

Ympäristösertifikaatti LEED

(Leadership in Energy and Environmental Design)

(Energia- ja ympäristösuunnittelun ohjaus)

Esittelytilaisuus:
Tekijä:

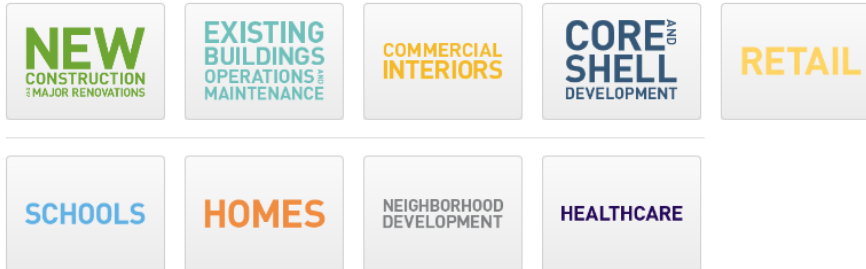
Rakennusautomaatioseminaari 2013, 30.5.2013
Projectus Team Oy, Timo Torkkeli

PROJECTUS TEAM

Esitelmän sisältö

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1. Sertifiointi eri rakennustyypeille



When to Use LEED for New Construction

LEED for New Construction was designed primarily for new commercial office buildings, but it has been applied to many other building types by LEED practitioners. All commercial buildings, as defined by standard building codes, are eligible for certification as LEED for New Construction buildings. Examples of commercial occupancies include offices, institutional buildings (libraries, museums, churches, etc.), hotels, and residential buildings of 4 or more habitable stories.



= NC

When to Use LEED for Core & Shell

The LEED for Core & Shell Rating System is a market-specific application that recognizes the unique nature of core and shell development. The LEED for Core & Shell Rating System acknowledges the limited level of influence a developer can exert in a speculatively developed building.



= CS

When to Use LEED for Schools

LEED for Schools addresses design and construction activities for both new school buildings and major renovations of existing school buildings.

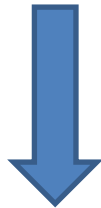


2. Pisteytys ja arvosteluasteikko

- Sertifiointihankkeiden pisteytys jaettu **kreditteihin**, joista on mahdollista saada **100 pistettä** (+ 10 bonuspistettä)

The LEED 2009 credit weightings process is based on the following parameters, which maintain consistency and usability across rating systems:

- All LEED credits are worth a minimum of 1 point.
- All LEED credits are positive, whole numbers; there are no fractions or negative values.
- All LEED credits receive a single, static weight in each rating system; there are no individualized scorecards based on project location.
- All LEED rating systems have 100 base points; Innovation in Design (or Operations) and Regional Priority credits provide opportunities for up to 10 bonus points.

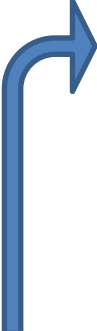


LEED 2009 for New Construction, Core & Shell, and Schools

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above

3. Pistejako

- 
- | | |
|--|---------------------|
| 1. (SS) Paikka ja ympäristö (arkkitehtuuri, sijoittuminen, päästävyys, liikenne) | 28 pistettä |
| 2. (WE) Veden säästäminen / tehokas käyttö | 10 pistettä |
| 3. (EA) Energia ja ilmapiiri | 37 pistettä |
| 4. (MR) Materiaalit ja materiaalilähteet | 13 pistettä |
| 5. (IEQ) Sisäilman laatu | 12 pistettä |
| 6. (ID) Innovaatiot | 6 pistettä |
| 7. (RP) Alueelliset tekijät | <u>4 pistettä</u> |
| | 110 pistettä |

Prerequisites and credits in the LEED Green Building Rating Systems address 7 topics:

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (IEQ)
- Innovation in Design (ID)
- Regional Priority (RP)

LEED prerequisites and credits have identical structures; see Section XI of this Introduction.

4. Automaation vaikutus pisteisiin

Core and Shell -rakennuksessa (CS)		
	Kaikki pisteet	Pisteet, joihin voi vaikuttaa automaatiolla
1. (SS), paikka ja ympäristö	28	4
2. (WE), veden säästäminen	10	0
3. (EA), energia	37	37
4. (MR), materiaalit ja materiaalilähteet	13	0
5. (IEQ), sisäilman laatu	12	6
6. (ID), innovaatiot	6	5
7. (RP), alueelliset tekijät	4	0
YHTEENSÄ	110	52

5. Esimerkit

project boundary is the portion of the project site that is submitted for LEED certification and must be used consistently across all Sustainable Sites prerequisites and credits.

