LEED Zero Program Guide

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Introduction to LEED Zero

LEED Zero highlights the achievements of exemplary projects in areas that are critical to the goal of reaching a regenerative future. Projects can complement their existing LEED certification or LEED O+M registration with one or more of the following LEED Zero certifications:

- **LEED Zero Carbon** recognizes buildings operating with net zero carbon emissions over the course of the past year. This certification provides a transparent accounting of the balance of carbon caused from energy consumption and occupant transportation to carbon emissions avoided or offset and will expand in the future to incorporate carbon caused from water consumption, waste generation, and the embodied carbon of materials used into the carbon balance.

- **LEED Zero Energy** recognizes buildings that achieve a source energy use balance of zero for the past year.

- **LEED Zero Water Certification** recognizes buildings that achieve a potable water use balance of zero for the past year.

- **LEED Zero Waste Certification** recognizes buildings that achieve GBCI's TRUE Zero Waste certification at the Platinum level.

LEED Zero encourages a holistic approach for buildings and places to enhance the health and well-being of building occupants and the natural environment. This work is even more important in light of the Intergovernmental Panel on Climate Change (IPCC) report from October 2018, describing the impacts of global warming of 1.5°C to 2°C above pre-industrial levels on environmental, human health and economic systems. In sum, climate change requires fundamental shifts to the structure and consumption habits of human society as well as adaptive and integrated carbon reduction, sustainable development and resilience strategies deployed at all scales.

For over two decades, LEED has guided and pushed projects to aim for higher performance and to reduce greenhouse gas emissions through integrated building strategies impacting energy, transportation, water, waste and materials. The built environment plays a critical role in accelerating the transition to a low-carbon society and enhancing the health of natural and human ecosystems.

Building on the success of LEED as a market transformation tool, LEED Zero verifies the achievement of net zero goals and signals market leadership in the built environment. Participants can pursue multiple LEED Zero certifications concurrently.

Program Requirements

Projects must be LEED certified under a BD+C or O+M rating system.

Core and Shell certified projects are eligible for LEED Zero if the building meets LEED minimum occupancy requirements for the duration of the performance period: the building must have an average occupancy of 50% or greater over the previous 12 months.

For projects pursuing LEED Zero Carbon, LEED Zero Energy, and LEED Zero Water certification:

1. Provide 12 months of performance data required for the desired certification to GBCI.
2. When the project achieves a carbon-dioxide equivalent (CO_2E) balance of zero, a source energy use balance of zero, and/or a potable water use balance of zero, the team submits for GBCI review.

Projects pursuing the LEED Zero Waste certification submit their TRUE Zero Waste Platinum certification for GBCI review.

Certification Process

LEED Zero certification fees are available here.

1. Registration
Email leedzero@usgbc.org to register your project. There is no registration fee.

2. Share Performance Data and Provide Documentation
Activate or update the LEED project profile in Arc.

Share performance data for the certification being pursued. Upload supporting documentation as outlined in the Required Documentation section.

3. Certification Review
Identify the 12-month performance period for the project's LEED Zero application.
Email leedzero@usgbc.org to confirm that the project's application is ready for review.

LEED Zero certification review comprises a preliminary review and final review by GBCI. The timeframe for review is 15 – 20 business days.

LEED Zero certification is valid for three years from the date of certification acceptance. Projects must submit performance data annually, or more frequently, for the duration of the three-year period when LEED Zero certification is valid.

LEED Zero projects recertify every three years to maintain their certifications up to date.

LEED Zero Carbon Certification

To obtain **LEED Zero Carbon** certification, a project must achieve a carbon-dioxide equivalent (CO_2E) balance of zero for the past year:

Carbon Balance = Total Carbon Emitted - Total Carbon Avoided

Carbon Emitted is calculated from delivered energy and occupant transportation. Carbon Avoided includes on-site renewable energy generated and exported to the grid, off-site renewable energy procurement, and the purchase of carbon offsets. Renewable energy generated and used on site reduces the amount of energy delivered.

