DOE Technical Assistance Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

The Parker Ranch installation in Hawaii

Advanced Benchmarking: Benchmark Building Energy Use Quickly and Accurately Using EPA's ENERGY STAR Portfolio Manager

Peter Flippen
ICF International

January 20, 2010

What is TAP?

DOE's Technical Assistance Program (TAP) supports the Energy Efficiency and Conservation Block Grant Program (EECBG) and the State Energy Program (SEP) by providing state, local, and tribal officials the tools and resources needed to implement successful and sustainable clean energy programs.

How Can TAP Help You?

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TAP offers:

- One-on-one assistance
- Extensive online resource library, including:
  - Webinars
  - Events calendar
  - TAP Blog
  - Best practices and project resources
- Facilitation of peer exchange

On topics including:

- Energy efficiency and renewable energy technologies
- Program design and implementation
- Financing
- Performance contracting
- State and local capacity building

The TAP Blog

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

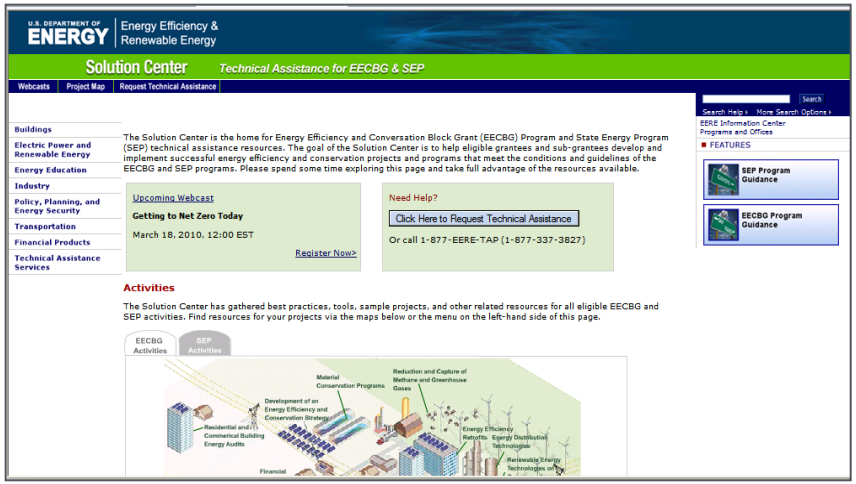
Access the TAP Blog!
http://www.eereblogs.energy.gov/tap/

Provides a platform for state, local, and tribal government officials and DOE's network of technical and programmatic experts to connect and share best practices on a variety of topics.

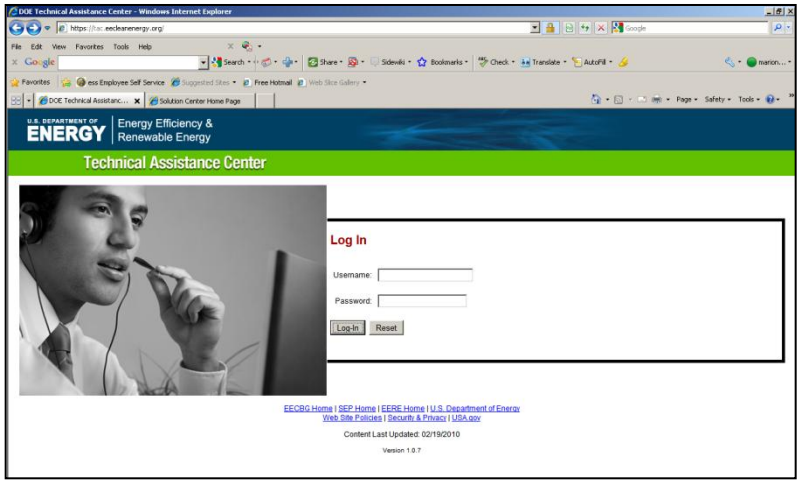
Accessing TAP Resources

We encourage you to:

1) Explore our online resources via the Solution Center



2) Submit a request via the Technical Assistance Center



3) Ask questions via our call center at 1-877-337-3827 or email us at solutioncenter@ee.doe.gov

Agenda

- **Portfolio Manager Overview**
- Benchmarking Efficiently
- Benchmarking Accurately
- Portfolio Manager Reporting
- Portfolio Manager Demo

Polling Question

What is Portfolio Manager?

- Free, web-based tool for benchmarking existing buildings
- Provides benchmarks for all commercial buildings, including:
  - ENERGY STAR energy performance score (1 to 100) for eligible buildings, and
  - Normalized energy use intensities (EUI) for all buildings
- Measures and tracks energy intensity, cost, emissions
- Facilitates sharing and reporting of energy performance to corporate, association, government, and utility stakeholders
- Facilitates applications for ENERGY STAR Label and Leaders recognition

What is EPA's Energy Performance Rating System?