CREDIT	TITLE	NC	SCHOOLS	CS
SS Prerequisite 1	Construction Activity Pollution Prevention	Required	Required	Required
SS Prerequisite 2	Environmental Site Assessment	NA	Required	NA
SS Credit 1	Site Selection	1 point	1 point	1 point
SS Credit 2	Development Density and Community Connectivity	5 points	4 points	5 points
SS Credit 3	Brownfield Redevelopment	1 point	1 point	1 point
SS Credit 4.1	Alternative Transportation—Public Transportation Access	6 points	4 points	6 points
SS Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1 point	1 point	2 points
SS Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3 points	2 points	3 points
SS Credit 4.4	Alternative Transportation—Parking Capacity	2 points	2 points	2 points
SS Credit 5.1	Site Development—Protect or Restore Habitat	1 point	1 point	1 point
SS Credit 5.2	Site Development—Maximize Open Space	1 point	1 point	1 point
SS Credit 6.1	Stormwater Design—Quantity Control	1 point	1 point	1 point
SS Credit 6.2	Stormwater Design—Quality Control	1 point	1 point	1 point
SS Credit 7.1	Heat Island Effect—Nonroof	1 point	1 point	1 point
SS Credit 7.2	Heat Island Effect—Roof	1 point	1 point	1 point
SS Credit 8	Light Pollution Reduction	1 point	1 point	1 point
SS Credit 9	Tenant Design and Construction Guidelines	NA	NA	1 point
SS Credit 9	Site Master Plan	NA	1 point	NA
SS Credit 10	Joint Use of Facilities	NA	1 point	NA

→ Esimerkki 1

LIGHT POLLUTION REDUCTION

	NC	SCHOOLS	CS
Credit	SS Credit 8	SS Credit 8	SS Credit 8
Points	1 point	1 point	1 point

Intent

To minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction and reduce development impact from lighting on nocturnal environments.

Requirements

NC, SCHOOLS & CS

Project teams must comply with 1 of the 2 options for interior lighting AND the requirement for exterior lighting.

For Interior Lighting

OPTION 1

Reduce the input power (by automatic device of) all nonemergency interior luminaires with a direct line of sight to any openings in the envelope (translucent or transparent) by at least 50% between 11 p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device provided the override lasts no more than 30 minutes.

OR

OPTION 2

All openings in the envelope (translucent or transparent) with a direct line of sight to any nonemergency luminaires must have shielding (controlled/closed by automatic device for a resultant transmittance of less than 10% between 11 p.m. and 5 a.m.).

For Exterior Lighting

Light areas only as required for safety and comfort. Lighting power densities must not exceed ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda) for the classified zone.

Classify the project under 1 of the following zones, as defined in IESNA RP-33, and follow all the requirements for that zone:

LZ1: Dark (developed areas within national parks, state parks forest land and rural areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles at the site boundary and beyond. Document that 0% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

¹ Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

SS CREDIT 8

Esimerkki 1

Vähentää valaistustehoa rakennuksen sisäpuolella 50 %:lla aikavälillä 23.00-05.00 koskien valaisimia, joiden valaistus voi suuntautua rakennuksen ulkopuolelle. Ei koske hätävalaistusta. Edellyttää valaistuksen ohjausta taloautomaatiikasta aikaohjauksella. Valosaasteen vähentämisen voi korvata myös automaattisesti ohjautuvilla sälekaihtimilla.

