



Treatment of CHP in LEED® for Building Design and Construction: New Construction and Major Renovations

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Overview

- Purpose of our project
- Growing influence of LEED® on building design
- CHP's value for LEED® projects
- CHP Partnership LEED® resources

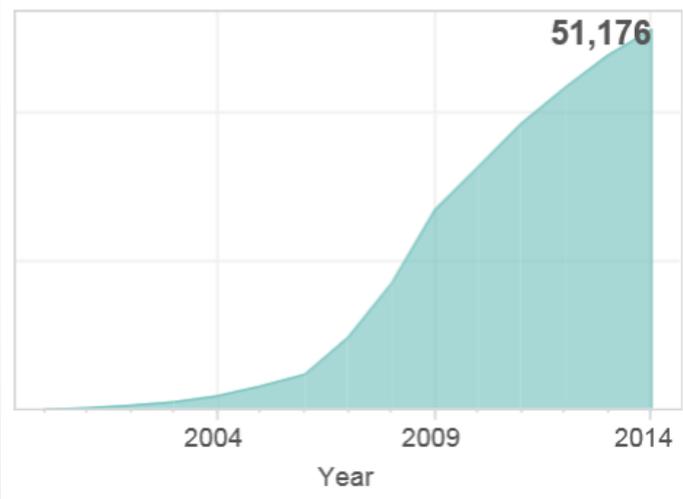
Introduction

- Who we are: EPA CHP Partnership
 - Focused on raising awareness and promoting the opportunities and benefits of CHP
- Why we are engaged
 - Use of LEED to recognize the environmental performance of buildings and facilities continues to grow at a rapid pace
 - Stakeholders often lack knowledge of treatment of CHP under LEED®
- Goal of LEED® Project
 - Help educate project developers, architects, LEED® professionals, and other stakeholders on how CHP can contribute to a project's LEED® point total
 - Consider CHP for your next LEED® project

Growth of LEED® Green Building Program

- LEED® green building program launched in 2000
- In the U.S. (as of October 2014):
 - More than 20,000 LEED®-certified commercial projects (2.9 billion GSF)
 - Annual certifications have grown from 40 in 2003 to nearly 4,000 in 2013
 - More than 30,000 additional LEED®-registered commercial projects (4.9 billion GSF)

Cumulative LEED® Projects



LEED® Projects by Building Type

Office/Mixed-Use: 36%
Education: 15%
Retail: 13%
Public Assembly: 6%
Residential: 5%
Health Care: 4%
Industrial: 4%
Laboratory: 3%
Military: 3%
Public Order/Safety: 3%

* Includes US-based LEED®-certified and LEED®-registered commercial projects

Importance of Energy & Atmosphere: Optimize Energy Performance Credit

LEED® Version	Total # of Pts. Available	Total # of Pts. Needed to Earn LEED® Certified™*	Total # of Optimize Energy Performance Pts. Available
LEED® v2009	110	40	19
LEED® v4	110	40	18 (16 for Schools; 20 for Healthcare)

*LEED® Certified™ is the lowest level that can be achieved under LEED®. LEED Silver® is earned with 50 points; LEED Gold® is earned with 60 points; LEED Platinum® is earned with 80 points.

→ Achieving all of the available Optimize Energy Performance credits would represent 47.5 percent (LEED® v2009) and 45 percent (LEED® v4) of the points needed to earn certification at the “LEED® Certified™” level.

CHP's Demonstrated Point Impact

Building	# of Apts.	CHP Type/Size	Pts. w/out CHP	Pts. w/CHP
1	620	130 kW MT	2	8
2	340	65 kW MT	2	10
3	500	200 kW MT	2	7
4	100	65 kW MT	1	7
5	185	65 kW MT	3	9
6	250	65 kW MT	1	7
7	230	200 kW MT	0*	9
8	40	75 kW Recip	0*	4

* Would not meet Prerequisite w/out CHP



Option 1: Whole Building Energy Simulation

- LEED® v2009
 - Projects must demonstrate savings of 10% (new construction) or 5% (major renovations) in the Design Building compared to a Baseline Building meeting the minimum requirements of ASHRAE 90.1-2007.
- LEED® v4
 - Projects must demonstrate savings of 5% (new construction), 3% (major renovations), and 2% (core and shell) in the proposed building (the “Design Building”) compared to a baseline case meeting the minimum requirements of ASHRAE 90.1-2010 (the “Baseline Building”).
- Savings are based on energy costs and determined by running energy models for the Design and Baseline Buildings

USGBC Methodology for Modeling CHP

Methodology for Modeling Combined Heat & Power for EAp2/c1 in LEED® 2009

<http://www.usgbc.org/resources/methodology-modeling-combined-heat-and-power-eap2c1-lead-2009>

- Guidance on how to account for CHP in the energy model required by Option 1
- Applies to on-site CHP systems which can either have the same ownership as the project (Case 1) or different ownership (Case 2)

USGBC Methodology for Modeling CHP

1. Energy requirements for the Baseline Building (which must meet requirements of ASHRAE 90.1) are estimated using an energy model.
 - Based on the model output, the cost of purchased grid electricity and purchased fuel to generate thermal energy is calculated.

