# LLNL Supercomputing Facility Achieves LEED Gold

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# LLNL Making Good Progress Toward 2015 Goal

**2015 Goal: 829,694 square feet (S.F.)**
**(15% of existing bldg S.F.)**

**B264**
**20,461 S.F.**

**B142**
**20,306 S.F.**

**TeraScale**
**241,197 S.F.**

**FY10:**
**34% of 2015 goal !**

# LLNL Implementing Green Cleaning Site-Wide

- FY08: LLNL Adopts Green Cleaning Policy that meets USGBC LEED requirements
- FY09: Green Cleaning expanded
  - New cleaning methods (microfiber cloths/mops, HEPA vacuum filters)
  - Recycled-content paper products
  - Biodegradable plastic liners
  - Green Seal Certified supplies
- FY10: Green Cleaning will be fully implemented site-wide

# LLNL Achieves LEED Gold for TeraScale Facility (TSF)

NNSA National Nuclear Security Administration **NEWS**

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**For Immediate Release**
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**NNSA Congratulates Lawrence Livermore National Laboratory for Receiving LEED Gold Level Certification for TeraScale Simulation Facility**

WASHINGTON, D.C. – The National Nuclear Security Administration (NNSA) congratulates Lawrence Livermore National Laboratory's (LLNL) TeraScale Simulation Facility (TSF) for receiving a Leadership in Energy and Environmental Design (LEED) gold level certification last month.

- TSF houses two of the world's fastest supercomputers – BlueGene/L and ASC Purple
- TSF is a one-of-a-kind facility that required a special research and calculation package to meet USGBC LEED Gold certification

# TSF was LEED-certified using the LEED-EB: Operations and Maintenance v2 rating system.

- LEED-EB O&M focuses on the performance of building systems and their maintenance in a facility that has been in continuous operation for at least one year.

# The LEED-EB Process

1

**Which credits should we pursue?**

Evaluate choices based on appropriateness, cost and time constraints

2

**What information do we need?**

Identify all data needed for LEED submittal package, credit-by-credit

3

**Is the information readily available?**

Determine if sub-metering is needed and identify subject matter experts/team members to track and gather data

4

**Are we missing anything?**

A simple policy change or a minor systems repair is sometimes all that is needed to capture a credit. Larger proposed changes need to be evaluated by facility management for appropriateness.

# Benchmarking within the LEED-EB Rating System

LEED uses EPA's Portfolio Manager and Energy Star programs to benchmark buildings.

Datacenters do not currently fit any available building type in either the Portfolio Manager system or the CBECS database.

**How do you benchmark within LEED-EB when your building does not align with Portfolio Manager's building database?**

**Create your own benchmarking database comprised of similar datacenters**

**TSF was compared to 3 on-site tera-flops capable office/datacenters**

# Benchmarking within the LEED-EB Rating System

**Source EUI = Total energy consumed on-site in kBtu/sf**

*LEED-EB uses a building's source Energy Use Intensity (EUI) as the basis for comparing energy efficiency.*

**How do you compare datacenters within LEED-EB when the buildings vary widely in square footage, energy usage and computation speed capability?**

