

**Best Practice:** Benchmarking City Properties  
City of Houston Case Study & General How-To Guide for Cities

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**Description of Best Practice:**

The City of Houston is actively benchmarking almost 10 million square feet of its building space, about 400 properties. This includes every metered building in the City portfolio, excluding the airport system and Houston First<sup>1</sup>. Seven million of the square feet are included in the Department of Energy's Better Building Challenge with the intention of including the remaining three million square feet in the next couple of years.

As the City moves forward, it anticipates using this data in a variety of ways. Potential uses include:

- Prioritize buildings for energy retrofits;
- Track progress of energy retrofit projects;
- Develop city building energy report cards for the City Green Teams to help them develop behavioral programs.

**Motivation and Stakeholders for Benchmarking:**

This city-wide project led by the Mayor's Office of Sustainability was largely driven by the City's decision to join the U.S. Department of Energy's Better Building Challenge. The city-wide benchmarking effort includes participation from representatives in all major City departments, with the greatest support from the General Services Department, Human Resources and Administration and Regulatory Affairs (ARA). The departmental stakeholders provide context into operations of the building, such as hours of operation, building uses, and occupancy.

**Benchmarking Tools and Process:**

The City Sustainability Team uses [U.S. Environmental Protection Agency's Portfolio Manager \(PM\)](#)<sup>2</sup> to benchmark public facilities. This benchmarking tool is free to the public and is required for the Better Building Challenge and for Energy Star Certification purposes. The City Sustainability Team is responsible for gathering the data needed for PM, namely square footage, space types, computers, operating hours, energy, and number of employees.

**Texas Senate Bill 898**

Recent Texas legislative activity has also motivated benchmarking. In 2011, Texas 82<sup>nd</sup> Legislature passed [Senate Bill 898](#) which requires political subdivisions, institutes of higher education and state agency facilities located in Clean Air Act non-attainment and near non-attainment areas<sup>1</sup> to establish an electricity reduction goal to reduce consumption by 5% each year for 10 years and report the progress of meeting this goal to SECO on a yearly basis. The reporting requirement began in September 2011. Benchmarking is key to meeting the requirements of this legislation and further information can be found on [SECO's Non-Attainment Area Energy Reporting](#) page.

*Data Sources:* The Sustainability Team gathers data using a variety of resources and methods, while taking advantage of support from fellow city departments. The three most valuable data sources include utility and building data and operating hours from the General Services Department; the age of building, square footage and date of ownership from the ARA Department; and building occupancy data from Human Resources. For facilities without available square footage data (an important metric for any benchmarking process), the Sustainability Team uses Google Earth to approximate the square footage. When this method is used, the Team flags that property to note that future verification of this property is

<sup>1</sup> The organization that manages the City's entertainment and convention facilities.  
<sup>2</sup> PM has become the standard used by Texas cities, which was largely driven by DOE's Better Building Challenge.



needed. The Team also works with department representatives to fill data gaps such as occupancy hours and number of occupants. In cases when data is simply not available, for example, determining the number of computers in certain offices, the City uses the PM default values.

*Data Upload:* The Sustainability Team has been able to gather and upload data back to 2008. Currently, the Team uploads new utility data twice a year, with the expectation of moving to quarterly uploads by 2015. The utility upload is facilitated through direct communication with the General Services Department, who sends the Sustainability Team a spreadsheet with all pertinent electricity and natural gas data for the PM upload twice a year. The Sustainability Team expects to move toward a multi-account upload using a PM template in the future, but currently believes it to be more effective to upload data on an individual basis.

*Data Validation:* For quick review purposes, the City visually inspects outliers during the manual data entry process. The City also utilizes PM's Data Quality Checker to determine if data is missing or to identify other irregularities. Further, the City looks at several of PM's reports regarding Source Energy Use Intensity (EUI) and Site EUI to identify any significant changes that could be anomalies over time. Finally, the City works with the Department of Energy to validate its data for the buildings participating in the Better Building Challenge.

### **Houston's Lessons Learned:**

The Sustainability Team offers the following advice based on their experience with benchmarking:

- Develop a team of stakeholders from the beginning to get departmental engagement. This will assist with getting non-utility data to increase the richness of the data.
- For a deregulated market, such as Houston, engage your Retail Electricity Provider (REP) to ensure that they are providing the appropriate data in a format this is easily transferrable to PM. REPs have experience with this process and typically just need to be asked.
- Begin your benchmarking efforts with PM. There may be better third party applications available, but PM is free, is relatively easy to use, and continues to improve. With the new SEED (Standard Energy Efficiency Data) platform, the functionality will only increase.

### **What to Know Before Getting Started:**

- Benchmarking measures building EUI in terms of energy usage per square foot using British Thermal Units (BTUs) as the primary unit of energy measurement.
- A variety of factors influence the energy intensity of a building. These factors include building size, building use, operating hours and number of occupants, as well as location within a climate zone.
- Most of the electric utilities in the state will provide free benchmarking to public facilities. A city can contact its local utility and ask for a benchmarking study.

### **How to Benchmark with Environmental Protection Agency's PM<sup>1</sup>:**

#### **1. Choose the building type**

There are 18 broad categories of building type and 80 primary functions built into PM to choose from.

#### **2. Enter energy data**

Data can be entered manually for each building using the Property Wizard and Meter Wizard or multiple properties can be tracked on spreadsheets to be uploaded all at once.