- 1 to 100 rating for existing commercial buildings
  - 50 = national average
  - 75 = qualification for ENERGY STAR Label
- Whole-building actual energy performance score and weather normalized energy intensity
- Developed based on national survey of commercial buildings (CBECS and others)
- Normalizes for weather, operating hours, occupant density, plug load
- Measures qualification for ENERGY STAR Label for Buildings

ENERGY STAR Score Eligible Building Types

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Bank/Financial Institutions

Courthouses

Data Centers

Dormitories

Hospitals

Hotels

Houses of Worship

K-12 Schools

Medical Offices

Office Buildings

Retail Stores

Supermarkets

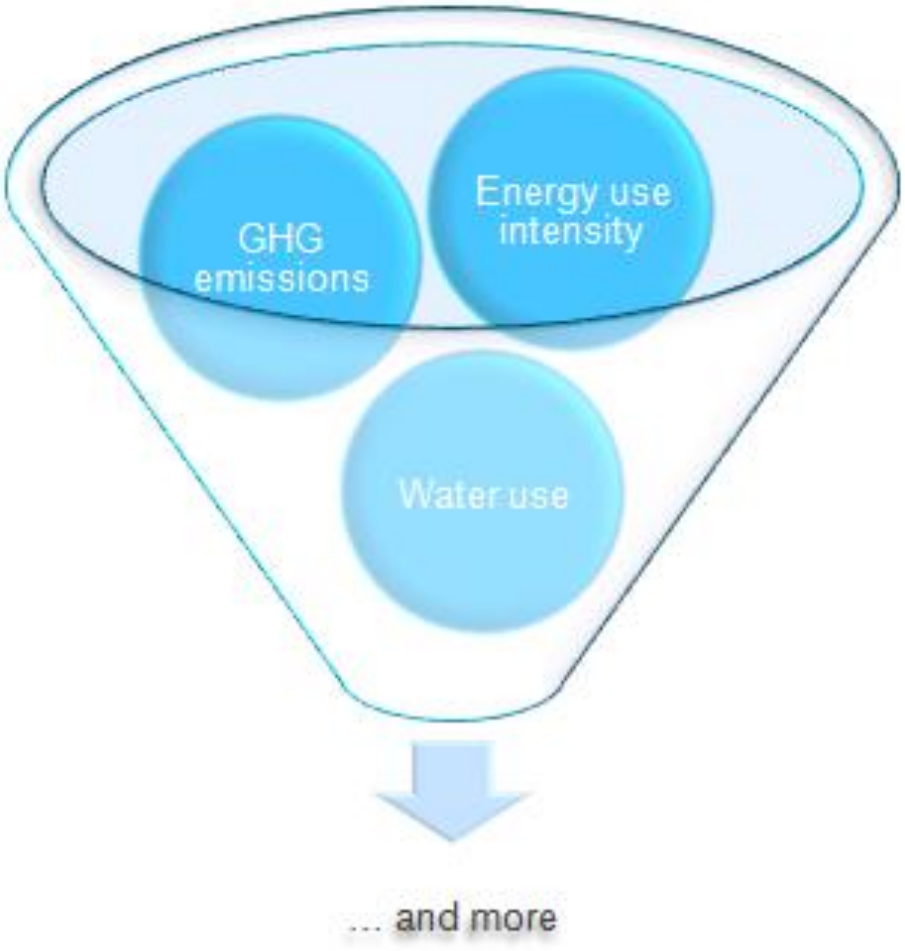
Warehouses

Wastewater Treatment Plants

Senior Care Communities

Valuable for *ALL* Commercial Buildings

- Such as:
  - Police Stations
  - Fire Stations
  - Convention Centers
  - Laboratories
  - Libraries
  - Malls
  - Movie Theatres
  - Restaurants
  - Stadiums and Arenas



User-Friendly Inputs

All Space Types	K-12 School	Office	Supermarket Grocery
• Address • Year Built • At least 12 months energy data	• SF • # Walk-in refrigerator freezer units • # PC's • Open weekends Y/N • Cooking Y/N • High School Y/N • % Heated • % AC	• SF • # Workers • Op. hrs. • # PC's • % Heated • % AC	• SF • # Workers • Op. hrs • # Walk-in refrigerator freezer units • Cooking Y/N • % Heated • % AC

Examples

Using Grant Funds for Benchmarking

- Grantees are encouraged to use funds for measurement and tracking of energy efficiency
- For example, funds allocated to EECGB category 3, 5, 6, and 13 (energy audits, retrofits, energy efficiency programs, and tracking on-site renewable energy generation) can be used for benchmarking
- Use of Portfolio Manager for reporting purposes could be considered an administrative expense
- Grantees encouraged to create groups in Portfolio Manager for buildings touched by grant funds