Environmental benefits of all renewable energy generation or procurement must be retained by the project.

An overview of the carbon balance is provided in Table 1.

Table 1: Carbon Balance

Item	Category	Calculation
CARBON EMITTED		
Energy delivered	Electricity drawn from grid	Equation 1
	Natural gas	Equation 2
	Propane	
	Fuel Oil (No. 1, 2, 4, 5, 6, diesel oil, kerosene)	
	Coal (anthracite, bituminous, coke)	
	District steam	
	District hot water	
	District chilled water	
	Wood	
	Total Carbon from Energy	
Transportation	Walk, bike, telecommute	always 0
	Motorcycle	Equation 3
	Heavy rail	
	2-3 Carpool	
	Light rail	
	Alternative fuel vehicles	
	Bus	
	Car (solo)	
	Total Carbon from Transportation	Equation 3
	(a) Total Carbon Emitted	Sum = carbon emitted from energy + transportation

CARBON AVOIDED		
Onsite renewable energy generated and exported to grid		Equation 4
Offsite renewable energy procured		Equation 5
Carbon Offsets		Sum CO_2E for carbon offsets purchase
	(b) Total Carbon Avoided	
CARBON BALANCE		
If difference is ≤ 0, project can submit for certification.		**(a) – (b)**

If purchasing Energy Attribute Certificates (EACs), also known as Renewable Energy Certificates (RECs), the EACs must be Green-e Energy certified or equivalent. Carbon offsets must be Green-e Climate certified or equivalent.

Projects must purchase EACs or carbon offsets annually during the three year period when the certification is valid. On-site renewable energy generation and consumption will vary based on weather and operating conditions, so year to year the required purchase will vary. For LEED Zero certification review, it is sufficient for the project owner to provide a written commitment to purchase EACs or carbon offsets, as applicable, each year during the three-year period when the certification is valid in order to maintain the net zero carbon balance.

LEED Zero Energy Certification

To obtain **LEED Zero Energy** certification, a project must achieve a source energy use balance of zero for the past year. The net zero energy balance is based on the quantity of source energy delivered and the quantity of renewable energy that displaces non-renewable energy on the grid. Renewable energy generated and used on site reduces the amount of energy delivered.

Source Energy Balance = (Total Source Energy Delivered) – (Total Non-Renewable Source Energy Displaced)

This equation can also be written as:

$$
\begin{aligned}
&Source\ energy\ balance \\
&\quad = (total\ energy\ delivered\ \times\ nonrenewable\ source\ conversion\ factor) \\
&\quad - ((total\ renewable\ energy\ generated\ and\ exported\ to\ grid \\
&\quad \times\ nonrenewable\ source\ conversion\ factor) \\
&\quad + (offsite\ renewable\ energy\ procured \\
&\quad \times\ nonrenewable\ source\ conversion\ factor))
\end{aligned}
$$

To calculate source energy delivered to the project, use the national average ENERGY STAR Source-Site Ratios for each building energy source from the Energy Star Portfolio Manager Technical Reference: Source Energy for projects in the U.S. and Canada. International projects may use the U.S. source-to-site ratios or published source-to-site ratios for the country or multi-country region where the project is located. Use the same source energy conversion factors for calculating energy delivered and non-renewable energy displaced.

Environmental benefits of all renewable energy generation or procurement must be retained by the project.

An overview of the source energy balance is provided in Table 2.

