The LEED Plaque Unpacked: What a Decade of LEED Project Data Reveals About the Green Building Market

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ABSTRACT

Ten years after the first Leadership in Energy and Environmental Design (LEED) certification issued by the U.S. Green Building Council, more than 22,000 LEED certified commercial projects have collectively achieved over 1,000,000 point credits using the LEED criteria. These million-plus green building design, construction, procurement, and measurement decisions have been applied across 3 billion square feet in 150 countries, spanning the building's lifecycle to include all commercial property types and time-scale dimensions. This analysis synthesizes LEED project credit achievement in energy efficiency and efficiency-related measures across successive LEED New Construction (NC) rating system versions spanning over a decade. These results characterize the average LEED project achievement on energy efficiency measures. This first-of-its-kind LEED credit level analysis further depicts credit achievement ranges observed at each LEED tier [Certified, Silver, Gold, Platinum] for all new construction projects in the United States that certified to LEED between 2007 and 2013.

A primary result of this research is to illuminate the uptake of energy efficiency measures of LEED projects. Equipped with this information – along with future parallel insights in water efficiency, indoor air quality, etc. – market actors and policymakers can make more informed and refined strategic decisions about how to best prioritize and drive green building outcomes using the LEED rating system.

Introduction

The LEED building rating system is administered by the U.S. Green Building Council (USGBC) with the first LEED version 1.0 pilot program released in 1998. The LEED rating system has since evolved with v2.0 released in 2000 and v2.1 in 2003; the latest release of LEED v4 supersedes the v2009 version. LEED includes specific rating systems for new and renovated buildings (New Construction / Core and Shell), tenant fit outs (Commercial Interiors), existing buildings, along with specific property types and circumstances (retail, schools, campus, volume). A LEED rating is recognized at four tiers corresponding to point achievement: Certified, Silver, Gold and Platinum with the incremental step-up to achieve LEED Platinum significantly more difficult. The introduction of LEED v2009 increased the achievable points from 69 to 110 while re-weighting key categories including the energy category.

The Energy and Atmosphere (EA) credit category within LEED is crucially important for achieving a project's environmental goals. Increasing energy efficiency in building design and operation is one of USGBC's primary goals for accomplishing market transformation. There is broad-based industry appetite to better understand what LEED buildings achieve via energy efficiency measures and metrics; however, LEED's nature as a voluntary rating system combining mandatory prerequisites with optional credits across design and operational phases makes it impossible to predict even generalized energy savings with high degrees of certainty. Analyzing LEED building achievement, by phase and rating system lifecycle, can help to define the "average LEED building" or, more granularly, the "average LEED Gold building."

Within the LEED-NC rating system, of particular interest is *EA Credit 1 - Optimize Energy Performance* (EAc1). This credit awards points on a sliding scale by the percentage documented efficiency improvements over the ASHRAE 90.1 baseline code, and has the largest point range of any credit within the various LEED rating systems.[1] Successive rating system versions reference the most recent national model building energy code as defined by ASHRAE.

The design of the EAc1 scoring system aims to maximize the efficiency of LEED buildings as compared to minimally code-compliant buildings built in the absence of LEED. This model-code-based efficiency metric is one that can result in market confusion – the metric is dissimilar to other commonly referenced measures, notably the Energy Use Intensity metric used by the LEED Existing Building rating system and Energy Star Portfolio Manager program.

USGBC exerts control of rating system version eligibility. Upon registration with LEED, projects must select the most current and prevailing LEED rating system at that time, locking in the specific rating system requirements. Large commercial projects have multi-year timelines which creates a significant certification data lag.

This paper analyses the specific quantities of EAc1 point achievements for over 9,000 LEED NCv2.1, v2.2 and v2009 projects in the United States. The analysis identifies trends in design-based energy efficiency while highlighting the changing baseline ASHRAE 90.1 energy codes that underlie LEED EAc1 credit eligibility requirements. Each LEED rating system version references the most recent and increasingly stringent ASHRAE 90.1 energy standard, requiring projects to achieve design improvements over this baseline to earn points under EAc1.

This paper also looks at complementary energy efficiency LEED credit achievement for projects that seek to increase the likelihood that building operations will meet the design intent. In particular the analyses explores credit attainment trends of *EAc3 – Enhanced Commissioning*, and *EAc5 – Measurement and Verification*.

From this information large portfolio owners, policy makers, and efficiency program designers can gain valuable insights into what LEED offers as a programmatic implementation.

Literature Review

Little research exists on green building market trends utilizing the LEED credit dataset, primarily due to the historic unavailability of specific credit achievement data in aggregated or consolidated form. USGBC is working to make this data more accessible through GBIG.org, a technology platform designed to search, explore and analyze green building activities worldwide.

A research project conducted in 2012 by USGBC analyzed LEED credit category trends over time, and by region. Findings showed credit achievement in the Energy & Atmosphere category has increased over time -- mean LEED EA category credit achievement in 2006-2008 was 6.4 points, and increased to a mean achievement in 2009-2011 of 7.0 points (Pyke 2012).

In a 2012 study, USGBC developed an approach to considering codes and rating systems, utilizing average credit achievement data for commercial projects to develop a profile of the "average" LEED-NC buildings for comparison with theoretical buildings built to meet emerging green building codes such as ASHRAE Standard 189.1, CALGreen, and IGCC (Burt 2012). These findings highlighted the need for a better understanding of what "average" LEED-NC buildings represent, and what these buildings achieve on the major energy efficiency credits within the LEED EA category across rating systems.

