

LEED

An Engineer's Perspective

What is it?

The Leadership in Energy and Environmental Design (LEED) is a building certification system that assesses buildings by a points based award system.

Points are assigned to several sustainable categories.

Award given based on the the total points achieved.

Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80 +

Where did it come from?

LEED is a product of the US Green Building Council (USGBC)

- The USGBC is a private non-profit body founded in Mike Italiano, David Gottfried and Rick Fedrizzi in 1993.
- The USGBC is not a government body or agency of the US government.
- LEED first launched as LEED v1.0 in 1998 as pilot project. Updated to Leed v2.0 in 2000. Current version is LEED 2009.

- The most recognized brand in green building certification.
- 8000+ projects certified, 23,000+ registered.
- Total of 162,000 LEED Professional Credentials awarded.
- 3,000 LEED Credentials per month issued since April 2009
- 108 Million US in revenue in 2009, up from 79 Million US in 2008

2009 2008

CHANGE IN NET ASSETS

Revenue

Accreditation	\$ 42,249,342	18,675,810
Membership Dues	\$ 17,292,228	15,802,561
Certification	\$ 15,294,895	7,588,939
Conferences and meetings	\$ 9,385,832	9,459,802
Publications	\$ 8,526,516	9,991,538
Project Registration Fees	\$ 5,656,930	4,754,140
Workshop Registrations	\$ 4,011,649	8,655,081
Investment Income	\$ 1,679,148	633,843
Sponsorship	\$ 1,184,950	1,646,506
Grants	\$ 987,951	876,217
Rental Income and Other	\$ 821,943	252,871
Other	\$ 401,601	-
Donated Materials	\$ 359,447	346,004
Total revenue	\$ 107,852,432	78,683,313

excerpt from USGBC 2010 Annual Report

Energy Point allocation under LEED NC (New Construction and Major Renovations) 2009

Categories are

- | | |
|---------------------------------|----------------------|
| 1. Sustainable Sites | - 26 possible points |
| 2. Water Efficiency | - 10 possible points |
| 3. Energy and Atmosphere | - 35 possible points |
| 4. Materials and Resources | - 14 possible points |
| 5. Indoor Environmental Quality | - 15 possible points |

Total of 100 base points

10 Bonus Points for Innovation in Design (6) and Regional Priority (4)

Energy Point allocation under LEED NC (New Construction and Major Renovations) 2009

- Any project seeking Certified, Silver, Gold or Platinum certification must demonstrate a 10 percent improvement above a building designed to comply with ASHRAE 90.1-2007 as a prerequisite.
- The most effective means of earning this credit is through an application called the “Whole Building Energy Simulation Model.”
- The energy model is a computer software simulation that starts with specified materials and systems for a building, calculates the energy cost for one year, and creates a report of the anticipated energy performance of the building.
- The ASHRAE standard and the LEED model compare the annual energy cost of the proposed building vs. the baseline building that just meets code.
- Points are awarded for predicted improved performance over the ASHRAE 90.1 baseline.

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15
42%	38%	16
44%	40%	17
46%	42%	18
48%	44%	19

Point Allocation for Energy Reduction EA Credit 1

The measured results of LEED certified buildings

- Survey funded by the USGBC , presented at GreenBuild 2007, the USGBC's annual gathering.
- Performed by The New Buildings Institute

What did the survey look at?

Measured performance of the LEED buildings against their proposed saving percentages on which the LEED points were awarded.

Compared the actual consumption of the LEED buildings to the energy usage data from all national building stock in the U.S.

Data compared using the EUI, energy use intensity (in kBtu/sf/yr)

U.S. National EUI data comes from the Commercial Building Energy Consumption Survey (CBECS), a national survey of building energy characteristics completed every four years by the federal Energy Information Administration.