Table 2: Source Energy Balance

<table>
<tr><th>Item</th><th>Category</th><th>Calculation</th></tr>
<tr><td colspan="3">ENERGY DELIVERED</td></tr>
<tr><td rowspan="10">Energy delivered</td><td>Electricity drawn from grid</td><td rowspan="9">Multiply energy consumed by the source conversion factor</td></tr>
<tr><td>Natural gas</td></tr>
<tr><td>Propane</td></tr>
<tr><td>Fuel Oil (No. 1, 2, 4, 5, 6, diesel oil, kerosene)</td></tr>
<tr><td>Coal (anthracite, bituminous, coke)</td></tr>
<tr><td>District steam</td></tr>
<tr><td>District hot water</td></tr>
<tr><td>District chilled water</td></tr>
<tr><td>Wood</td></tr>
<tr><td>(a) Total Energy Delivered</td><td></td></tr>
<tr><td colspan="3">NON-RENEWABLE ENERGY DISPLACED</td></tr>
<tr><td colspan="2">Onsite renewable energy generated and exported to grid</td><td rowspan="3">Multiply by the non-renewable source conversion factor for the displaced energy</td></tr>
<tr><td colspan="2">Offsite renewable energy procured</td></tr>
<tr><td></td><td>(b) Total Non-Renewable Energy Displaced</td></tr>
<tr><td colspan="3">SOURCE ENERGY BALANCE</td></tr>
<tr><td colspan="2">If difference is ≤ 0, project can submit for certification.</td><td>(a) – (b)</td></tr>
</table>

If purchasing Energy Attribute Certificates (EACs), also known as Renewable Energy Certificates (RECs), the EACs must be Green-e Energy certified or equivalent. Carbon offsets must be Green-e Climate certified or equivalent.

Projects must purchase EACs annually during the three-year period when the certification is valid. On-site renewable energy generation and consumption will vary based on weather and operating conditions, so year to year the required purchase will vary. For LEED Zero certification review, it is sufficient for the project owner to provide a written commitment to purchase EACs each year during the three-year period when the certification is valid in order to maintain the net zero source energy balance.

LEED Zero Water Certification

To obtain **LEED Zero Water** certification, a project must achieve a potable water use balance of zero for the past year.

> Water Balance = Total Potable Water Consumed – (Total Alternative Water Used + Water Returned to Original Source)

An overview of the water balance is provided in Table 3.

"Water returned to its original source" includes rainwater stored and infiltrated or evapotranspirated via green infrastructure, and wastewater treated and returned to the local watershed or aquifer via decentralized wastewater treatment systems. Calculations for the amount of rainwater retained and infiltrated on-site must be based on the calculation methodology outlined under LEED v4 Sustainable Sites credit Rainwater Management.

Table 3: Water Balance

Item	Description
POTABLE WATER CONSUMED	
Water consumption	Total potable water consumed by the project
(a) Total Potable Water Consumed	
ALTERNATIVE WATER SOURCES and WATER RETURNED	
Off-site Water Sources	Reclaimed water delivered from municipality
	Municipally renovated wastewater
	Other off-site source – specify
On-site Water Sources	Captured rainwater (roof)
	Captured rainwater runoff (site)
	Captured rainwater overflow
	AHU Condensate
	Steam recovery
	Greywater reuse
	Other on-site water source – specify
Water Returned	Water collected from building systems (e.g. green infrastructure, on-site treated wastewater) and returned to original water source

(b) Total Alternative Water Sources + Water Returned	Sum = onsite + offsite + returned
WATER BALANCE	
If difference is ≤ 0, project can submit for certification.	**(a) – (b)**

LEED Zero Waste Certification

To obtain **LEED Zero Waste** certification, a project must achieve GBCI's TRUE Zero Waste certification at the Platinum level. The TRUE Zero Waste program requires projects to have a zero waste policy in place, achieve an average of 90% or greater overall diversion from landfill, incineration (waste-to-energy) and the environment for solid, non-hazardous wastes for the most recent 12 months, and fulfill five other minimum program requirements.

A project team submits their TRUE Zero Waste Platinum certification for GBCI review in order to earn LEED Waste Certification.

Calculations

Equation 1. Annual CO_2e from Electricity Consumption

> Annual CO_2e from Electricity Consumption = annual electricity consumption (kBtu) x grid coefficient for the location (g CO_2E/kBtu)

Annual carbon dioxide equivalent emissions (CO_2e) is automatically calculated from electricity data submitted from projects. The electricity consumption is converted into equivalent GHG emissions using the U.S. Environmental Protection Agency's (EPA) subregional grid mix coefficients for U.S. and Canadian projects, and national grid mix coefficients from the International Energy Agency's (IEA) "CO_2 Emissions from Fuel Combustion 2017."