[1] Some efficiency measures also contribute to other LEED credits. The double counting is intentional.

Methodology

From the first LEED certification in October 2001 through to year-end 2013, the LEED NCv2.1, v2.2, and v2009 rating system versions account for 9,026 LEED certified commercial projects totaling over 851 million square feet in the United States. Projects certified under prior LEED NC versions were eliminated from this analysis -- versions 1.0 and 2.0 pre-date USGBC's information technology infrastructure and electronic credit-level data is unavailable for analysis.

LEED credit achievement data is aggregated using pivot tables depicting each LEED certification tier by year and rating system to show the portion of projects and total square footage in each category, and the proportion of projects achieving LEED EAc1.

Table 1. Summary LEED NC EAc1 credit achievement data

LEED-NC Rating Systems All US Projects	2007	2008	2009	2010	2011	2012	2013	United States Grand Total *
LEED NC 2.1	**309**	**326**	**275**	**157**	**76**	**53**	**24**	**1,483**
Certified	105	88	74	30	13	9	2	438
Silver	105	118	93	63	31	18	12	523
Gold	79	101	93	57	29	21	9	446
Platinum	20	19	15	7	3	5	1	76
LEED NC 2.2	**28**	**163**	**774**	**1,318**	**1,412**	**1,215**	**830**	**5,741**
Certified	7	35	146	206	179	150	84	807
Silver	10	63	243	467	495	430	306	2,015
Gold	9	56	345	581	655	552	381	2,579
Platinum	2	9	40	64	83	83	59	340
LEED NC 2009				**12**	**193**	**636**	**961**	**1,802**
Certified				3	53	131	217	404
Silver				3	63	265	383	714
Gold				4	62	204	301	571
Platinum				2	15	36	60	113
Annual Totals	**337**	**489**	**1,049**	**1,487**	**1,681**	**1,904**	**1,815**	**9,026**

* Not shown includes 264 pre-2007 projects of which 263 were LEED NCv2.1 and 1 LEED NCv2.2

Total LEED Certified Gross SF All US Projects	EAc1 2007	EAc1 2008	EAc1 2009	EAc1 2010	EAc1 2011	EAc1 2012	EAc1 2013	United States Grand Total **
LEED NC 2.1	**30,220,161**	**35,667,531**	**38,023,532**	**23,394,183**	**11,472,310**	**4,691,432**	**2,624,640**	**171,732,176**
Certified	12,237,832	8,747,132	7,517,232	3,043,596	3,896,971	326,590	139,306	48,549,061
Silver	6,132,085	13,257,445	11,795,497	7,890,156	3,379,307	856,760	759,230	50,722,309
Gold	10,795,385	12,644,780	17,154,318	11,742,248	4,022,347	3,101,297	1,577,803	67,158,034
Platinum	1,054,859	1,018,174	1,556,485	718,183	173,685	406,785	148,301	5,302,772
LEED NC 2.2	**1,938,888**	**21,349,405**	**84,993,455**	**118,353,697**	**136,643,446**	**114,840,385**	**82,246,593**	**560,418,169**
Certified	46,798	1,956,128	15,185,152	21,185,403	14,057,414	11,763,884	7,625,647	71,820,426
Silver	897,297	13,174,308	32,570,666	41,697,068	46,886,324	34,721,928	26,440,978	196,440,869
Gold	971,318	5,531,334	36,124,415	52,050,392	63,114,831	62,535,657	43,716,957	264,044,904
Platinum	23,475	687,635	1,113,222	3,420,834	12,584,877	5,818,916	4,463,011	28,111,970
LEED NC 2009				**193,295**	**10,099,451**	**38,884,253**	**69,874,547**	**119,051,546**
Certified				17,782	2,490,683	7,036,700	16,212,698	25,757,863
Silver				92,280	3,833,737	15,274,517	23,651,036	42,851,570
Gold				69,004	3,448,514	15,434,303	26,606,007	45,557,828
Platinum				14,229	326,517	1,138,733	3,404,806	4,884,285
Annual Totals	**32,159,049**	**57,016,936**	**123,016,987**	**141,941,175**	**158,215,207**	**158,416,070**	**154,745,780**	**851,201,891**

** Not shown includes 25.7 million sq ft of pre-2007 projects

% LEED Credit Acheivement All US Projects	EAc1 2007	EAc1 2008	EAc1 2009	EAc1 2010	EAc1 2011	EAc1 2012	EAc1 2013	United States Grand Total
LEED NC 2.1	**24%**	**63%**	**71%**	**71%**	**70%**	**77%**	**54%**	**47%**
Certified	17%	47%	51%	57%	38%	56%	50%	29%
Silver	23%	57%	70%	54%	61%	67%	17%	43%
Gold	29%	84%	85%	95%	90%	90%	100%	66%
Platinum	50%	74%	93%	100%	100%	100%	100%	71%
LEED NC 2.2	**82%**	**83%**	**92%**	**95%**	**98%**	**98%**	**99%**	**96%**
Certified	100%	51%	76%	89%	96%	95%	98%	89%
Silver	50%	84%	93%	93%	95%	97%	99%	95%
Gold	100%	100%	98%	99%	100%	99%	99%	99%
Platinum	100%	100%	100%	100%	100%	100%	100%	100%
LEED NC 2009				**100%**	**97%**	**98%**	**98%**	**98%**
Certified				100%	92%	95%	94%	95%
Silver				100%	98%	98%	98%	98%
Gold				100%	100%	100%	100%	100%
Platinum				100%	100%	100%	100%	100%

Results

Using the LEED credit-level dataset described above, the average design efficiency of each LEED NC v2.1, v2.2, and v2009 rating system is measured by 'percent improvement over baseline energy code' against annual gross square feet of LEED certifications.