**Determine your basis of comparison**

**Determine your normalizing factors**

# Basis of Comparison : TSF vs. Datacenters 2, 3 & 4

**How much power (kWh) would Datacenters 2, 3, & 4 have used to perform the same work (teraflops) as TSF?**

**Normalizing Factors:**
- **Computation Speed**
- **Datacenter Occupancy**

**are used to calculate**

**Normalized Annual Whole Building Electricity Use**

**Normalized Annual Whole Building Electricity Use**

**is plugged into EAc1:Opt.C3 spreadsheet to determine**

**Source EUI**

| | Datacenter 2 | Datacenter 3 | Datacenter 4 | TSF (B453) |
|---|---|---|---|---|
| Whole Building (sf) | 51,398 | 11,783 | 11,087 | 241,197 |
| Whole Building Electricity Use (kWh) | 26,779,436 | 6,052,547 | 1,883,976 | 98,336,717 |
| Whole Building Natural Gas use (ccf) [Not used in Datacenters] | 19,010 | 4,753 | 4,321 | 95,054 |
| Data Center (sf) [computers and cooling] | 35,000 | 7,000 | 8,500 | 121,607 |
| Data Center Electricity Use (annual kWh) [computers and cooling] | 16,057,080 | 3,600,360 | 902,280 | 89,771,810 |
| Percentage of Datacenter in Use (%) | 75% | 75% | 90% | 60% |
| | | | | |
| Teraflops | 187.0 | 110.0 | 46.0 | 1583.0 |
| MW | 1.8 | 0.4 | 0.1 | 10.2 |
| sf/Teraflops | 140.4 | 47.7 | 166.3 | 46.1 |
| Teraflops/MW | 102.0 | 267.6 | 446.6 | 154.5 |
| kWh (data center only)/TF | 85,867 | 32,731 | 19,615 | 56,710 |
| Normalized for power consumption per unit of processing power and for % of datacenter in use compared to B453 (annual kWh) | 108,741,637 | 41,449,963 | 20,700,134 | 89,771,810 |
| | | | | |
| TOTAL Non-Data Center sf including HVAC/Sppt. | 16,398 | 4,783 | 2,587 | 119,590 |
| TOTAL Non-Data Center Natural Gas Use (annual ccf) | 19,010 | 4,753 | 4,321 | 95,054 |
| TOTAL Non-Data Center Electricity Use (annual kWh) | 10,722,356 | 2,452,187 | 981,696 | 8,564,907 |
| | | | | |
| GRAND TOTAL **Whole Building** Normalized Electricity Use | 119,463,993 | 43,902,150 | 21,681,830 | 98,336,717 |
| | | | | |

# Lessons Learned from the LEED-EB Certification Process

**Detailed energy consumption data is the key to attaining nearly one-third of all available LEED-EB credits in a "gold" level submission package.**

**TSF has a sophisticated Building Automation System that tracks all building systems' performance in real time.**

**TSF is metered at the utility level and the computational load is sub-metered down to 100 kVA.**

# Achieving "Gold" LEED-EB Certification: Policy Changes and Equipment Installation

**Monitoring and metering systems can help your building run efficiently today and simplify your pursuit of LEED-EB credits.**

**Meter and sub-meter all energy consumption and track and record all readings: 1 year of continuous data is needed for LEED-EB.**

**Tweaking heating and cooling systems' set-points and run times maximizes energy savings with minimum operational impact.**

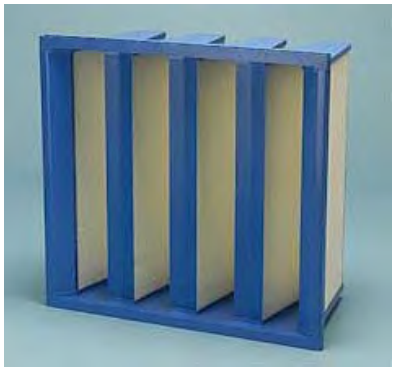
**Determine optimum supply air temperatures through modeling and/or testing.**

**Install and use economizers to complement your datacenter cooling systems.**

# Achieving "Gold" LEED-EB Certification: Four Small Changes to Make Now

**1**

**Add occupancy-sensing multi-level lighting controls**

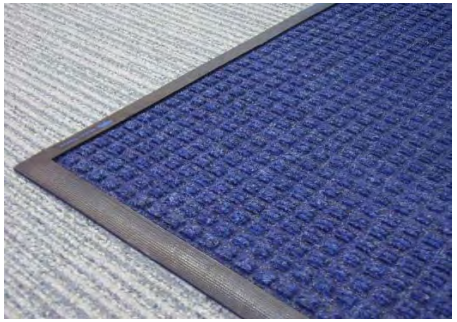


**3**

**Replace standard HVAC filters with MERV 13 or higher filters**

**2**

**Place 10' of walk-off mats inside of all major entrances**



**4**

**Replace standard light bulbs with CFL/low-mercury light bulbs**