Alternatively, projects in the US and Canada may complete an offline calculation to calculate CO_2e from electricity on an hourly basis using EPA's AVERT tool or another source of hourly carbon emissions factors for the regional grid. Projects in other countries may complete an offline calculation to calculate CO_2e from electricity on an hourly basis where there is an appropriate source of hourly carbon emissions factors for the grid.

Equation 2. Annual CO_2e from Fuel Consumption

> Annual CO_2e from fuel = annual fuel consumption (BTU) x carbon emission factor for the fuel (CO_2E/BTU)

Equivalent GHG emissions are calculated automatically from project fuel consumption, using the U.S. EPA fuel coefficient values.

Equation 3. Annual CO_2e from Transportation

Based on regular building occupant and visitor responses to an occupant transportation survey, project greenhouse gas emissions are automatically calculated as annual CO_2e resulting from occupant transportation to and from the building. The project team must conduct at least one occupant transportation survey every 365 days.

An emissions value is calculated for each building occupant that completes the survey as follows:

Equation 3a. CO_2e value for each route provided for the occupant

> CO_2e for route (lbs) = (CO_2e lbs./mile) * distance traveled in miles

Table 4: CO_2e values for a one-way trip, for each mode of transit:

Mode	CO2e pounds/mile	Source
Walk, bike, telecommute	0	NA
Motorcycle	0.26	DEFRA/DECC 2014: emissionfactors.com
Heavy rail	0.33	American Bus Association Foundation. Updated Comparison of Energy use & CO2 Emissions From Different Transportation Modes, 2008.
2-3 Carpool	0.39	EPA: http://www.epa.gov/cleanenergy/energy-resources/refs.html
Light rail	0.44	American Bus Association Foundation. Updated Comparison of Energy Use & CO2 Emissions from Different Transportation Modes, 2008.
Alternative Fuel Vehicles	0.44	U.S. DOE National average for a 2014 Nissan Leaf: fueleconomy.gov
Bus	0.68	American Bus Association Foundation. Updated Comparison of Energy Use & CO2 Emissions from Different Transportation Modes, 2008.
Car (solo)	0.93	EPA: http://www.epa.gov/cleanenergy/energy-resources/refs.html

Equation 3b. CO_2e for each occupant:

CO_2e for individual occupant (lbs.) = ($\sum$ CO_2e for route) / # routes

For visitors, calculations include one route as their survey includes only one way and one day.

For regular building occupants, calculations may include more than one route as their survey requests information regarding two commutes over one week, and includes all seasons/yearly variations). Each route is weighted equally.

Equation 3c. Project CO_2e per one-way trip per occupant (lbs.)

Project CO_2e per one-way trip occupant (lbs.) = ($\sum$ CO_2e for individual occupant) / # occupants in survey

Equation 3d. Survey Scaled CO_2e value for each occupant

Survey Scaled CO_2e value for each occupant = Average Survey CO_2e value for each occupant (lbs.) * Total Occupants * Operating days per week * 2 trips/day * Survey period (weeks)

Equation 3e. Annual CO_2e value for transportation:

Annual CO_2e value for transportation = ($\sum$ all Scaled Survey Period CO_2E values for each occupant)

Equation 4. Annual Carbon Avoided from Onsite Renewable Energy Generated and Exported to Grid

Annual Carbon Avoided from On-Site Renewable Energy Generated and Exported to Grid = $\sum$ hourly electricity generation (kWh) from on-site renewable energy x hourly carbon emission rates for the recipient grid

Complete an offline calculation to calculate CO_2e avoided from on-site generated electricity on an hourly basis using EPA's AVERT tool or another source of hourly carbon emissions factors for the regional grid. Where hourly data are not available, monthly or annual on-site generated electricity may be used to calculate avoided carbon emissions using the AVERT marginal emission factor for the renewable energy type and for the region, for the most recent year available.