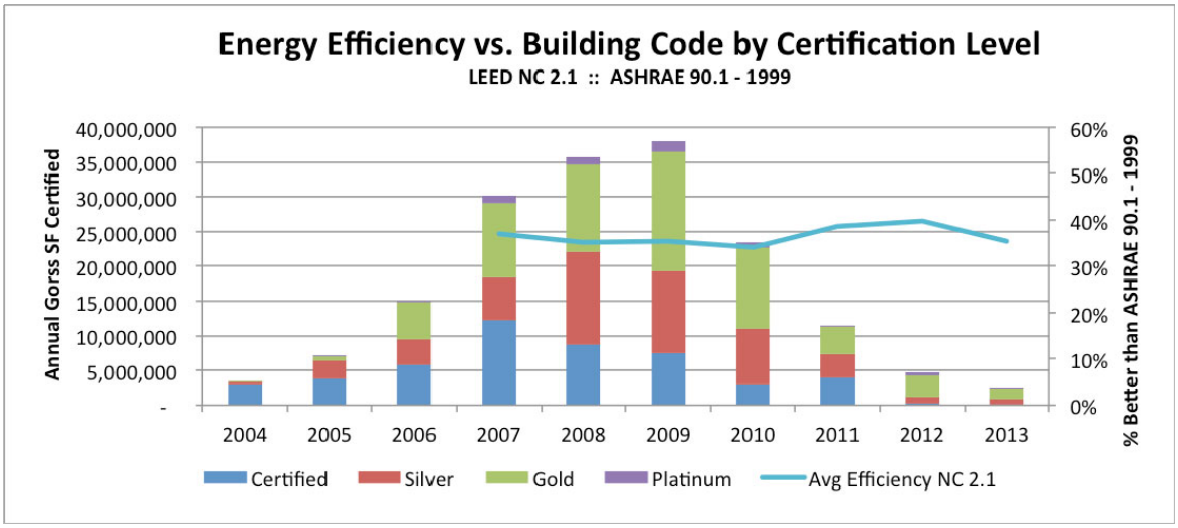

Figure 1. LEED NC 2.1 average energy efficiency and LEED tier.

For the 1,483 LEED NC v2.1 projects included in this analysis [Figure 1], the average annual design efficiency varied between 34% and 40% better than ASHRAE 90.1-1999. The average design score is fairly consistent within LEED-NC rating systems, and across certification levels. This phenomena may be attributable to market efficiencies created at scale as designers discover, share, and repeat cost effective energy efficiency design strategies [aka "learning"]. LEED NCv2.1 certified gross square footage increased significantly in 2007 then dropped off after 2010 as projects registered under this rating system completed their journey through the pipeline consistent with the multiyear timeframe of most commercial building projects. There remain a very small number of projects certifying under this rating system version in 2012 and 2013, and no more are expected.

The LEED NCv2.2 rating system saw much faster market uptake, reaching the 20 million square foot per year benchmark in its second full year following release before peaking at 136 million square feet certifying in 2011. Although declining in velocity, LEED-NCv2.2 continues to experience significant certifications with over 80 million square feet certified in 2013 as projects transition to certifying under the LEED NCv2009 rating system.

The average design efficiency for LEED NCv2.2 projects [Figure 2] is more consistent than seen in v2.1 and hovers at a 26% design improvement over ASHRAE 90.1-2004, which is more stringent compared to its predecessors. In 2007 to correspond with the release of v2.1, USGBC required all certified projects regardless of tier to achieve a minimum of two points in EA Credit 1, or 14 percent design savings over ASHRAE code. Findings show the average LEED project consistently achieved over two EAc1 points; this requirement eliminated the potential for LEED certifications to fall into the lower tail of the EAc1 credit achievement distribution curve.