Ulkovalaistuksen teho ei saa ylittää ASHRAE-standardin valaistustehoja [W/m²]

Figure 3. Task Area from Unshielded Floodlight

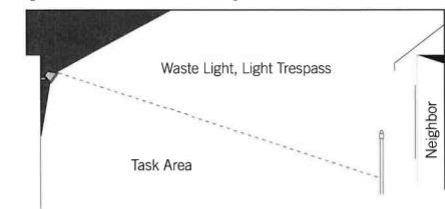


Figure 4. Shielded Floodlight

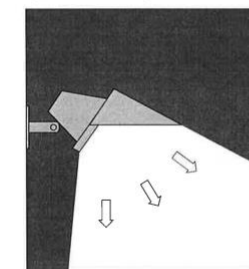
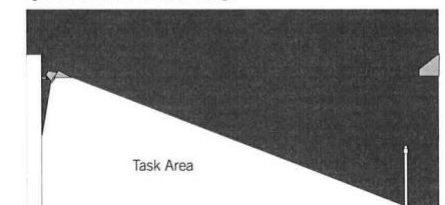


Figure 5. Task Area from Shielded Floodlight



Esimerkki 2 ja 3

CREDIT	TITLE	NC	SCHOOLS	CS
EA Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required	Required	Required
EA Prerequisite 2	Minimum Energy Performance	Required	Required	Required
EA Prerequisite 3	Fundamental Refrigerant Management	Required	Required	Required
EA Credit 1	Optimize Energy Performance	1-19 points	1-19 points	3-21 points
EA Credit 2	On-site Renewable Energy	1-7 points	1-7 points	4 points
EA Credit 3	Enhanced Commissioning	2 points	2 points	2 points
EA Credit 4	Enhanced Refrigerant Management	2 points	1 point	2 points
EA Credit 5	Measurement and Verification	3 points	2 points	NA
EA Credit 5.1	Measurement and Verification—Base Building	NA	NA	3 points
EA Credit 5.2	Measurement and Verification—Tenant Submetering	NA	NA	3 points
EA Credit 6	Green Power	2 points	2 points	2 points



Esimerkki 2 (EAP1)



Esimerkki 3 (EA1)

Esimerkki 2 (EAP1)

Energiajärjestelmien toiminnanvarmennus (TOVA, PAKOLLINEN)

- Tulee varmistaa, että energian kulutukseen liittyvät systeemit ovat asennettu, kalibroitu ja säädetty, kuten on suunniteltu.
- Projektissa on toiminnanvarmennuskonsultti, jolle toimitetaan mittauspöytäkirjat raportointia varten. Konsultin tulee raportoida tulokset kiinteistön omistajalle. Raportointia varten konsultti tarvitsee kentältä mm. mittauspöytäkirjat, itselleluovutuspöytäkirjat, painekoepöytäkirjat yms.
- Käyttöön otettavat systeemit ovat:
 - Lämmitys, ilmanvaihto, ilmastointi (jäähdytys) ja kylmäainejärjestelmät
 - Valaistuksen ohjaukset
 - Lämpimän käyttöveden järjestelmät
 - Uusiutuvat energiajärjestelmät (esim. tuuli- ja aurinkoenergia)

FUNDAMENTAL COMMISSIONING OF BUILDING ENERGY SYSTEMS

	NC	SCHOOLS	CS
Prerequisite	EA Prerequisite 1	EA Prerequisite 1	EA Prerequisite 1
Points	Required	Required	Required

Intent

To verify that the project's energy-related systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents.

Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner's project requirements.

Requirements

NC, SCHOOLS & CS

The following commissioning process activities must be completed by the project team:

- Designate an individual as the commissioning authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
 - The CxA must have documented commissioning authority experience in at least 2 building projects.
 - The individual serving as the CxA must be independent of the project's design and construction management, though the CxA may be an employee of any firms providing those services. The CxA may be a qualified employee or consultant of the owner.
 - The CxA must report results, findings and recommendations directly to the owner.
 - For projects smaller than 50,000 gross square feet, the CxA may be a qualified person on the design or construction teams who has the required experience.
- The owner must document the owner's project requirements. The design team must develop the basis of design. The CxA must review these documents for clarity and completeness. The owner and design team must be responsible for updates to their respective documents.
- Develop and incorporate commissioning requirements into the construction documents.
- Develop and implement a commissioning plan.
- Verify the installation and performance of the systems to be commissioned.
- Complete a summary commissioning report.

