

Energy Benchmarks for Single Buildings and Installations

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Participants

- **Oak Ridge National Laboratory**
- **U.S. Army Installation Management Command**
- **U.S. Army Engineer Research and Development Center**

Purpose

- **Describe and demonstrate new performance rating tools that offer for:**
 - **BUILDINGS:** A much more reliable method for rating building performance
 - **INSTALLATIONS:** A new and advanced energy performance rating capability

Background: At 3rd Army Energy Workshop, Dallas, TX, Jan. 2007

- **Value of building/installation performance ratings presented**
- **Demonstrated that accurate building energy performance comparisons required normalization for building operating characteristics (simple Btu/sqft comparisons are unreliable)**
- **A rating methodology incorporating these normalizations was presented**
- **Introduced work to develop energy performance benchmarking/rating tools for Army buildings and installations**

Reminder - Why We Must Normalize for Building Use/Design in Assessing Performance

- **Differences in building use and design strongly influence building energy use!**

Building type	Change in building use or design	Increase in total energy use
Office	24/7 operations	21%
Office	double worker density	11%
Office	double worker & PC density	24%
School	12 months use	6%
School	add cafeteria	10%
School	add swimming pool	30%

Building Results: Primary Drivers of Energy Use in Buildings (vary by building type)

Administrative Buildings	Barracks (Permanent-Party)
Floor area	Floor area
Operating hours	No. of units
No. of workers	Percent heated
No. of personal computers	Percent cooled
Percent heated	Heating degree days
Percent cooled	Cooling degree days
Heating degree days	
Cooling degree days	

Demonstration: Energy Use Benchmarking Tools for Barracks and Installations

- **Scoring/Rating**
 - **0-100 scale**
 - **Higher score = higher performance**
 - **75 = better than 75%**
 - **50 = better than 50%**
 - **etc.**

U.S. Army Permanent-Party Barracks Energy Use Benchmarking Tool



This tool quantifies the projected performance of a user-defined dormitory-type building relative to all dormitory-type buildings nationwide.¹ A score of 75 equals performance at the top 25th percentile of buildings. A score of 50 denotes mid-point performance. Buildings scoring below 25 are poor performers and often have the best energy and cost reduction opportunities. To use this tool, you will need to calculate your building's annual energy consumption. Provide entries for your building in the white cells below. Click on underlined headings for help.

Building Description

Building Name:

5-digit Zip Code:

Mapping Location:

Weather Data at Your Site		
	Typical	Actual
Annual HDD:	1847	2100
Annual CDD:	2365	2500

	<u>Total Building Gross Floor Area (ft²)</u>	<u>Percent of Gross Floor Area Heated</u>	<u>Percent of Gross Floor Area Cooled</u>	<u>Number of Lodging Units</u>
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Building Parameters:

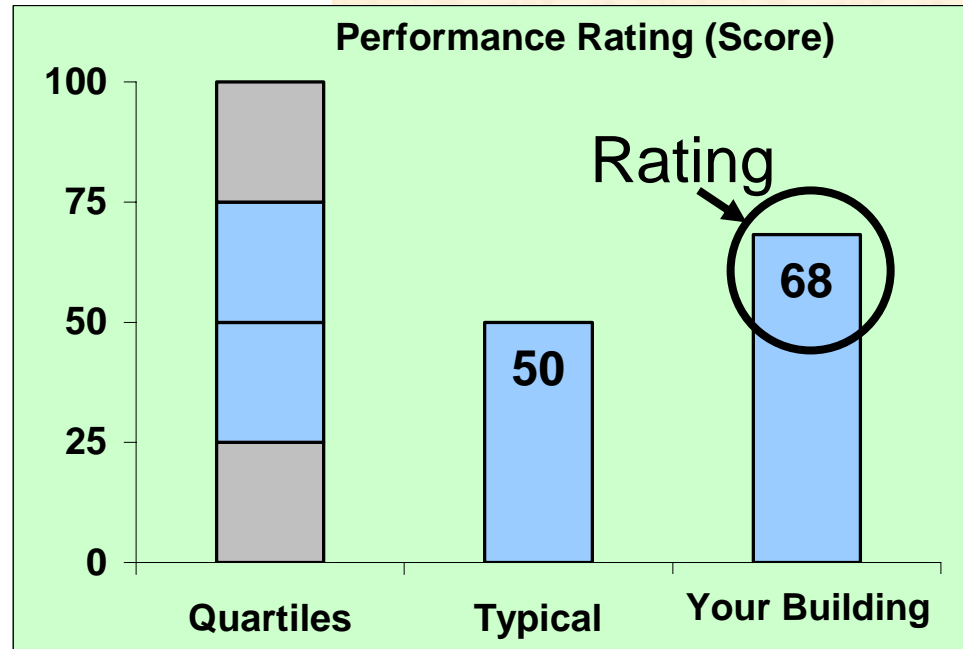
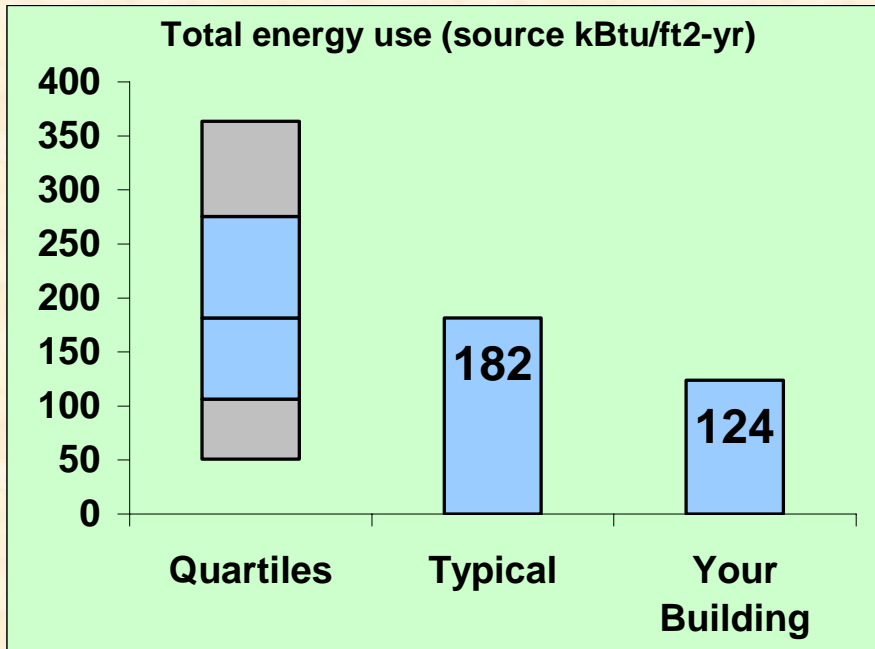
Actual weather data for the same time period as reported annual consumptions should be entered for better scoring.

Annual Consumptions

	Electricity	Gas	Fuel Oil	District Steam	District Hot Water
Select Energy Units:	<input type="text" value="kWh"/> ▼	<input type="text" value="Therms"/> ▼	<input type="text" value="Gal"/> ▼	<input type="text" value="klbs"/> ▼	<input type="text" value="kBtu"/> ▼
Energy	<input type="text" value="347,893"/>	<input type="text" value="14,856"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



Tool Output: Barracks



Source: Dormitories, 1999 U.S. EIA CBECS Survey

Energy savings potential is: MODERATE

Highest use for described building:	364	kBtu/ft2
Median use for described building:	182	kBtu/ft2
Lowest use for described building:	51	kBtu/ft2

Rating: >75 very good, >50 good, <50 moderate, <25 poor
 High rating = high performance = lower savings potential.
 Low rating = poor performance = better savings potential

Installation Results: Primary Drivers of Energy Use at Installations

- **Total floor area of these spaces reported separately (9 facility classes analyzed):**
 - Entire installation
 - Operational and training facilities (+ impact)
 - Administrative facilities (- impact)
 - Housing & community facilities (- impact)
 - Supply facilities (- impact)
 - Laboratory facilities (sub-class, + impact)
 - Ammunition storage facilities (sub-class, - impact)
 - Production facilities (sub-class, + impact)
- **Weather (heating and cooling degree days)**

(analysis tested facility classes only due to limited installation data)

U.S. Army Installation Energy Use Benchmarking Tool



This tool rates the energy performance of a user-defined installation relative to Army installations nationwide.¹ It normalizes for the differing mix of building types from installation to installation (a key driver of installation energy use) and for weather. A score of 75 equals performance at the top 25th percentile of installations. A 50 is mid-point performance. Scores below 25 suggest poor performance and may offer excellent energy and cost reduction opportunities). To use, you will need to calculate annual energy consumptions by fuel type.