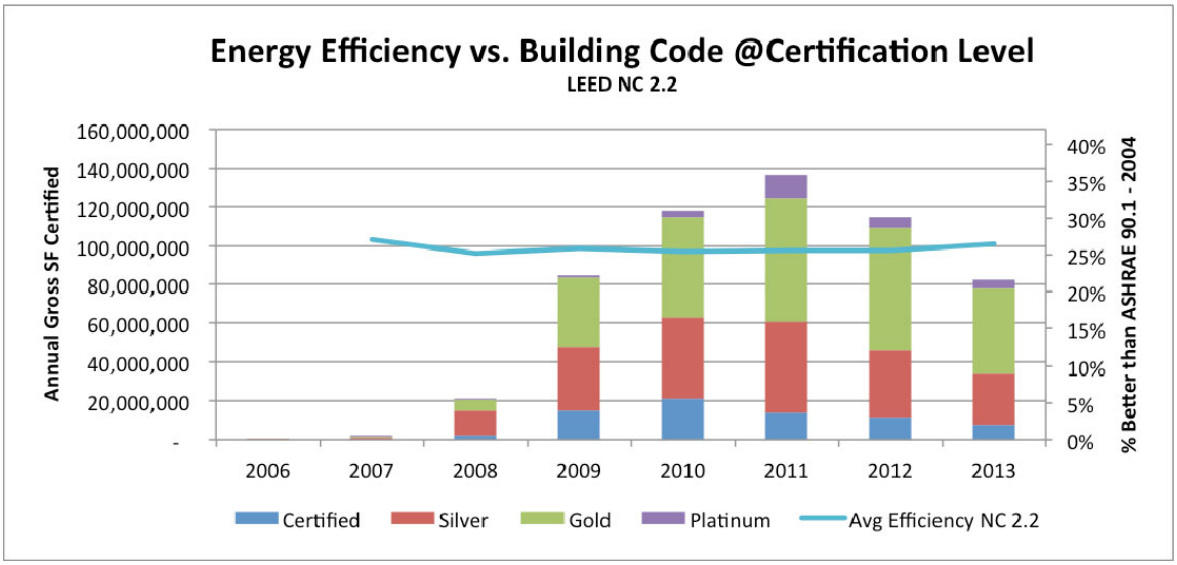

Figure 2. LEED NC 2.2 average energy efficiency and LEED tier.

In 2007, the Pacific Northwest National Laboratory [PNNL] found that buildings built to ASHRAE 90.1-2004 standards are projected to use between 2.6% to 9.7% less site energy, 5.8% to 11% less source energy, and save 6% to 13% in energy costs (the metric used by LEED) compared to the 1999 ASHRAE standard.[2] The US Department of Energy's analysis of the ASHRAE standard found site energy savings of 11.9% and source energy savings of 13.9% nationwide in commercial buildings.[3] With LEED NCv2.2 adopting 90.1-2004 as the baseline, NCv2.2 buildings represent an increase in energy efficiency over LEED NCv2.1, though precise determination of efficiency gains is impossible without significant simulation to match the building type mix found in LEED with the underlying CBECS data that supports energy models.

The newer LEED NC v2009 rating system had few projects certify in 2010, and the rating system did not reach the 20 million square foot per year threshold until 2012. While the referenced ASHRAE 90.1 standard increased again from 2004 to 2007, the average annual design efficiency again remains extremely consistent at 29% better than ASHRAE 90.1-2007.

This average improvement of 29% over 90.1-2007 is a significant advance in design efficiency compared to the roughly 20% savings seen in NCv2.2 using the 90.1-2004 standard as baseline. Additive to this design efficiency gain, DOE's analysis of ASHRAE versions found national source energy improvements of 3.9% and site energy savings of 4.6% between ASHRAE's 2004 and 2007 energy code standards.

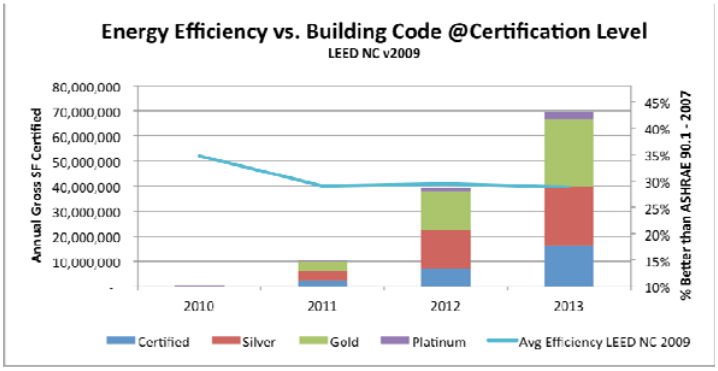

Figure 3. LEED NCv2009 average energy efficiency and LEED tier.

[2] http://www.pnl.gov/main/publications/external/technical_reports/PNNL-16770.pdf
[3] http://www.gpo.gov/fdsys/pkg/FR-2008-12-30/pdf/E8-30975.pdf

Average LEED Design Energy Consumption Reductions vs. ASHRAE 90.1 Energy Codes

The LEED credit-level dataset also provides insight into the average project design energy efficiency gains by certification tier for each LEED-NC rating system.

Each graph in Figure 4 demonstrates the annual average design efficiency by LEED tier for the specific LEED-NC rating system version as compared to the baseline referenced ASHRAE energy code. All three LEED rating systems demonstrate remarkable consistency, with average efficiency rankings generally higher for each successive LEED certification tier.

Projects achieving LEED Platinum greatly outpace other certification levels by consistently averaging 55-60% design energy efficiency gains in the early NCv2.1 rating system, and in excess of 40% in later LEED versions as the baseline ASHRAE standards increased in stringency. Each rating system average falls between the LEED Silver and LEED Gold tiers suggesting that project owners invest in additional energy efficiency techniques when elevating LEED tiers.

Project owners clearly value energy efficiency within the LEED framework. When LEED was released to the market, no energy saving credits were required as a LEED certification prerequisite, yet projects routinely averaged 30% design gains over the ASHRAE benchmark. Energy efficiency objectives remained optional in NC v2.1 and NC v2.2 until 2007 when USGBC implemented a condition of certification requiring a minimum of two EAc1 points, or 14% efficiency requirement over ASHRAE 90.1-2004.