Commissioned Systems

Commissioning process activities must be completed for the following energy-related systems, at a minimum (if they are installed as part of the core and shell project):

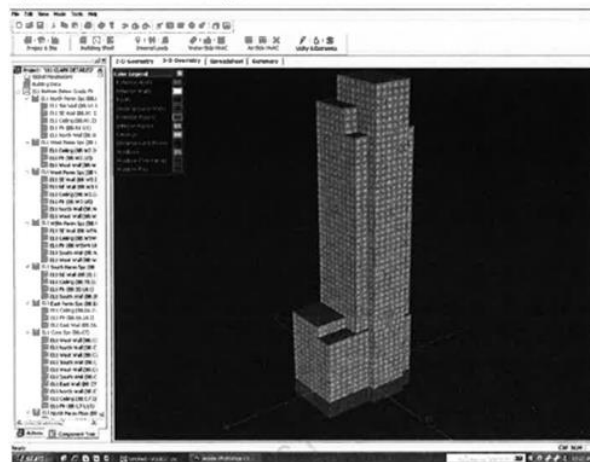
- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls.
- Lighting and daylighting controls.
- Domestic hot water systems.
- Renewable energy systems (e.g. wind, solar).

Esimerkki 3 (EA1)

EA1: Energiakäytön optimointi

- Laskenta suoritetaan tietokonepohjaisella dynaamisella simulointiohjelmalla noudattaen ASHRAE Standard 90.1-2007 – standardia
- Suomi sijaitsee standardin mukaan säävyöhykkeellä nro 7
- Verrataan kahta vaihtoehtoa; baseline vs. proposed
- Pisteytystaulukko energiakustannusten säästöstä 12 – 48 % (pisteet 1-21)
 - omavaraiset energialähteet
 - LTO-hyötysuhteet
 - tarpeen mukainen ilmanvaihto
 - CO₂-mittaus ja ilmamääräsäätimet
 - läsnäoloanturit
 - IV-koneiden käyntiaikojen asettelu konekohtaisesti
 - valaistuksen ohjaus (sisällä ja ulkona)
 - taajuusmuuttajakäyttöiset pumpput
 - lämpimän käyttöveden kulutuksen minimointi
 - Lämmitys- ja jäähdytysjärjestelmien viritys (antureiden ja moottoriventtiileiden toimivuus)

Figure 2. Screenshot from Building Simulation Software



OPTIMIZE ENERGY PERFORMANCE

	NC	SCHOOLS	CS
Credit	EA Credit 1	EA Credit 1	EA Credit 1
Points	1-19 points	1-19 points	3-21 points

Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Requirements

NC, SCHOOLS & CS

Select 1 of the 3 compliance path options described below. Project teams documenting achievement using any of the 3 options are assumed to be in compliance with EA Prerequisite 2: Minimum Energy Performance.

OPTION 1. Whole Building Energy Simulation (1-19 points for NC and Schools, 3-21 points for CS)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda) using a computer simulation model for the whole building project. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points (NC & Schools)	Points (CS)
12%	8%	1	3
14%	10%	2	4
16%	12%	3	5
18%	14%	4	6
20%	16%	5	7
22%	18%	6	8
24%	20%	7	9
26%	22%	8	10
28%	24%	9	11
30%	26%	10	12
32%	28%	11	13
34%	30%	12	14
36%	32%	13	15
38%	34%	14	16
40%	36%	15	17
42%	38%	16	18
44%	40%	17	19
46%	42%	18	20
48%	44%	19	21

Esimerkki 3 (EA1) jatkoa

EA1: Varmennus ja testaaminen

- Asennusten oikeellisuus, suorituskyvyn testaaminen ja vertaaminen projektin suunniteltujen perusteiden mukaiseksi tehdään kolmessa portaassa:
 - Asennustapataarkastus
 - Tarkistetaan, että järjestelmien laitteet ovat asennettu oikein ja tehdään tarvittavat korjaukset ennen toimintakokeita
 - Toimintakoe (suorituskyvyn testaaminen)
 - Tehdään kun järjestelmän kaikki komponentit on asennettu, sähköistetty, ohjelmoitu ja tasapainoitettu (systeemeittäin)
 - Sisältää käynnistykset, sammutukset, kuormituskokeet, hälytysten ja lukitusten testaaminen
 - Tulosten arviointi (konsultti)
 - Tulokset arvioidaan ja varmistetaan, että suunnittelun kriteerit täyttyvät
 - Raportoidaan kiinteistön omistajaa sekä suunnittelu- ja rakennustiimiä korjaustoimenpiteitä varten

STEP 8

Verify the installation and performance of the systems to be commissioned.

Commissioning is conducted to verify the performance of commissioned systems as installed to meet the owner's project requirements, basis of design, and contract documents.