Measured performance of the LEED buildings
vs their proposed saving percentages

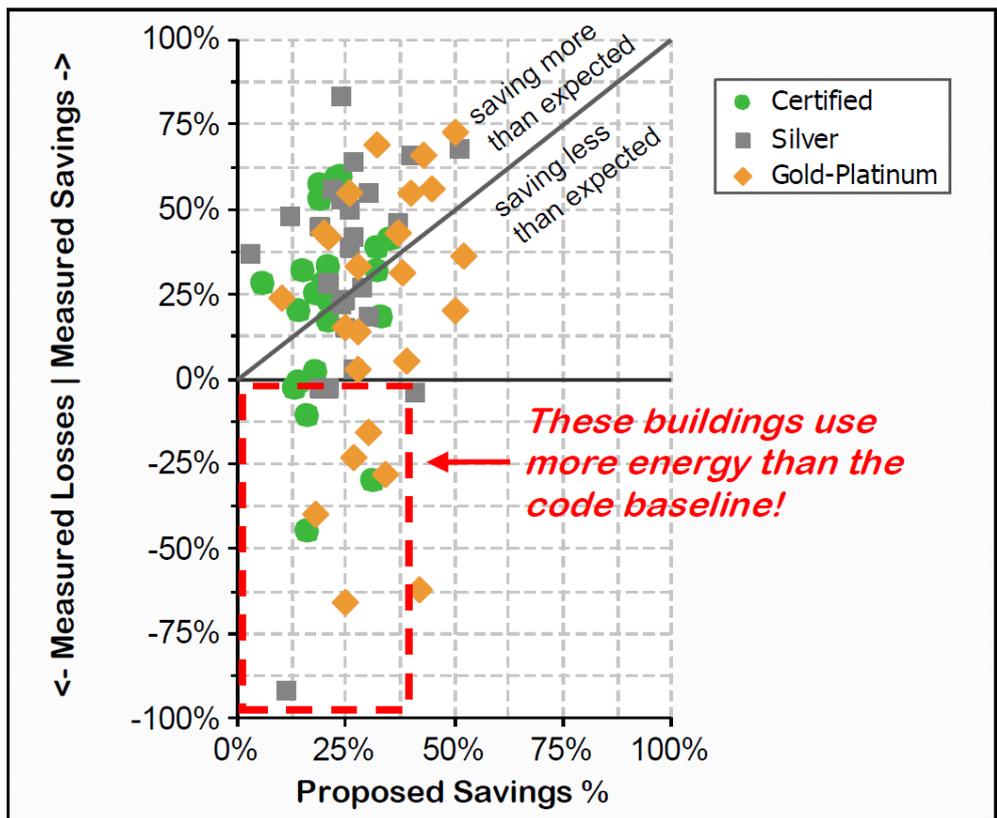


Figure ES- 5: Measured versus Proposed Savings Percentages

Survey Results

Large scatter of results.

Some building used more energy than the code baseline!