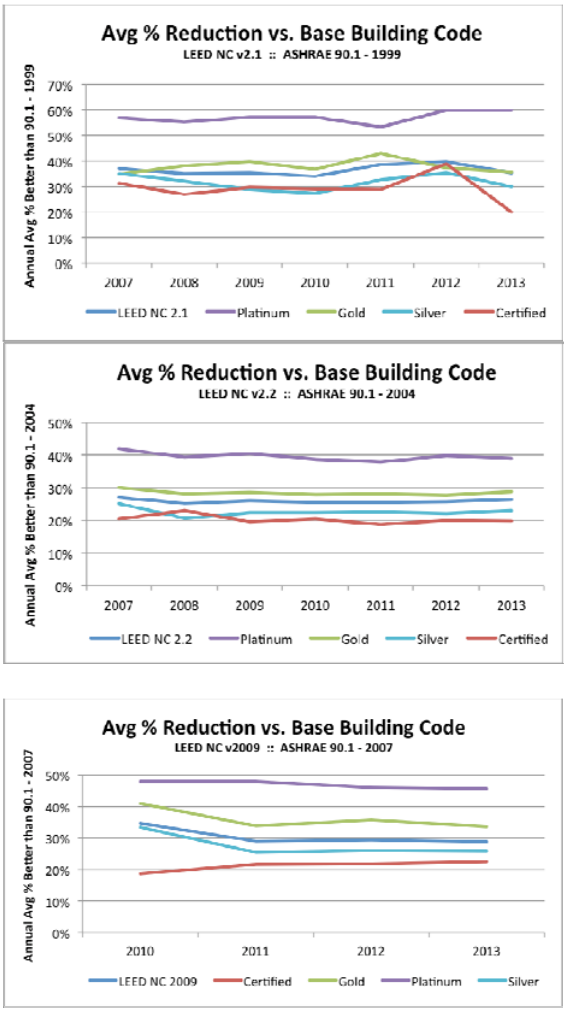

Figure 4. LEED NC avg % energy efficiency gains.

In the LEED NC v2009 rating system, EAc1 credit achievement analysis reveals a similar pattern showing significant design energy efficiency. Of note is a widening gap between projects certifying at the LEED Gold and LEED Platinum tiers and those at the lower LEED tiers. These higher rated LEED certifications increased their designed energy efficiency roughly 5 percentage points on average in addition to the increases between the 2004 and 2007 ASAHRAE versions. Clearly the market dynamics driving LEED certification consistently result in projects delivering energy efficiency gains when compared to prevailing energy codes.

Percentage of LEED Certified Projects Pursuing the Energy Efficiency Credit [EAc1]

Energy efficiency beyond base code compliance is the hallmark of a high performance building, and a feature expected of LEED buildings by the broader real estate market.

Figure 5 depicts the large percentage of LEED projects attaining EAc1 at increasing levels over time. LEED NCv2.1 exhibits a particular dynamic of a wider achievement range as EAc1 was an optional credit for this rating system version. From a baseline of 25% EAc1 credit achievement in 2007, the market accelerated investments in energy efficient features with Platinum projects on average doubling EAc1 credit attainment rates from 50% to 100% at the time of v2.1 maturity in 2010. LEED Certified projects attained the EAc1 credit at below a 20% rate in 2007, improving to nearly 60% achievement in 2010.

USGBC recognizes the need for ongoing programmatic improvement to the LEED rating system. Achieving a minimum of 2 points under EAc1 became mandatory for NCv2.2 projects registered after 2Q07. [4] This minimum threshold requirement resulted in rapid growth in owners engaging energy efficiency within LEED projects.

The LEED NC v2009 version update requires projects to demonstrate 10% design improvement over the newly-referenced upgraded ASHRAE 90.1-2007 energy code before achieving points for energy efficiency under EAc1. The rapid increase in EAc1 credit achievement reveals how mandated energy improvement prerequisite can result in stimulating engagement in energy efficiency at all levels of LEED. A full 95% of projects at the lowest LEED tier of v2009 now achieve additional points under EAc1, and are doing so under a more stringent ASHRAE version when compared to LEED NCv2.1 projects. This remarkable participation increase showcases the underlying power of LEED as a market-driven, asset-differentiation construct to engage the real estate industry in market transformation.