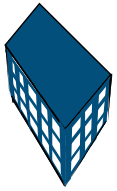
Agenda

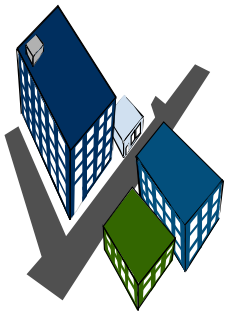
- Portfolio Manager Overview
- **Benchmarking Efficiently**
- Benchmarking Accurately
- Portfolio Manager Reporting
- Portfolio Manager Demo

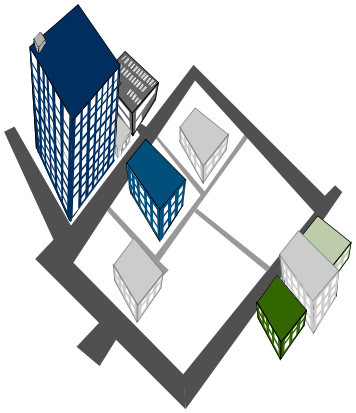
Benchmarking with a Score or EUI

- Determine a buildings eligibility for a score
- Avoid spending time collecting building data for a building that will not achieve a score
- Key score eligibility criteria
  - Floor area of “Other” space (e.g. library, restaurant, cafeteria, etc.) cannot exceed 10% of the total floor area
  - More than 50% of the floor area must be defined by one space type eligible to receive an energy performance rating
  - Greater than 5,000 square feet (except hospitals, bank branches, data centers, and houses of worship)

Benchmarking with Portfolio Manager







- **Single Building Manual Entry**
  - Enter benchmarking information into Portfolio Manager.
- **Bulk Data Upload**
  - Upload large sets of data in Portfolio Manager using an Excel template.
- **Automated Benchmarking Services**
  - A framework for exchanging data using web services between the EPA's rating system and third parties.

Building Import Templates

- Mass Import Template
  - For initial import of building, space, and energy data for 10 or more buildings of the same space type
  - Specific Excel template for each building type
  - Detailed instructions on the first tab
  - Processed within a matter of weeks

Building Import Templates

- Multi Facility Meter Update
  - For meters already created in Portfolio Manager
  - Enables Portfolio Manager users to select the number of meters and months for an update
  - Tool provides a Excel spreadsheet with cells for updated energy data
  - User uploads completed spreadsheet in Portfolio Manager and receives email when meters are updated

What is the Automated Benchmarking System (ABS)?

- A framework for exchanging data between EPA's Portfolio Manager and a third party system such as a utility CIS
- Enables third party tools to deliver EPA benchmarking data as an alternative or in addition to a Portfolio Manger account
- Includes Web-based services using Extensible Markup Language (XML) to…
  - authorize data release
  - transfer energy and/or building data
  - report energy benchmarking results

Service Providers Offer Automated Benchmarking

- Advantage IQ
- American Energy Assets
- Angus Systems
- CA Technologies
- eComponents Technology
- EduCon
- ei3
- Energard Technologies
- Energy Print
- Energy Watchdog
- EnergyCAP, Inc.
- EnergySolve
- IBS, Inc.
- Johnson Controls
- LPB Energy Management
- New Energy Technology
- NISC
- NorthWrite
- Performance Systems Development
- Planet Footprint
- Rapid Improvement Associates
- Siemens
- Summit Energy
- Sustainable Real Estate Manager
- The E Group
- TRC Energy Services
- UtilityAccounts.com

More information at www.energystar.gov/abs

Utility ABS Around the Country

- Current ABS providers
  - ComEd, Avista Utilities, Puget Sound Energy
  - California utilities: PG&E, SDG&E, SoCal Gas, Southern California Edison, SMUD
- Developing ABS
  - Seattle City Light
- Considering ABS
  - Austin Energy, Arizona Public Service, Baltimore Gas & Electric

Agenda

- Portfolio Manager Overview
- Benchmarking Efficiently
- **Benchmarking Accurately**
- Portfolio Manager Reporting
- Portfolio Manager Demo

Polling Question

Energy Data Requirements

- To receive an energy performance benchmark, you must enter energy meters that account for all energy use (regardless of fuel type) in the building.
- Data rule sets:
  - There must be at least 11 full consecutive calendar months of energy data for all active meters. If there are multiple meters, there must be 11 consecutive months.
  - No individual electrical meter entry can be for a period longer than 65 days.
  - Meter start and end dates cannot have gaps in the dates (e.g. end: 1/1/2011, start: 1/3/2011) or overlapping dates (e.g. end: 1/3/2011, start: 1/2/2011)

Office Benchmarking Example

Office Space Type Definition

- Facility spaces used for general office, professional, and administrative purposes
- Total gross floor area includes all supporting functions such as staff kitchens, lobbies, atria, conference rooms, auditoria, staff fitness areas, storage areas, stairways, elevator shafts, etc.