Actual consumption of the LEED buildings
compared to all other buildings

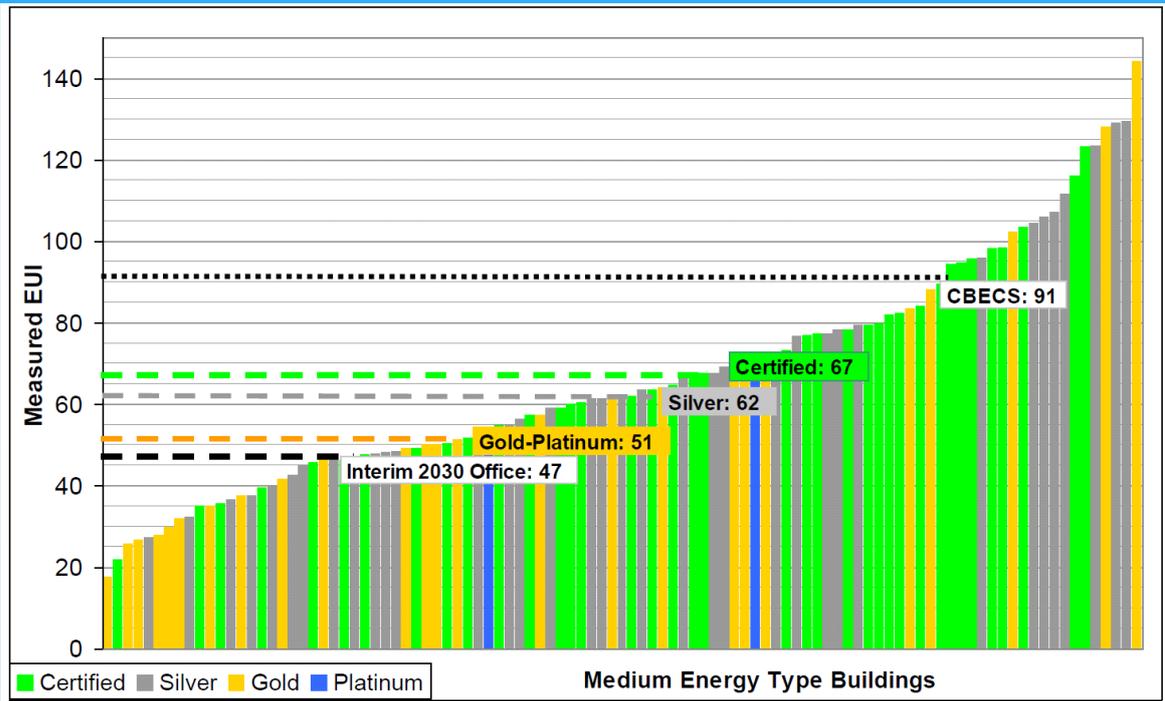


Figure ES- 2: EUI (kBtu/sf) Distribution

NBI Survey Results

Survey Results

LEED measured buildings median EUI = 69

CBECS national average for all building stock = 91

Energy Saving using LEED = 24 percent

Survey presented conclusion that the LEED certified buildings performed 25%-30% better than non-LEED buildings.

Analysis of Results

Henry Gifford, a New York based energy consultant challenged the results on a number of points

The survey invited all 552 building owners that had been LEED certified at that point to submit data on their building.

- 250 responses received
- Complete energy data only obtained from 121 buildings, just 22% of the total no of LEED certified buildings.
- There is a likelihood that these 121 building owners that were tracking their data and willing to subject the data to scrutiny would be the among the best performers in the dataset.

Analysis of the Results

The LEED buildings were all constructed after 2000, automatically benefitting from recent advances in energy efficiency of lighting, hvac equipment etc.

- The compared EUI mean for existing buildings (91) included all buildings in the database including those built before 1920.
- So to make a fair comparison the LEED results should be compared to CBECS data for post 2000 constructed buildings.
- This CBECS data showed an EUI of 81 vs 91 for all buildings in the database.
- Using this comparison, the LEED buildings saved 15%, not the 24% claimed originally

Analysis of the Results

The LEED EUI of 69 presented in the survey was a median value ie the number seperating the higher half of a group of measurements from the lower half.

- The CBECS data presented of 91 was a mean or average value.
- Comparing the median of one dataset to the mean of another is a meaningless comparison.
- The mean value of the LEED buildings, not presented at the time, was later released.
- The mean EUI value of the 121 LEED buildings included in the study was 105.

Analysis of the Results

The LEED buildings surveyed had a mean EUI value of 105

The CBECS buildings surveyed had a mean EUI value of 91

The CBECS buildings constructed after 2000 had a mean EUI of 81.6

The LEED buildings compared with the entire CBECS dataset used 15% more energy.

The LEED buildings compared with the post 2000 constructed dataset used 29% more energy.

LEED and the Energy Problem

- The buildings did not use more energy because there were LEED certified.
- LEED Certification award purely on predicted performance and not actual performance.
- There was no requirement for LEED buildings prior to 2009 to measure or track energy data to determine how they actually performed.
- Operating a building efficiently as important to energy use as the initial design.
- If System A is 20% more efficient than System B and System A operates at 12 hours a day and System B operates at 10 hours a day, no difference in energy consumption.

LEED and the Energy Problem

- The total points allocated under LEED 2009 for energy efficiency beyond the ASHRAE 90.1 code is 19, leaving 81 points still on the table.
- Easier points to get under LEED than the Energy Efficiency Points, a problem with the LEED process.

LEED improvements since study

- The USGBC has now started collecting data on LEED buildings with water and energy data to be provided for 5 years from the date of occupation.
- Building Performance Partnership program established to attempt to collect energy data from LEED certified buildings.
- LEED Building Operations and Maintenance introduced in 2009
- Improvement in energy and water performance promised in LEED 2012.
- ASHRAE 90.1 under continuous improvement, so the baseline improving.
- Next survey should show the LEED performance improving for LEED 2009 certified buildings now that energy is being monitored, but no real data yet.

Recommendations for the Caribbean

- Start a regional version of the CBECS to gather baseline data on actual energy use of Caribbean buildings.
- Publish energy data for all public buildings, both leased and owned.
- Adopt and implement ASHRAE 90.1 as a minimum, modified if necessary.
- Energy efficiency and water efficiency generate ROI that will drive sustainable practice in both new building construction and existing building operation.