USGBC Methodology for Modeling CHP

2. The same process is used with the Design Building (the one with CHP).
 - The cost of fuel for the CHP and any purchased electricity or fuel used to produce thermal energy is calculated.

Optimize Energy Performance Credit (Option 1)

3. Optimize Energy Performance points are calculated based on the percentage reduction in energy cost for the Design Building.

Percent Improvement Over Baseline	Points	
	LEED® v2009	LEED® v4
6%	---	1
14%	2	5
22%	6	9
38%	14	15
48%	19	---
50%	---	18

CHPP Resources

- **Treatment of CHP in LEED® for Building Design and Construction: New Construction and Major Renovations**
 - Introduces CHP and its benefits to architects and engineers
 - Summarizes how CHP is treated under LEED® BD+C: New Construction
- **LEED® CHP Calculator**
 - Estimates the energy cost savings and “Optimize Energy Performance” points a building meeting the requirements of ASHRAE 90.1 can achieve with CHP
 - Intended to be used at very early stages of building design so that CHP is given consideration as an energy option

→ Both resources available at www.epa.gov/chp.



LEED® CHP Calculator

A	B	C	D	E
1				
2	LEED CHP Calculator Version 1.0		<input type="button" value="Reset Inputs"/>	
3			<p>**The "Baseline Building" is the building that meets the requirements of ASHRAE 90.1 (2007 or 2010, depending on the LEED rating system)</p>	
4			<p align="center">Instructions</p>	
5	1. In what state is the Baseline Building located?	California	<p><i>Click on the input cell and use the drop down list to select the state in which the Baseline Building is located.</i></p>	
6	2. What is the average monthly electric demand (kWh/month) for the Baseline Building?	216,333	<p><i>Enter the Baseline Building's average monthly electric demand (kWh/month).</i></p>	
7	3. What is the average monthly heating demand (MMBtu/month) for the Baseline Building?	1,113	<p><i>Enter the Baseline Building's average monthly heating demand (in MMBtu/month).</i></p> <p><i>The Calculator considers heating demands only (CHP can provide cooling as well, and if this is your primary thermal need, please contact the CHPP helpline at 703-373-8108 or chp@epa.gov for additional assistance).</i></p>	
8	4. How many hours per year will the Baseline Building operate?	I will enter a value	<p><i>Enter the annual operating hours of the Baseline Building or choose from one of the hourly operating schedules in the drop-down list.</i></p>	
9		7,686		
10	5. What is the fuel price (\$/MMBtu) used to produce heat?	\$9.08	<input type="button" value="Use State Average Natural Gas Price"/>	<p><i>Enter the cost in \$/MMBtu of fuel used to produce heat for the Baseline Building (when CHP is not used). If unsure of the fuel cost, the default button will supply the average commercial gas price for the state you selected in Question 1.</i></p>
11				
12				
13				
14				
15				

LEED® CHP Calculator

CHP System Information*

CHP System Type	Recip Engine
CHP System Capacity, kW	260
CHP Electric Efficiency	27.0%
CHP Heat Output, Btu/kWh	6,690
CHP Heat Output, MMBtu/hour	1.7
CHP System Fuel Cost (Natural Gas), \$/MMBtu	\$9.08
CHP O&M Cost, cents/kWh	\$0.0240

Estimate of Annual Energy Costs of the Baseline Building with and without CHP

	Baseline Building: No CHP	Baseline Building: With CHP	Difference
Energy Use			
<i>Annual Electricity Use</i>			
Annual Purchased Power, kWh	2,595,996	700,015	(1,895,981)
Annual CHP Power Generation, kWh	0	1,895,981	1,895,981
Total Annual Electricity Use, kWh	2,595,996	2,595,996	0
<i>Annual Thermal Energy Use</i>			
Non-CHP Thermal Use*, MMBtu/yr	13,356	672	(12,684)
CHP Thermal Used, MMBtu/yr	0	12,684	12,684
Total Thermal Energy Use, MMBtu/yr	13,356	13,356	0
<i>Annual Fuel Use</i>			
Non-CHP Thermal Fuel Use*, MMBtu/yr	16,695	840	(15,855)
CHP Fuel Use, MMBtu/yr	0	23,960	23,960
Annual Total Fuel Use, MMBtu	16,695	24,799	8,104
Energy Costs			
Purchased Electricity	\$406,793	\$139,402	(\$267,390)
Purchased Fuel	\$151,591	\$225,178	\$73,588
Annual Energy Costs	\$558,383	\$364,581	(\$193,802)
Energy Cost Savings			\$193,802
			34.71%

Estimated "Optimize Energy Performance" Points Earned with CHP

	Energy Cost Savings		Points Earned with CHP
LEED v2009	\$193,802	34.71%	12
LEED v4	\$193,802	34.71%	13



Key Takeaways

- CHP can have a dramatic LEED® point impact
- CHP has lots of other benefits for buildings
- Think of CHP for your next project
- We're here to help!

Contact Information

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