Office Space Inputs

- Gross floor area
- Weekly operating hours
- Number of workers on main shift
- Number of personal computers
- Percent of gross floor area that is air conditioned
- Percent of gross floor area that is heated

www.energystar.gov/benchmark

General Guidelines for Benchmarking an Office Building

- Enter as much of the building square footage as possible under a single space entry
- All supporting building functions are captured within the “office” benchmarking model
- Only separate building into multiple spaces to describe the operations of the facility
  - Spaces with weekly operating hours that are significantly different
  - Computer data center
  - Retail space serving the general public – not just employees (e.g., restaurant, retail store with exterior entrance)

Defining Space Types

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Space Use Add Space

Space Name	Space Type	Floor Area (Sq. Ft.)
Lobby & Atrium	Other - Social/Meeting	5,000
Mechanical Rooms	Other - Other	5,000
Parking Garage - Above Grade Levels	Parking	50,000
Parking Garage - Below Grade Levels	Parking	50,000
Tenant 1	Office	150,000
Tenant 2	Office	
Tenant 3	Office	
Vacant Suite 1	Office	
Vacant Suite 2	Office	
Total		

no

yes

Space Use Add Space

Space Name	Space Type	Floor Area (Sq. Ft.)
Office Building	Office	220,000
Parking Garage	Parking	100,000
Vacant Space	Office	10,000
Total		330,000

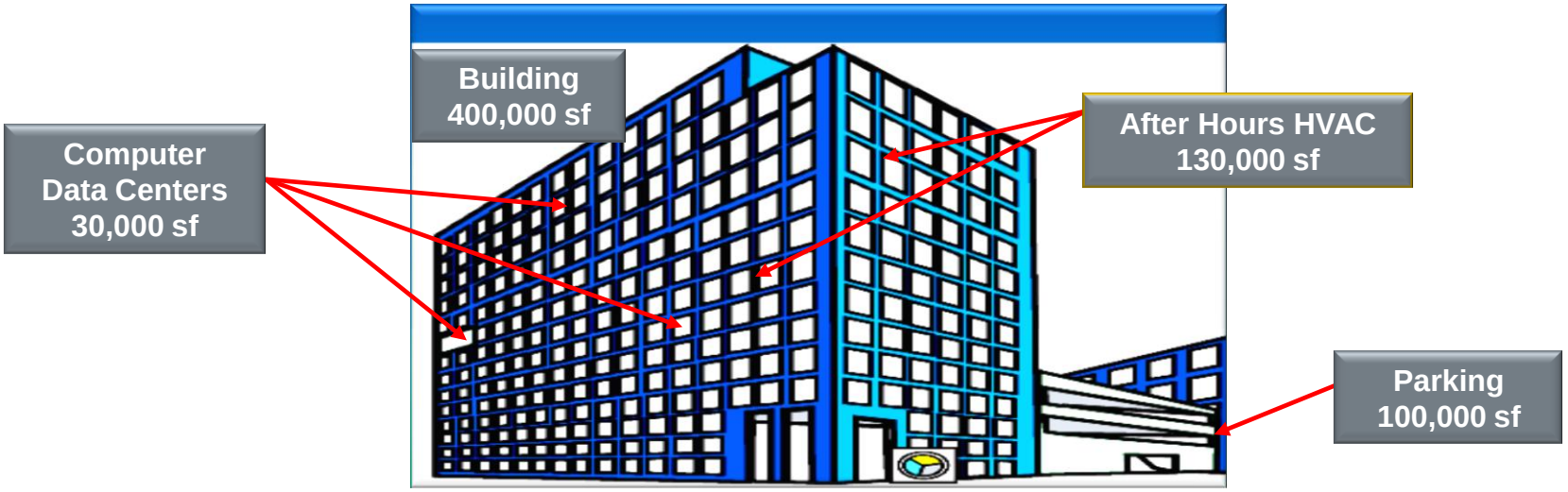
Approach for Vacant Space

- If vacant space averages more than 10% of the building floor area over the past 12 months, vacant space must be input in Portfolio Manager as a separate Office space. For the vacant space, use the following operating characteristics:
  - Weekly Operating Hours = 0
  - Workers on Main Shift = 0
  - Number of PCs = 0
  - Percent Heated and Percent Cooled = Report conditioning as it occurs in the vacant space
- **NOTE:** Space that is leased but unoccupied is also considered to be vacant