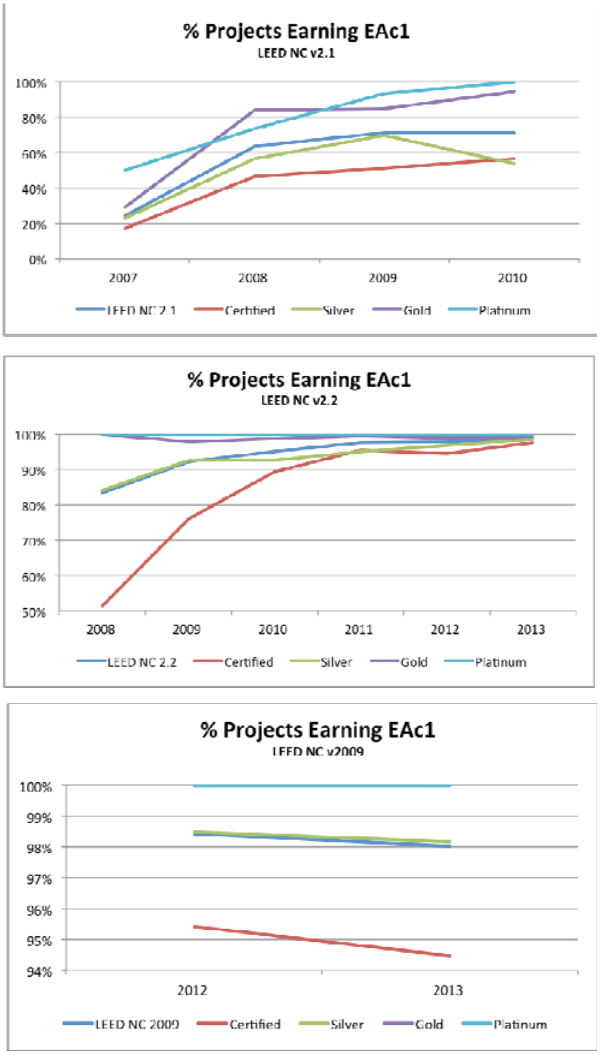

Figure 5. Percent of LEED projects earning EAc1.

[4] Older versions of the LEED-NC rating system are sometimes criticized for providing pathways for project owners to achieve a LEED certification, yet not incorporate significant design-based energy efficiency measures. USGBC responded to this critique by requiring a minimum of two EAc1points in the LEED NCv2.2 rating system version and referencing ever-stringent ASHRAE standards each rating system update.

LEED Certified Project Credit Achievement – Enhanced Commissioning Credit [EAc3]

Design efficiency is not the same as building operating performance; buildings are likely to perform outside of the range intended by their designers at some point during their lifecycle. This deviation is usually a result of building operating conditions varying from the design model assumptions. Underperformance is also caused by improper installation of building systems.

Commissioning is a validation by a third party that building systems are installed and operating properly. LEED requires basic commissioning as prerequisite -- additional credit can be earned for engaging enhanced commissioning processes (EAc3). Enhanced commissioning is anecdotally reported as one of the more expensive LEED credits to achieve, but with clear financial benefits and investment paybacks.

Figure 6 shows the percentage of LEED projects attaining EAc3. The graphs depict NC rating systems experiencing 20 million square feet or more of certifications in a calendar year.

LEED NC v2.1 required fundamental commissioning on all projects.[5] Projects could achieve a LEED point under EAc3 if an independent commissioning agent was used throughout the process. Note from 2007 to 2010 the percentage of v2.1 projects attaining EAc3 doubles at all certification levels, consistent with v2.2 and v2009.

LEED NC v2.2 brought clarity to the commissioning prerequisite requirement by requiring engagement by a single authority independent of the design and construction management teams, and specifically listing key energy-related systems for commissioning to include HVAC, lighting, hot water and renewable energy.

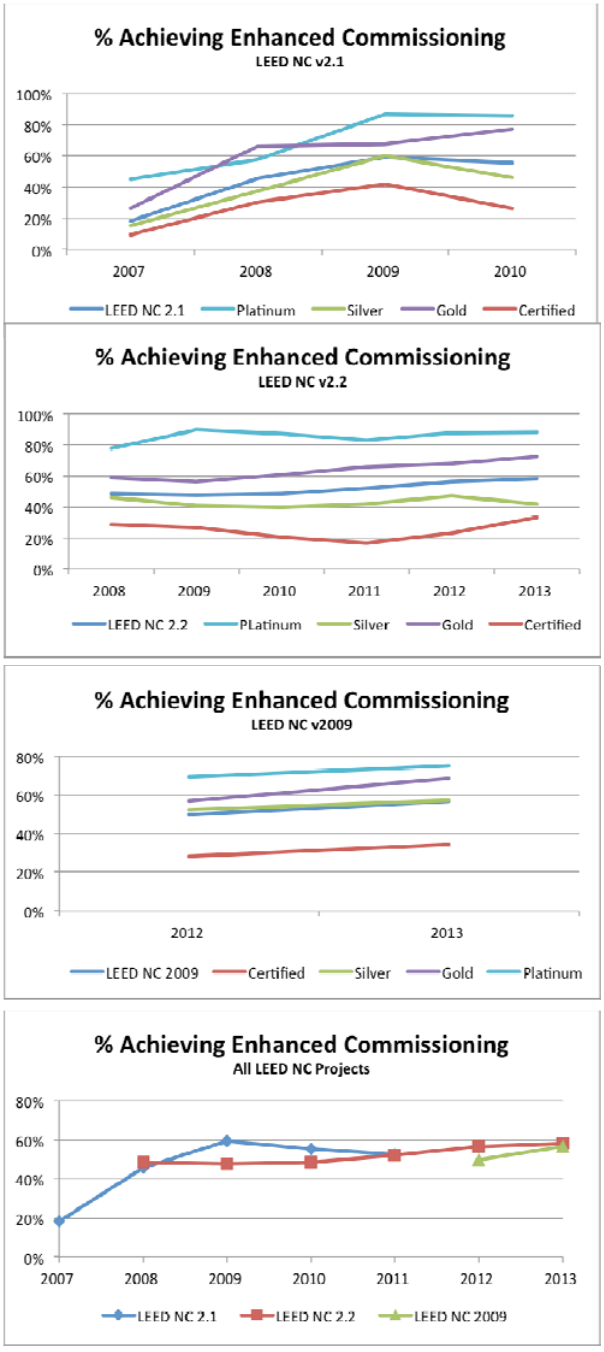

Figure 6. Percent of LEED projects earning EAc3.