Installation Description

Installation: "optional entry"

5-digit Zip Code:

Mapping Location: Alexandria, VA

Weather Data at Site

	Typical	Actual
Annual HDD:	4047	3984
Annual CDD:	1549	1583

Actual weather data should be provided and match consumption time periods.

<u>Input Installation Floor Areas by Facility Classifications (HELP?):</u>	<u>Installation Total (ft2)</u>	<u>Operational & Training Facilities (ft2)</u>	<u>Administrative Facilities (ft2)</u>	<u>Housing & Community Facilities (ft2)</u>	<u>Supply Facilities (ft2)</u>	<u>Laboratory Facilities (ft2)</u>	<u>Ammunition Storage Facilities (ft2)</u>	<u>Production Facilities (ft2)</u>
	8,798,886	1,345,700	2,489,187	1,760,102	795,357	1,192,694	6,403	0

Annual Consumptions and Costs

Select Energy Units: Coal (Tons) Electricity (kBTU) Distillate Oil (kBTU) Residual Oil (BBLs) Other (light) O (BBLs) Hydro (kWh) Natural Gas (kBTU)

Energy: 0 622,657,481 114,746,675 0 0 0 373,309,635

Cost (\$):

Calculated cost (\$/unit):

Select Energy Units: Photovoltaic (kWh) Propane (kBTU) Steam (lbs) Hot Water (lbs) Solar (Mbtu) Wind (kWh) Wood (Tons)

Energy: 0 2,363,695 0 0 0 0 0

Cost (\$):



Tool Output: Installations

Rating

Results

	Fort Belvoir	Average
<u>Score Against Peers</u>	52	50
<u>Building Site Energy Use (MMBtu/year)</u>	1,113,077,486	1,132,314,161
<u>Building Source Energy Use (MMBtu/year)</u>	2,515,322,382	2,558,793,246
Site Energy Use Intensity (kBtu/ft ² -year)	126.5	128.7
Source Energy Use Intensity (kBtu/ft ² -year)	285.9	290.8
Energy Cost Intensity (\$/ft ² -year)		
Total Annual Energy Cost (\$/year)		

Use: Installation Benchmarking Can Improve Assessment Priority

Site	Existing Priority ¹	Performance-Based Priority ²	Performance Score
Arsenal 1	1	9	8
Fort 1	3	10	32
Arsenal 2	5	17	41
Misc Site 1	6	NA	NA
Misc Site 2	7	None	73
Misc Site 3	8	NA	NA
Fort 2	9	15	25
Arsenal 3	2	None	51
Misc Site 4	4	None	58
Depot 1	None	2	2
Fort 3	None	7	10

Existing: Based on bill size & cost of energy

Performance: Based on bill size, cost of energy, energy performance

Other Valuable Uses of Building and Installation Benchmarking Tools

- **Assess energy performance**
 - Establish a performance baseline
 - Track performance changes
 - Determine if an installation/building is a good, moderate, or poor performer
- **Improving energy efficiency efforts**
 - Find the opportunities (low performers)
 - Prioritize limited assessment resources (target the opportunities)
 - Find the role models (high performers)
 - Study role models, take lessons learned to others
- **Test your design targets (if a new building design scores moderate or low, your not building an efficient building)**

Benchmarking Tools Summary

- **These tools can be used to rate the energy performance of your facilities and new building designs**
- **These tools allow you to increase your capabilities and make better building, portfolio, and energy program decisions**
- **Your feedback is invited**

THANK YOU!!!!!!

For More Information

Download tools at:

<http://eber.ed.ornl.gov/benchmark/tools.htm>

Questions:

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