Additional Space Types Used in Benchmarking Office Buildings

- Parking
  - If energy consumption is tracked on the main building meter and *cannot* be excluded from the energy consumption of the office building
  - If parking area energy is being *separately* metered, *do not* account for energy consumption or parking square footage when benchmarking
- "Other"
  - For space types that do not have their own rating model (e.g., laboratory space; restaurant on ground floor)
  - Must be less than 10% of total square footage for building to be eligible for a rating

Sample Office Building



Space Name	Space Type	Floor Area (sf)	Occupants	PC's	Op. Hours	% Cooled Heated
Data centers	Computer Data Center	30,000	N/A	N/A	168	N/A
Overtime air tenants	Office	130,000	650	1430	110	> 50%
All remaining tenants	Office	240,000	1,000	1,200	65	> 50%
Parking (Energy use on house meter)	Parking	100,000	N/A	N/A	168	N/A

Getting an N/A

Reason	Possible Solutions
Less than one full year of energy data	Is one lagging meter holding you back? Obtain current data or wait till a full year (at least 11 discrete months) is available
Gaps or overlaps in meter data	Fix the typos
Weather data is not yet available	Wait another few weeks
Less than one full year of space attribute data	Review your Effective Dates or wait till a full year of data is available
Less than 50% of building is defined by one of the main space types (e.g., Office)	Do you have Other or Retail space that belongs in Office?
Operating hours are less than 30 hours per week	Large vacant areas (0 operating hours) can cause the building's average operating hours to drop below 30
sf of Enclosed and Non-Enclosed parking areas is larger than building sf	Sub-meter and remove the parking garage from PM

Agenda

- Portfolio Manager Overview
- Benchmarking Efficiently
- Benchmarking Accurately
- **Portfolio Manager Reporting**
- Portfolio Manager Demo

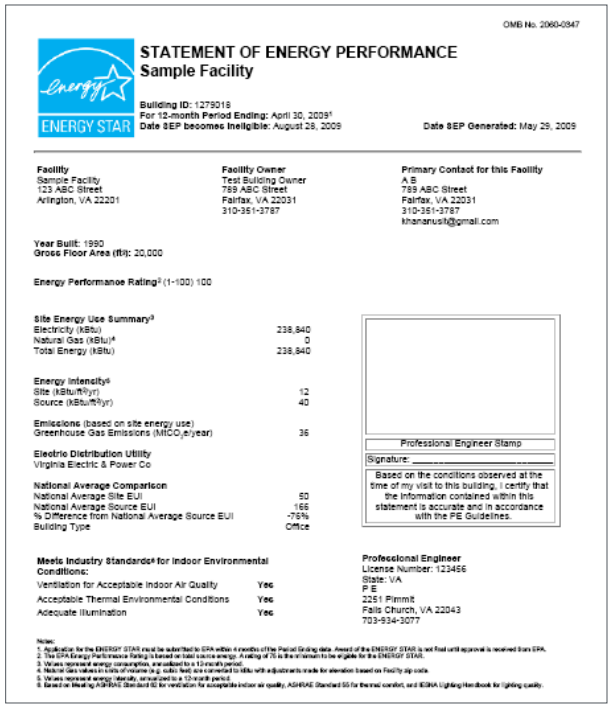
Benchmarking Data Available From Portfolio Manager

- 1 to 100 energy performance scores
- Weather normalized and non-weather normalized energy intensity values (kbtu/square foot) and annual energy consumption (kbtu)
- National average site and source energy intensity for non-ratable building types
- Direct, indirect, and total greenhouse gas emissions

Reporting Capabilities

- Compare a baseline period to another period
- Create custom views and custom groups
- Variety of reporting options include:
  - Export a custom view
  - Generate an Energy Performance Report
  - Generate a Statement of Energy Performance and Facility Summary Report
  - Run a custom report
    - Choose from key energy, environmental, and/or cost performance indicators
    - Download data in Excel, CSV, PDF, and XML formats for analysis

Document and Communicate Improvements



OMB No. 2060-0347

ENERGY STAR

STATEMENT OF ENERGY PERFORMANCE
Sample Facility

Building ID: 1279018
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes Ineligible: August 28, 2009 **Date SEP Generated:** May 29, 2009

Facility	Facility Owner	Primary Contact for this Facility
Sample Facility 123 ABC Street Arlington, VA 22201	Test Building Owner 789 ABC Street Fairfax, VA 22031 310-351-3787	A B 789 ABC Street Fairfax, VA 22031 310-351-3787 khananusit@gmail.com