[5] LEED NCv2.1 commissioning pre-requisite allowed design team contractors to perform the requisite tasks as long as the commissioning agents themselves were not involved in the design.

Plotting the annual EAc3 credit attainment across all rating systems shows a generally upward trend of achievement, albeit with a relatively wide variation between LEED tiers.

LEED Certified Project Credit Achievement – Measurement and Verification Credit [EAc5]

Similar to the LEED credit for enhanced commissioning, achieving the measurement and verification credit (M&V) can help reduce variance between building operating performance and the designers' original intent. This LEED credit requires design teams to work with the building owner to create a plan for monitoring building energy consumption and ongoing conservation measures. As operating circumstances inevitably change, owners and operators of buildings achieving EAc5 have greater information to inform forward-looking management decisions.

This credit requires developing a M&V plan consistent with Option D of the *International Performance Measurement & Verification Protocol (*IPMVP*)* to include the sub-metering of major energy systems. Credit requirements maintain consistency across LEED versions, while the point value was increased to three points (from one) in v2009.

Figure 7 shows low EAc5 credit achievement percentages across the LEED NC rating systems with the notable exception of LEED Platinum projects, particularly in v2.2 projects. This is likely due to upfront costs for required equipment coupled with a market lag in adopting technologies and best practice procedures outlined in IPMVP.

The number of projects achieving EAc5 took a noticable jump in the v2009 rating system nearly doubling for LEED Gold projects and tripling for Silver and Certified. This is in large measure the result of rebalancing the LEED rating system to give a 3 point weight to this credit in v2009 (up from 1 point), lending further credence to the value of LEED points as currency to prompt market transforming behaviors.

The 2013 achievement rate for v2009 projects (all LEED tiers) is 4x the v2.1 achievement rate seen in 2011 at all LEED tiers. This significant growth in EAc5 achievement

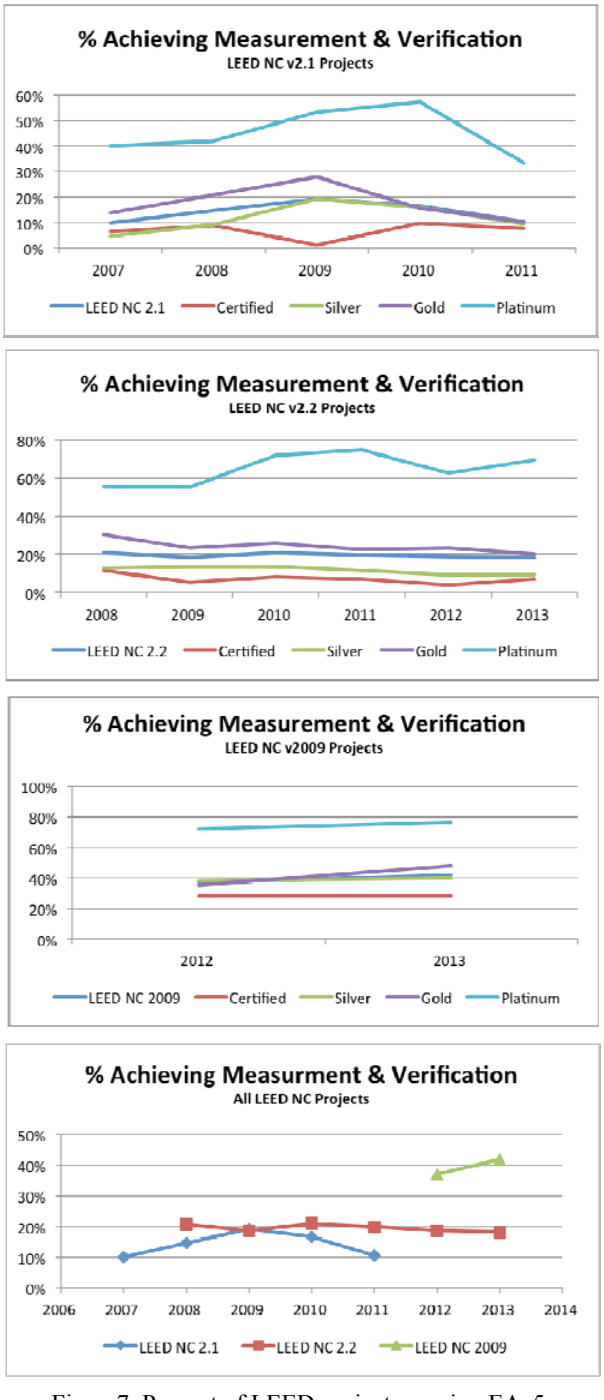

Figure7. Percent of LEED projects earning EAc5.

may be due to a combination of rapid technology diffusion required to achieve EAc5, industry learning, and/or owner recognition of the increased volatility risk from energy prices.