Equation 5. Annual Carbon Avoided from Offsite Renewable Energy Procured

> Annual Carbon Avoided from Off-Site Renewable Energy Procured = ∑ hourly electricity generation (kWh) from off-site renewable energy x hourly carbon emission rates for the recipient grid

Complete an offline calculation to calculate CO_2e avoided from off-site generated electricity on an hourly basis using EPA's AVERT tool or another source of hourly carbon emissions factors for the regional grid. Where hourly data are not available, monthly or annual generation and emissions rates may be used to calculate avoided carbon emissions using the AVERT marginal emission factor for the renewable energy type and for the region, for the most recent year available.

Renewable Energy Guidance

LEED Zero recognizes exported on-site renewable energy and off-site renewable energy, consistent with the approach reflected in LEED v4.1. After maximizing passive strategies and investing in energy efficiency to reduce overall energy demand, project teams should follow a hierarchy for selecting renewable energy sources:

1. On-site generation;
2. Local generation, such as community solar or wind, in instances where it will have a beneficial decarbonizing impact;
3. Offsite generation projects, such as through power purchase agreements;
4. Energy attribute certificates (EACs), also known as Renewable Energy Certificates (RECs)

Additional Guidance – LEED Zero Carbon:

For projects pursuing LEED Zero Carbon certification, avoided carbon calculations are based on the best available data for the recipient grid, with a preference for hourly carbon factors.

Onsite generated energy exported to the grid is included in carbon balance calculations with attention to avoided carbon at the time of export. A building with excess on-site solar energy exported to a grid that has significant amounts of solar energy may have minimal carbon reduction effect. Conversely, a building with onsite solar energy production along with storage, so that excess power can be exported during hours when the grid is dominated by fossil fuel generation, would have greater carbon reduction effects.

Off-site renewable energy procured is included in carbon balance calculations on the basis of the recipient grid and time of generation.

LEED Zero Carbon Example

Carbon Balance = Total Carbon Emitted - Total Carbon Avoided

A building in Boston has the following annual delivered energy types:

- 290 MWh electricity
- 85 MBtu natural gas

The project purchases 36 MWh of power in the form of Green-e Energy certified RECs from a wind farm in Texas.

Step 1. Calculate Carbon Emitted

The project administers an occupant transportation survey via Arc. Based on the results of the survey, calculated carbon emissions from transportation are 150,369 $lbCO_2e$/year.

To convert energy to GHG emissions:

- Co-efficient to convert electricity to GHG emission = 558.2 $lbCO_2e$/MWh (NEWE (NPCC New England) eGrid emissions factor) [1]
- Co-efficient to convert natural gas to GHG emission = 116 $lbCO_2e$/MBtu[2]

Table 5. Carbon Emitted

Source	Annual Consumption	Calculate Carbon Emitted	Total Carbon Emitted ($lbCO_2e$/year)
Electricity	290 MWh	= 290 x 558.2 $lbCO_2e$/MWh	161,878
Natural Gas	85 MBtu	= 85 x 116 $lbCO_2e$/MBtu	9,860
Transportation	-	-	150,369
		Total Carbon Emitted	**322,107**

Step 2. Calculate Carbon Avoided

To convert off-site renewable energy procurement to carbon avoided:

- Co-efficient to convert electricity to GHG emission = 1,009.2 $lbCO_2e$/MWh (ERCT (ERCOT All) eGrid emissions factor) [3]

Table 6. Carbon Avoided

Source	Annual Consumption	Calculate Carbon Avoided	Total Carbon Avoided ($lbCO_2e$/year)
Off-site renewable energy purchase	36 MWh	= 36 x 1,009.2 $lbCO_2e$/MWh	36,331
		Total Carbon Avoided	**36,331**

[1] https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf
[2] https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf
[3] https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Step 3. Calculate Carbon Balance

Carbon Balance = 322,107 $lbCO_2e$/year – 36,331 $lbCO_2e$/year
= 285,776 $lbCO_2e$/year

This project has a carbon imbalance of 285,776 $lbCO_2e$/year.