Year Built: 1990
Gross Floor Area (ft²): 20,000

Energy Performance Rating[2] (1-100) 100

Site Energy Use Summary[3]

Electricity (kBtu)	238,840
Natural Gas (kBtu)[4]	0
Total Energy (kBtu)	238,840

Energy Intensity[5]

Site (kBtu/ft²/yr)	12
Source (kBtu/ft²/yr)	40

Emissions (based on site energy use)
Greenhouse Gas Emissions (MtCO₂e/year) 36

Electric Distribution Utility
Virginia Electric & Power Co

National Average Comparison

National Average Site EUI	50
National Average Source EUI	166
% Difference from National Average Source EUI	-76%
Building Type	Office

Professional Engineer Stamp

Signature: _____

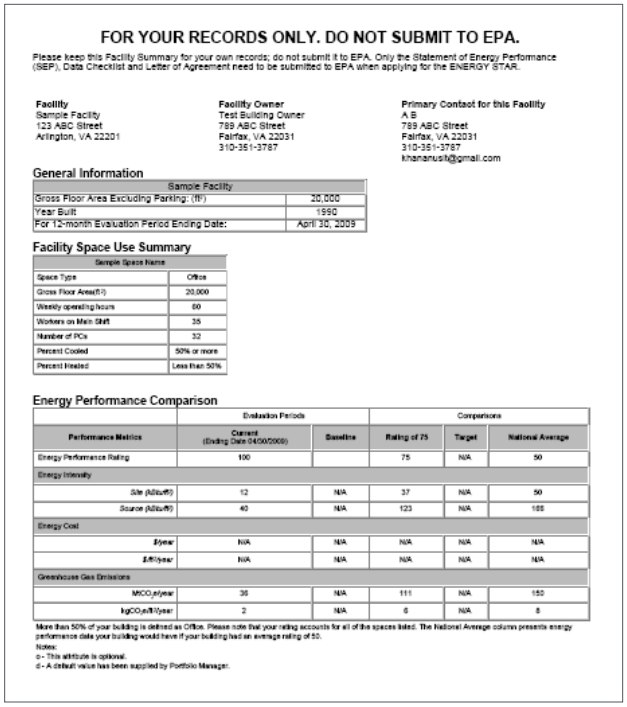
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate and in accordance with the PE Guidelines.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	Yes
Acceptable Thermal Environmental Conditions	Yes
Adequate Illumination	Yes

Professional Engineer
License Number: 123456
State: VA
P E
2361 Pimmit
Falls Church, VA 22043
703-934-3077

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, normalized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.



FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility	Facility Owner	Primary Contact for this Facility
Sample Facility 123 ABC Street Arlington, VA 22201	Test Building Owner 789 ABC Street Fairfax, VA 22031 310-351-3787	A B 789 ABC Street Fairfax, VA 22031 310-351-3787 khananusit@gmail.com

General Information

Sample Facility	
Gross Floor Area Excluding Parking: (ft²)	20,000
Year Built	1990
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

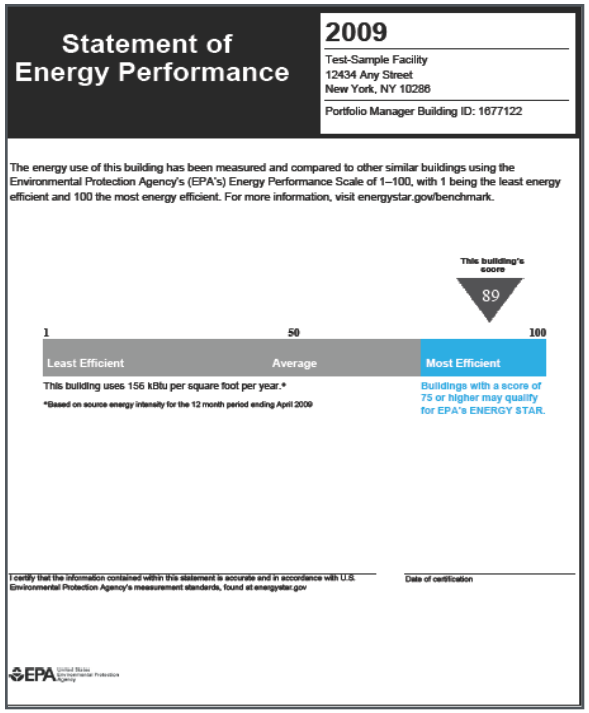
Sample Space Name	
Space Type	Office
Gross Floor Area(ft²)	20,000
Weekly operating hours	60
Workers on Main Shift	35
Number of PCs	32
Percent Cooled	50% or more
Percent Heated	Less than 50%

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	Current (Ending Date 04/30/2009)	Baseline	Rating of 75	Target	National Average
Energy Performance Rating	100		75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	12	N/A	37	N/A	50
Source (kBtu/ft²)	40	N/A	123	N/A	166
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/ft²/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
MtCO₂e/year	36	N/A	111	N/A	152
kgCO₂e/ft²/year	2	N/A	6	N/A	8

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.



