



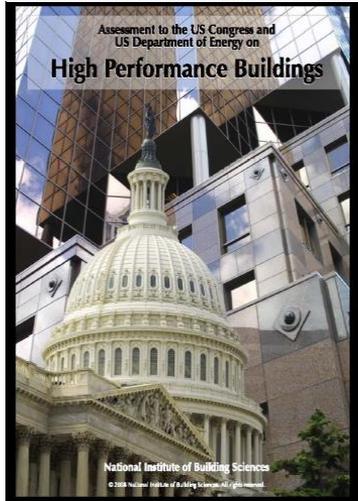
# **Zero Energy Building Policies and Definitions**

Roger Grant  
National Institute of Building Sciences  
August 12, 2015

# Background and goals

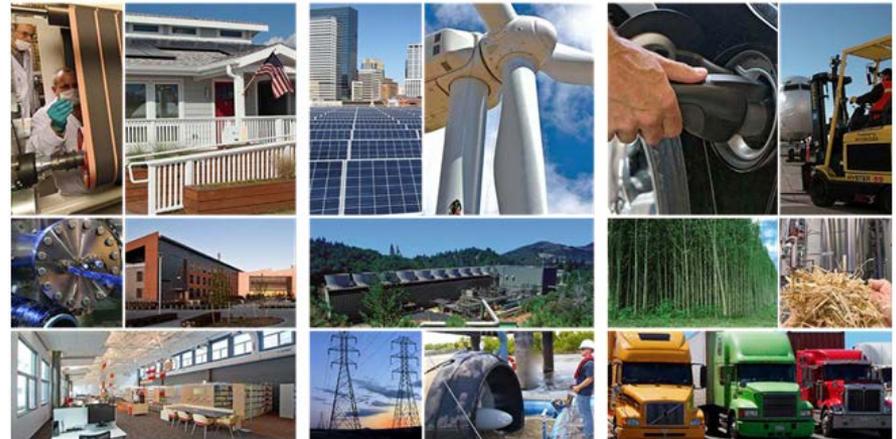
## High Performance Building Council

a council of the National Institute of Building Sciences



## National Institute of Building Sciences High Performance Building Council

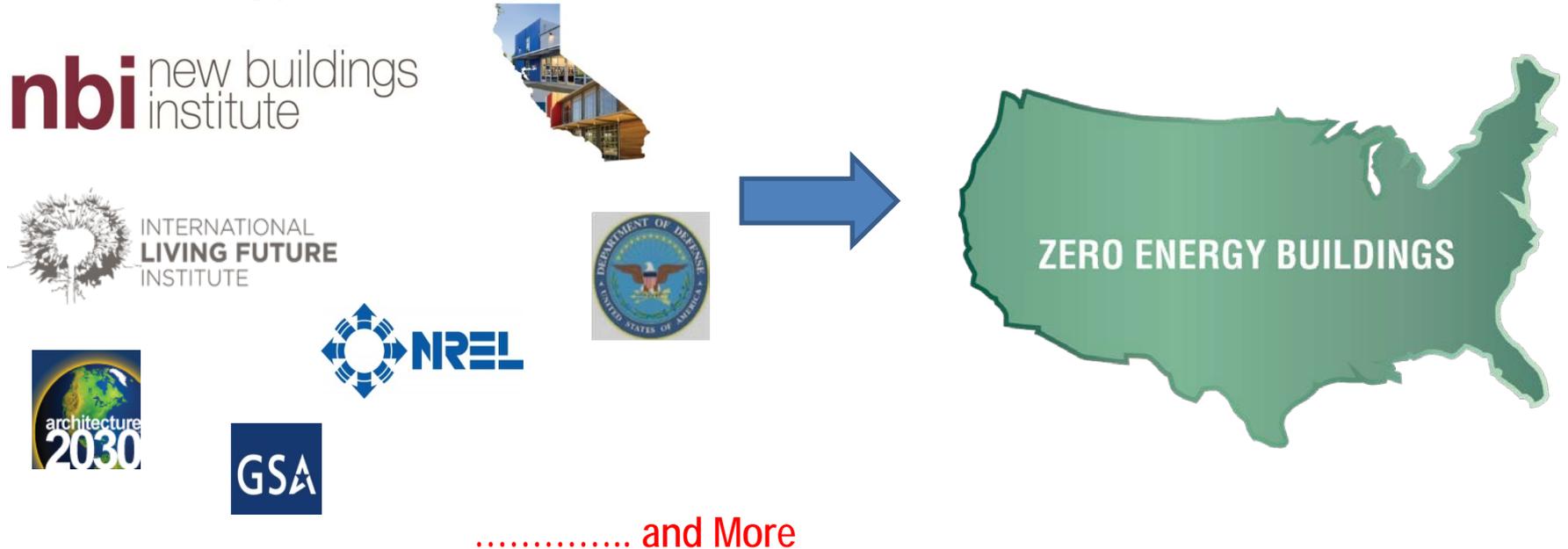
## Department of Energy Building Technologies Office



U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency &  
Renewable Energy

# Project Goal

Converge on an industry-accepted national DOE definition for ZE that will support program and policy goals and encourage commercial new construction and major renovation projects to design, construct, and operate buildings that achieve a high level of energy efficiency.