The project must increase renewable energy procurement and/or invest in carbon offsets in order to achieve LEED Zero Carbon certification.

LEED Zero Energy Examples

Source Energy Balance = (Total Source Energy Delivered) – (Total Non-Renewable Source Energy Displaced)

Example 1

A building has the following:

- Actual annual energy consumed: 300,000 kBtu electricity
- On-site renewable energy generated and consumed from PV: 150,000 kBtu electricity from photovoltaics
- Off-site wind power procured: 150,000 kBtu electricity

Step 1. Calculate Energy Delivered

Energy Delivered = (300,000 – 150,000) x 2.80
= 420,000 kBtu

Step 2. Calculate Non-Renewable Energy Displaced

Off-site renewable electricity displaces fossil-fuel generated electricity on the grid, for which the source energy conversion factor is 2.80.

Non-Renewable Energy Displaced = 150,000 x 2.80 = 420,000 kBtu

Step 3. Calculate Source Energy Balance

Source Energy Balance (E_{source}) = 420,000 kBtu – 420,000 kBtu = 0 kBtu

Because $E_{source} \leq 0$, the building can achieve LEED Zero Energy certification.

Example 2

A building has the following:

- Actual annual energy consumption:
  - 120,000 kBtu electricity
  - 160,000 kBtu natural gas
- On-site renewable energy generated and consumed from PV: 100,000 kBtu electricity from photovoltaics

- Off-site wind power procured: 80,000 kBtu electricity

Step 1. Calculate Energy Delivered

Energy Delivered = (120,000 – 100,000) x 2.80) + (160,000 x 1.05)
= 56,000 + 168,000
= 224,000 kBtu

Step 2. Calculate Non-Renewable Energy Displaced

Off-site renewable electricity displaces fossil-fuel generated electricity on the grid, for which the source energy conversion factor is 2.80.

Non-Renewable Energy Displaced = 80,000 x 2.80 = 224,000 kBtu

Step 3. Calculate Source Energy Balance

Source Energy Balance (E_{source}) = 224,000 kBtu – 224,000 kBtu = 0 kBtu

Because $E_{source} \leq 0$, the building can achieve LEED Zero Energy certification.

Example 3

A warehouse building has the following:

- Actual annual energy consumption:
  - 200,000 kBtu electricity
  - 60,000 kBtu natural gas
  - 100,000 kBtu chilled water
- A Power Purchase Agreement for a large PV array installed on the roof. The PV array exports 260,000 kBtu to the grid annually.
  - The project retains the environmental attributes, or EACs, associated with the renewable energy generation.

Step 1. Calculate Energy Delivered

Energy Delivered = [(200,000 x 2.80) + (60,000 x 1.05) + (100,000 x 0.91)]
= 560,000 + 63,000 + 91,000
= 714,000 kBtu

Step 2. Calculate Non-Renewable Energy Displaced

On-site renewable electricity exported to the grid displaces fossil-fuel generated electricity on the grid, for which the source energy conversion factor is 2.80.

Non-Renewable Energy Displaced = 260,000 x 2.80 = 728,000 kBtu

Step 3. Calculate Source Energy Balance

Source Energy Balance (E_{source}) = 714,000 kBtu – 728,000 kBtu = - 14,000 kBtu

Because $E_{source} < 0$, the building is operating at net positive energy and can achieve LEED Zero Energy certification.

Required Documentation

Projects pursuing LEED Zero Carbon, LEED Zero Energy, and LEED Zero Water certification upload 12 months of metered performance data required for the desired certification in Arc. Additional required documentation is outlined in Table 7.

Table 7. LEED Zero Documentation Requirements

Documentation	Carbon	Energy	Water	Waste
Utility bills for all energy and water sources, with consumption values and dates highlighted	X	X	X	
Calculations showing net zero balance ≤ 0	X	X	X	
Documentation for each source of renewable energy, including purchase contract for off-site renewable energy, or purchase contract for carbon offsets, as applicable	X	X		
Narrative description of alternative water sources and water returned to original water source			X	
TRUE Zero Waste Platinum certification				X