Statement of Energy Performance

2009

Test-Sample Facility
12434 Any Street
New York, NY 10288

Portfolio Manager Building ID: 1677122

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.

This building's score
89

1 — 50 — 100

Least Efficient — Average — Most Efficient

This building uses 156 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending April 2009

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Agenda

- Portfolio Manager Overview
- Benchmarking Efficiently
- Benchmarking Accurately
- Portfolio Manager Reporting
- **Portfolio Manager Demo**

Live Portfolio Manager Demonstration

www.energystar.gov/benchmark

www.energystar.gov/istar/pmpam

Next steps

- Review online listing of state and local government benchmarking initiatives for ideas for ARRA funded activities.
- Consider incorporating Portfolio Manager benchmarking into current commercial building efficiency projects to promote transparency and accountability.
- Work with your organization's facility or energy management department to benchmark public facilities to show leadership in the state/city/community.
- Complete a DOE technical assistance request for additional support needed to incorporate benchmarking into projects.

Thank you!

ENERGY STAR Web site:
www.energystar.gov/benchmark

DOE Solution Center:
www.eere.energy.gov/wip/solutioncenter

DOE Technical Assistance Center:
https://tac.eecleanenergy.org/

Peter Flippen, pflippen@icfi.com, Technical Assistance Support Contractor for the Department of Energy

Leslie Cook, cook.leslie@epa.gov, ENERGY STAR Public Sector Program Manager

Upcoming Webinars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Please join us again:

Title: **Managing Financing Programs - Spreadsheet Models**
Host: US DOE
Date: January 24, 2011
Time: 1:00 PM – 2:30 PM

Title: **Developing an Evaluation Measurement and Verification Plan for Your Energy Efficiency Project/Program**
Host: NEEP
Date: January 25, 2011
Time: 2:00 – 3:00 EST

Title: **Community Renewables: Wind, Solar and Model Program Rules**
Host: NREL
Date: January 26, 2011
Time: 3:00 – 4:15 EDT

Title**: Strategies for Managing Construction Contractors**
Host: ICF International
Date: February 7, 2011
Time: 1:00-2:30 EDT

Title: **Integration of Renewables and Efficiency: Leveraging Interest and Funding**
Host: VEIC
Date: February 17, 2011
Time: 2:00-3:00 EDT

Title: **SolOpt: How to Optimize Roof Space for Solar Hot Water and PV Installations**
Host: NREL
Date: February 23, 2011
Time: 3:00-4:15 EDT

For the most up-to-date information and registration links, please visit the Solution Center webcast page at www.wip.energy.gov/solutioncenter/webcasts

Appendix: New Data Center Rating

New Data Center Rating

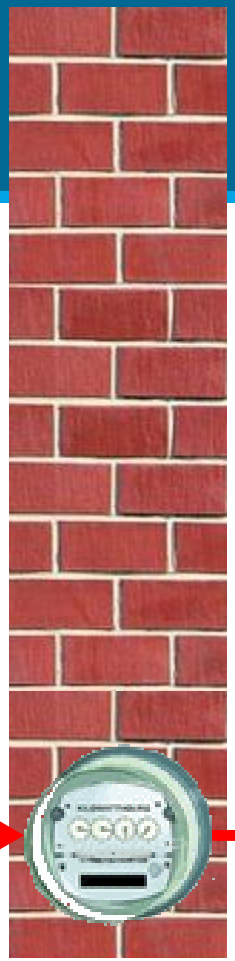
- New ENERGY STAR performance scale for Data Center
  - ENERGY STAR score is for spaces specifically designed and equipped for high density computing (server racks, data storage silos, etc)
  - Typically facilities with an Uninterruptible Power Supply (UPS)
  - Usually have dedicated cooling systems
- Applicable for free standing data centers and larger buildings with data centers
- Is **not** for computer training classroom and closet with LAN server

New Data Center Rating

- How is an ENERGY STAR score computed?
  - Total Energy/IT Energy
  - Total energy is from utility bills
- IT Energy
  - More complex – wide variety of equipment and metering configurations
  - ENERGY STAR selected the measure that is most commonly available (easiest) to maintain broad applicability
  - Model requires IT energy at the Uninterruptible Power Supply (UPS) output
  - Tool accepts many alternate IT metering scenarios if UPS output is not available

