiences." ACEEE Research Report E123. March 26. http://aceee.org/research-report/e123 (accessed January 22, 2016)

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http://harcresearch.org/sites/default/files/El%20Paso%27s%20Energy%20Savings%20Challenge.pdf