#### **3. Verify your data**

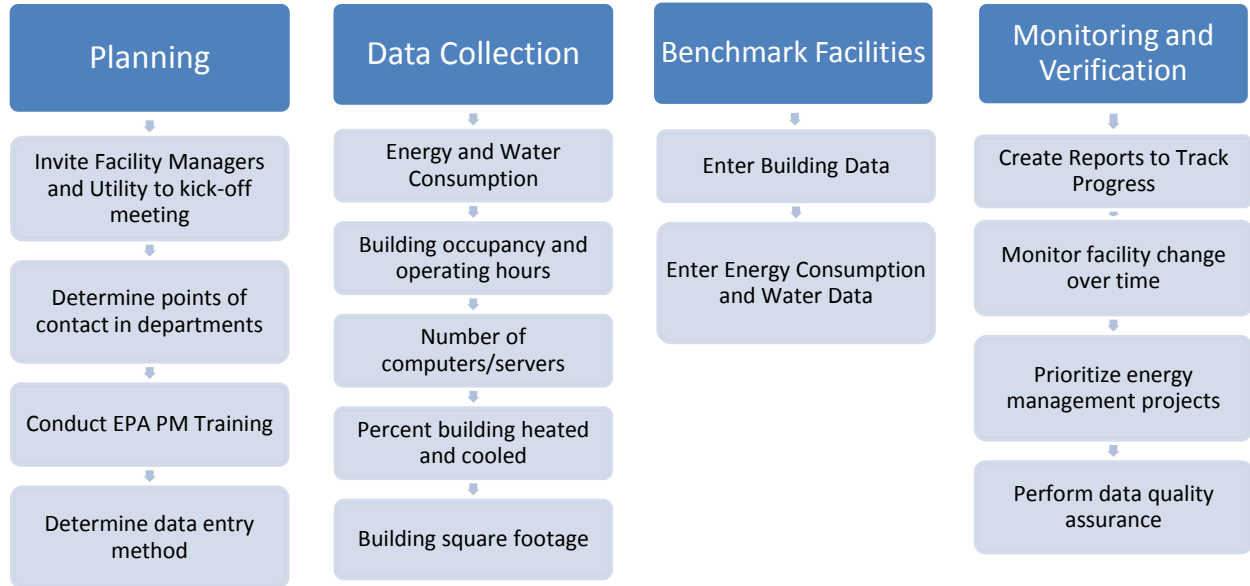
PM has a data quality checker to search out and fix errors.

#### **4. Interpret your Results**

PM has hundreds of metrics to help you compare your data to the benchmarks most useful to your properties.

## Steps to Benchmarking:

The following are the four steps that should be considered when developing a benchmarking program when utilizing PM. The U.S. Environmental Protection Agency provides regular trainings via webinar. To register for training visit the [ENERGY STAR website](#).



## Barriers and Solutions:

The primary barrier to benchmarking energy use of a city's facility is largely access to quality data. This would include access to energy, facility and facility use data. Following is a table listing the barriers faced by Texas cities as they work to collect data and benchmark their buildings. The barriers are matched with solutions that have been implemented or are in the process of being implemented<sup>3</sup>.

Barriers	Solutions
<ul style="list-style-type: none"> <li>Good, quality facility data on square footage, occupancy hours, building use, occupancy and equipment is difficult to access because it has to be collected from various sources and utility use information is not centralized.</li> </ul>	<ul style="list-style-type: none"> <li>Develop relationship with and educate the city risk management/ insurance team to help them understand the importance of providing data specific to building size, age and equipment.</li> <li>Develop relationship with department heads and Human Resources to work together to develop and implement strategies on collecting data and reducing errors and confusion.</li> </ul>
<ul style="list-style-type: none"> <li>In most cases, city staff is not properly trained to collect and provide data in a way that would facilitate facility energy benchmarking.</li> </ul>	<ul style="list-style-type: none"> <li>Develop cross-functional team across city departments to educate about benchmarking and get buy-in to provide data.</li> </ul>

<sup>3</sup> Participating cities are willing to share templates with other cities.

<ul style="list-style-type: none"> <li>Information is not typically shared concerning the operation of facilities, such as when a new facility is opening, closing, or changing hours of operation, making it difficult to include new facilities or reconcile energy use in existing facilities.</li> </ul>	<ul style="list-style-type: none"> <li>Engage and develop relationship with the department responsible for design and construction of facilities.</li> <li>Conduct a reconciliation of existing meters in previous year and compare with current bills to determine what has been added or deleted from previous year's list.</li> </ul>
<ul style="list-style-type: none"> <li>Utility bills are hard to obtain, making it very difficult to enter accurate data and identify errors in billing. Further, without bills, it is difficult to determine if utility data provided is correct and was entered correctly by the department receiving the bills.</li> </ul>	<ul style="list-style-type: none"> <li>Involve natural gas and electricity utility in the process and work to develop an energy data sharing system that regularly provides energy data.</li> <li>Request that utility bills are provided to benchmarking staff in addition to the departments responsible for payment, or request those departments scan and forward bills to benchmarking staff.</li> <li>In cases where only energy usage is provided without an actual bill, identify outliers by searching for anomalies once data is entered into PM.</li> </ul>
<ul style="list-style-type: none"> <li>The multi-facility templates in PM do not work well, causing difficulty when uploading data for a large number of facilities.</li> </ul>	<ul style="list-style-type: none"> <li>Develop spreadsheet templates to gather and upload data, reducing the need to upload each facility individually.</li> </ul>
<ul style="list-style-type: none"> <li>PM is not strong at conducting measurement and verification, i.e. the ability to verify pre and post-retrofit project energy use and energy costs over time. The primary shortfall seen by some cities is that it does not provide data at a granular enough level, such as day-to-day weather normalization or avoided use by fuel type.</li> </ul>	<ul style="list-style-type: none"> <li>Conducting research on using more robust energy information systems.</li> <li>Systems mentioned include Noesis, e-Sight, Resource Advisor, and Lucid.</li> </ul>