Analysis

LEED NC Projects and Average Design Energy Efficiency

It is worthwhile to consider the data from LEED NC rating system versions that are at the end of their life cycle, specifically the NCv2.1 rating system. This LEED rating system was released in 2004 and saw a significant uptick in market adoption resulting in certification growth in 2007. The 2007 through 2010 years were the peak of v2.1 projects with roughly 115 million square feet of space certified in this 4-year span [Figure 1]. These peak years reveal LEED certification growth at all tiers, not exclusively at the lower end. This consistent growth in aggregate certifications yielded strong design efficiency gains, as average design efficiency remained remarkably consistent for each LEED tier [Figure 4].

Within the LEED framework, a year-over-year analysis reveals buildings do not achieve increasingly better design efficiency rates during a rating system lifecycle. This may indicate design teams learn new efficiency strategies and continue to replicate them, but the real estate industry as a whole does not strive to continually increase design efficiency. Some projects almost certainly move to higher levels of certification by way of enhanced designer expertise; however, the consistent long-term average indicates this upward movement potential is offset by some combination of dilution from growth in project volume certifying at lower LEED tiers and new entrants pursuing LEED for the first time. An alternative thesis is that design teams innovate when faced with new requirements and new rating systems rather than throughout the life cycle of a single rating system.

Average Design Energy Efficiency and LEED Certification Tier

The LEED NC rating systems taken as a whole, and within the four certification tiers, show consistent annual design efficiencies. When an updated LEED rating system is released the market quickly adopts a new, higher level of design efficiency and reaches an equilibrium for each certification tier. The newly released LEED v4 rating system adopts the ASHRAE 90.1-2010 standard, a significant bump-up from 90.1-2007. PNNL's analysis released in May 2013 determined the jump from 2007 to 2010 can result in a 24.5% improvement in site energy and 23.4% energy cost savings as determined by a suite of 16 prototype EnergyPlus building models simulated in all eight US climate zones. LEED v4 requires a 5% improvement over ASHRAE 90.1-2010 before awarding up to 18 additional credits based on percentage design improvements.

The demonstrated consistency of design efficiency across certification levels may be useful to code development organizations. Given demonstrably achievable design energy efficiency increases by the broader marketplace, LEED buildings can serve as performance improvement objectives for national model codes from ASHRAE and ICC.

Average Annual Attainment of the LEED Energy Efficiency Credit

Each LEED rating system version release adopts increasingly stringent ASHRAE 90.1 baseline energy standards. This adoption of higher energy efficiency baselines coupled with the high percentage of projects attaining EAc1 demonstrates how USGBC has successfully engaged market-driven competition can be an important element in propelling market transformation. In

addition to referencing new standards, the v2009 rating system version increased the relative importance of energy efficiency within the point totals available.

This analysis reveals it is quite rare to identify a LEED building certified within the last four years that fails to surpass the most stringent national model energy codes by less than double-digit percentages.

Average Annual Attainment of LEED Enhanced Commissioning Credit

All LEED buildings must have a basic level of commissioning to be eligible for certification. Beyond this base level, LEED awards points for enhanced commissioning [EAc3] which includes submittal review, systems training, and plans for ongoing commissioning. Credit achievement data indicate approximately half of all buildings achieving a LEED NC rating through year-end 2013 achieve the enhanced commissioning credit. Increasing project participation with enhanced commissioning activities can be prompted by awarding additional points for achieving this credit, or through the adoption of additional commissioning requirements in the national model energy codes. With the release of LEED v4, USGBC increased the number of points available for EAc3 from two (2) points in all prior NC rating system versions to six (6) points in v4 in an effort to drive both increased energy efficiency engagement and operational quality control.

Average Annual Attainment of LEED Measurement & Verification Credit

Due to upfront costs and complexity, achievement rates for the LEED M&V credit are consistently low with the exception of the LEED Platinum tier. With the release of v2009, USGBC increased the point value from one (1) to three (3) which contributed to a doubling of annual attainment percentage as compared to LEED v2.2. USGBC has broken up the M&V credit in v4 in an attempt to further increase market adoption. Some aspects of the v2009 credit are combined with the commissioning prerequisite including a prerequisite requiring building level metering. Additionally, LEED v4 contains a new credit for advanced metering. These structural changes are designed, in part, to increase engagement of M&V best practices.

Conclusions

This analysis results in two major conclusions. First, the green building market innovates rapidly in response to new rating system versions. Significant increases in design energy efficiency are reflected in the LEED credit achievement at each tier. Continued innovation during a rating system's lifecycle may be present, but is not directly observable from the data.

Second, there exists significant opportunity to coordinate between voluntary leadership standards like LEED and mandatory minimum codes and standards. LEED credit attainment can be valuable to informing code development and adoption for energy standards and other aspects of green building to include water efficiency and materials and resources. Discussions on how best to maximize this coordination are happening between the USGBC, ASHRAE, and ICC to include consideration of the role of the green building codes like standard 189.1 and the IGCC.

The overall upward trend of energy efficiency engagement showcases the market-transformative nature of LEED by recognizing and differentiating market leaders for delivering projects that achieve energy efficiency gains compared to base building code. This market engagement dynamic results in both a diffusion of learning and a competitive race-to-the-top as future projects benchmarks against a self-identified peer group of high performance projects.

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