Verification of the installation and performance of commissioned systems typically includes 3 steps for each commissioned system: installation inspection, performance testing, and comparison of the results with the owner's project requirements and the basis of design.

- Installation inspections (sometimes called prefunctional inspections) are a systematic set of procedures intended to identify whether individual system components have been installed properly. Often this process occurs at startup of individual units of equipment and involves using "prefunctional checklists" or "startup and checkout forms" to ensure consistency in the inspections and document the process. Installation inspections may be performed by the CxA, the installing contractor, or others, depending on the procedures outlined in the commissioning plan. Installation inspections provide quality control to ensure that relatively minor issues (e.g., an improperly wired sensor, a control valve installed backward) are discovered and corrected prior to systems performance testing.

- Systems performance testing (sometimes called functional performance testing) occurs once all system components are installed, energized, programmed, balanced, and otherwise ready for operation under part- and full-load conditions. Testing should include each process in the sequence of operations under central and packaged equipment control, including startup, shutdown, capacity modulation, emergency and failure modes, alarms, and interlocks to other equipment.

Systems performance testing typically relies on testing procedures developed by the CxA specifically for the system to be tested. A wide variety of methods may be used to simulate and evaluate that the system being tested performs as expected (per the owner's project requirements, basis of design, and contract documents) in all modes of operation.

Systems performance testing may be performed by some combination of the CxA, the installing contractor, and others, depending on the procedures outlined in the commissioning specifications and the commissioning plan. It may reveal problems with the performance of the commissioned systems and may require significant follow-up and coordination among members of the project team.

- Evaluation of results is the final step. At each point in the process of installation inspections and systems performance testing, the CxA should evaluate whether the installed systems meet the criteria for the project as set forth by in the owner's project requirements and the basis of design documents.

Any discrepancies or deficiencies should be reported to the owner, and the team should work collaboratively to find an appropriate resolution.

6. Yhteenveto onnistuneesta sertifioinnista

SELKEÄ PROJEKTIN KULKU JA ALOITUS AJOISSA

- Pisteiden kartoitus aloitetaan varhaisessa vaiheessa ennen varsinaista suunnittelua
- Tutkitaan toteutusvaihtoehtoja ja kustannuksia
- Päätetään toteutusvaihtoehdot esiselvittämisen jälkeen ja laaditaan järjestelmäkuvaus (työselitys)
- Huomioidaan suunnitelmissa tilaajan, sertifioinnin ja järjestelmäkuvauksen vaatimukset
- Laaditaan suunnitelmat
- Kohteen rakentaminen / urakointi
- Toiminnanvarmennus ja dokumentoidaan siitä toiminnanvarmennuskonsultille
- Lopullinen pisteytys ja sertifiointiluokan varmistuminen



LEED 2009 for New Construction, Core & Shell, and Schools

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above

6. Yhteenveto onnistuneesta sertifioinnista

MIETTEITÄ

- Projektissa LEED-koordinaattori/konsultti, joka kerää tarvittavat tiedot dokumenttien täyttämistä varten LEED-onlineen
- Sertifiointina hieman sekava ja työläs
- Sisältää englanninkielisen 623-sivuisen manuaalin ja 189-sivuisen ASHRAE- standardin, joiden puitteissa toimitaan
- Manuaalissa viitataan toisiin sivuihin eli ohjeistuksessa hypitään manuaalin sisällä kohdasta toiseen
- Omat erikoisuutensa, kuten CO2-antureiden asennuspaikka
- Urakoitsijoilta vaatii laiteajojen ja mittauspöytäkirjojen toimittamista koordinaattorille. Lisäksi käyttökoulutukset huoltohenkilökunnalle (kohteen valmistuttua ja toinen koulutus 10 kuukauden käytön jälkeen)
- Vaatii suunnittelijoilta suunnittelulähtötietojen selvittämistä LEED-pisteiden saavuttamista varten, jotka käydään läpi omistajan ja konsultin kanssa. Yleensä konsultti kertoo vaatimukset ja raja-arvot.
- Taloteknisten järjestelmien toimivuus on isossa roolissa. Kiinteistö tarvitsee toimivan taloautomaation, hyvin säädetyt järjestelmät ja koulutetun henkilökunnan

Kiitos ajastanne

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