

BEYOND
SMART CITIES

**ADVANCED ENERGY MODELING FOR LEED
ONLINE TRAINING COURSE**

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ENERGY SPECIALIST CURRICULUM



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**A TYPICAL ENERGY SYSTEMS AND SCENARIOS
EXCEPTIONAL CALCULATIONS
FOR ENERGY PROFESSIONALS**

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WHAT SHOULD YOU LEARN



- HVAC systems that are difficult to model and require exceptional calculations;
- Energy cost savings calculations for existing building additions;
- Energy cost savings calculations for multiple buildings on the same site;
- District energy system (DES) modeling requirements; and
- Combined Heat and Power (CHP) system modeling requirements.

EXCEPTIONAL CALCULATIONS

Section G2.5 of ASHRAE 90.1-2016 stipulates that when no simulation program can adequately model a design, material, or device, the rating authority (here, USGBC) may approve an exceptional calculation method to demonstrate above-standard performance.

Applications for approval of an exceptional method must include documentation of the calculations performed and theoretical and/or empirical information supporting the accuracy of the method. The LEED reviewer evaluates whether the exceptional calculations can substantiate the energy savings and whether the energy and costs saved are entered appropriately in the LEED credit form.

TABLE 5.1. LEED INTERPRETATIONS REGARDING EXCEPTIONAL CALCULATIONS

Table 5.1 lists examples of energy efficiency measures for which exceptional calculations are required and cites applicable LEED Interpretations with further guidance on the methodology.

Scenario	LEED Interpretation
Energy savings from HVAC systems controlled by occupancy sensors	LEED Interpretation 1847
Energy savings from natural ventilation	LEED Interpretation 1734
Energy savings from automatic lighting controls	LEED Interpretation 2360
Process energy use reduction	LEED Interpretations 2339, 5317, 1844, 1693
Process energy savings from efficient hard-wired lighting in residential units	LEED Interpretation 5253
Process energy savings in data centers	LEED Interpretation 2441

CALCULATIONS FOR ADDITIONS TO EXISTING BUILDINGS

If a project consists of both an existing building renovation and new construction, the following equation is used to determine the appropriate point thresholds for EA Prerequisite 2 and EA Credit 1:

$$\text{Target Percentage} = \frac{\text{Existing Floor Area}}{\text{Total Floor Area}} \times \text{Target Percentage of Savings for Existing Buildings} + \frac{\text{New Floor Area}}{\text{Total Floor Area}} \times \text{Target Percentage of Savings for New Buildings}$$

For example, if a project comprises 75,000 square feet of existing buildings and 40,000 square feet of new construction, the point threshold table must be modified as shown in Table 5.2. Table 5.2. EA Credit 1 Point thresholds for New Construction plus Renovations to Existing

CALCULATIONS FOR ADDITIONS TO EXISTING BUILDINGS +

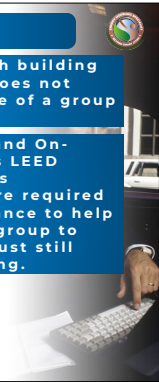
New Buildings	Existing Building Renovations	Project Target	Points
12%	8%	9.4%	1
14%	10%	11.4%	2
16%	12%	13.4%	3
18%	14%	15.4%	4
20%	16%	17.4%	5
22%	18%	19.4%	6
24%	20%	21.4%	7
26%	22%	23.4%	8
28%	24%	25.4%	9
30%	26%	27.4%	10
32%	28%	29.4%	11
34%	30%	31.4%	12
36%	32%	33.4%	13
38%	34%	35.4%	14
40%	36%	37.4%	15
42%	38%	39.4%	16
44%	40%	41.4%	17
46%	42%	43.4%	18
48%	44%	45.4%	19



CALCULATIONS FOR MULTIPLE BUILDINGS

✓LEED requires individual energy models for each building in a group of buildings within a master site; it does not allow project teams to calculate the performance of a group of buildings in one energy model.

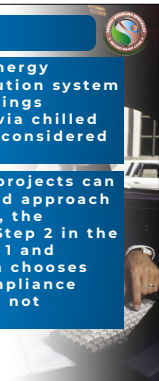
✓LEED Application Guide for Multiple Buildings and On-Campus Building Projects (AGMBC 2010) requires LEED project teams to certify their buildings or spaces individually; that is, individual energy models are required for each building. AGMBC 2011 will contain guidance to help project teams certify multiple buildings as one group to receive a single certification; however, teams must still submit individual energy models for each building.



DISTRICT ENERGY SYSTEMS

✓A district energy system (DES) uses a central energy conversion plant and a transmission and distribution system that provides thermal energy to a group of buildings (heating via hot water or steam, and/or cooling via chilled water). Plants providing only electricity are not considered DES.

✓Like conventional EA Credit 1 approaches, DES projects can take either a prescriptive or a performance-based approach to calculations. For the performance-based path, the modeling protocols that were called Step 1 and Step 2 in the Version 1.0 guidance have been recast as Option 1 and Option 2 in the new guidance. Each project team chooses one of the two performance options to show compliance with both EA Prerequisite 2 and EA Credit 1; it is not required to do both.



DISTRICT ENERGY SYSTEMS

✓ **Option 1: stand-alone building scenario** - This option documents the performance of the building alone, with upstream equipment modeled as cost neutral. The energy source is modeled as purchased energy in both the baseline and the proposed cases for all downstream equipments serviced by district or campus energy systems. This option has a point cap (the maximum number of points that can be earned). Projects seeking more points must use Option 2.

✓ **Option 2: aggregate building and des scenario** - This option documents the combined performance of the building and central plant by including the performance of upstream equipment. This option has a point floor (the minimum number of points that must be earned). Projects seeking fewer points must use Option 1 unless the building housing the thermal energy plant is itself the LEED project building.

COMBINED HEAT AND POWER SYSTEMS

Combined heat and power (CHP) systems capture and use the heat that would otherwise be lost in traditional fossil fuel generation of electrical power. The total efficiency of these integrated systems is much greater than that from central station power plants and separate thermal systems. CHP systems can also reduce peak demand and CO₂ emissions.



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THANK YOU

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