Energy for all non-IT equipment use, including HVAC, lighting, and plug loads

Energy into building, from all fuel sources



Building master meter(s)

Data Center

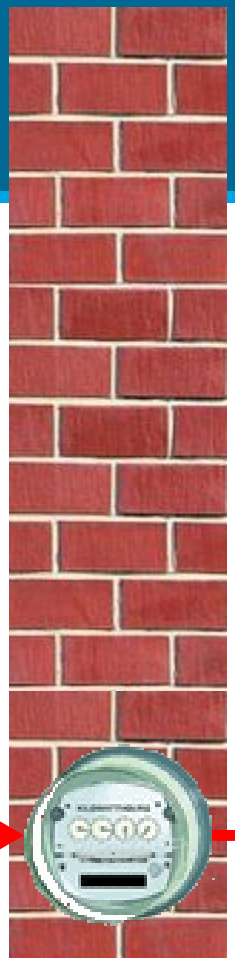
UPS

PDUs

Server Racks & Storage Devices

Energy for all non-IT equipment use, including HVAC, lighting, and plug loads

Energy into building, from all fuel sources



Building master meter(s)

Data Center

UPS output meter

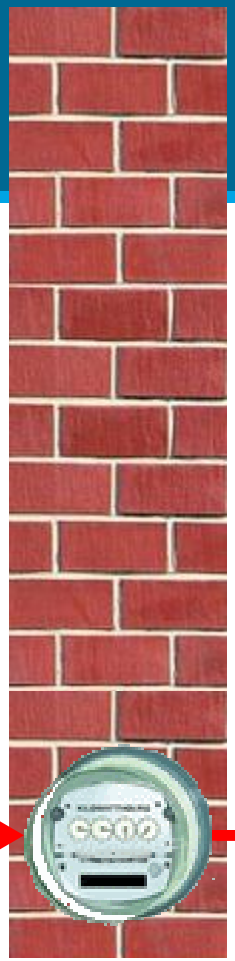
UPS

PDUs

Server Racks & Storage Devices

Energy for all non-IT equipment use, including HVAC, lighting, and plug loads

Energy into building, from all fuel sources



Building master meter(s)

Data Center

Non-IT equipment for the data center, such as cooling systems and lighting.

UPS output meter

Sub-meter

UPS

PDUs

Server Racks & Storage Devices

Data Center Inputs

- Floor Area
- IT Energy Configuration - How Uninterruptible Power Supply (UPS) is used determines how IT Energy must be entered
  - UPS supports only IT Equipment (**preferred**)
  - UPS includes non-IT load of 10% or less
  - UPS includes non-IT load greater than 10%. Non-IT load is sub-metered.
  - UPS includes non-IT load of greater than 10%. Non-IT load is **not** sub-metered.
  - Facility has no UPS
  - IT Energy is not metered – Apply Estimates

Data Center Inputs

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- IT Energy Configuration (continued)
  - IT Meter requirements display based on IT Energy Configuration
    - Meter required at either the UPS Output or PDU Input
  - Many users may need to install new energy meters for IT
  - Last option is to apply estimates
    - Intended for buildings with no IT meter
    - Only permitted for 2 years (until June 2012), after which IT energy measurements are required
    - Can only be applied to buildings with data centers whose square foot is less than 10% of the total energy
    - ***Are*** permitted for label applications (until June 2012)

Upcoming Webinars

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Please join us again:

Title: **Designing Effective Incentives to Drive Residential Retrofit Program Participation**
Date: October 29, 2010
Time: 2:00 - 3:00pm EDT

Title: **How to Design a Community Energy Alliance**
Date: November 1, 2010
Time: 2:00 - 3:15pm EDT

Title: **Preparing for the Arrival of Electric Vehicle**
Date: November 3, 2010
Time: 2:00 - 3:00pm EDT

Title: **Effective O&M Policy in Public Buildings**
Date: November 4, 2010
Time: 2:00 - 3:00pm EDT

Title: **Local Power Empowers: CHP and District Energy**
Date: November 8, 2010
Time: 2:00 - 3:00pm EDT

Title: **Driving Demand: Working With and Learning from Contractors**
Date: November 9, 2010
Time: 2:00 - 3:15pm EST

Title: **EM&V 101: General Approaches to Tracking Data and Estimating Savings**
Date: November 10, 2010
Time: 2:00 - 3:00pm EST

Title: **Energy Efficiency Rebate Programs 101**
Date: November 15, 2010
Time: 12:00 - 2:00pm EST

Title: State Clean Energy Policy Impact
Date: November 17, 2010
Time: 3:00 - 4:15pm EST

Webcast page: www.wip.energy.gov/solutioncenter/webcasts