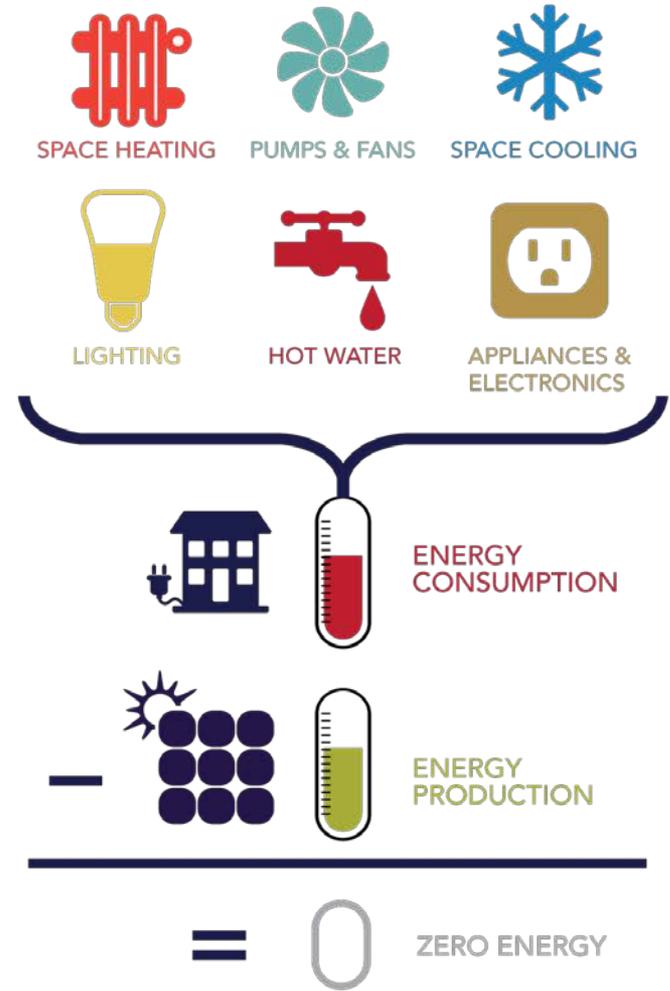
# ZEB Concept

Over the course of a year, if the on-site renewable energy produced  $\geq$  the energy consumed within the boundary, it is considered a ZEB

Goal 1: Reduce Consumption

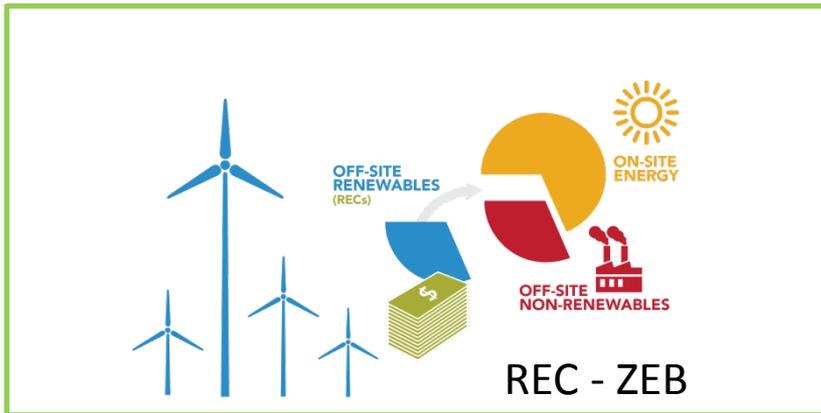
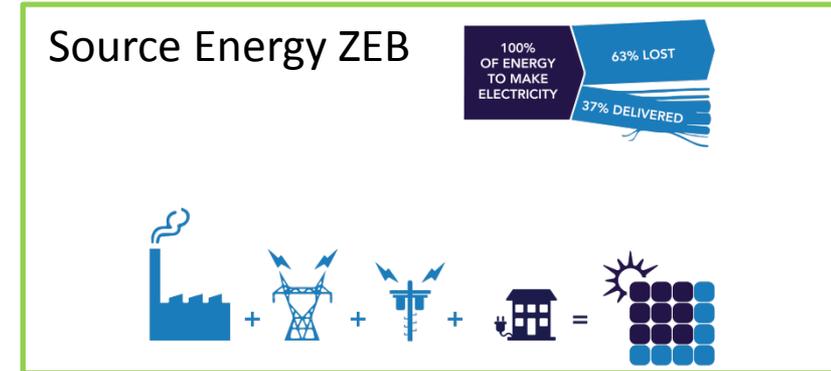
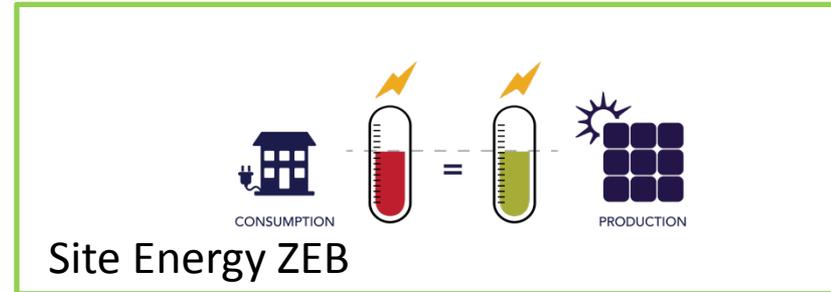
Goal 2: Apply On-site Renewable Energy

MEASURED FOR 365 DAYS

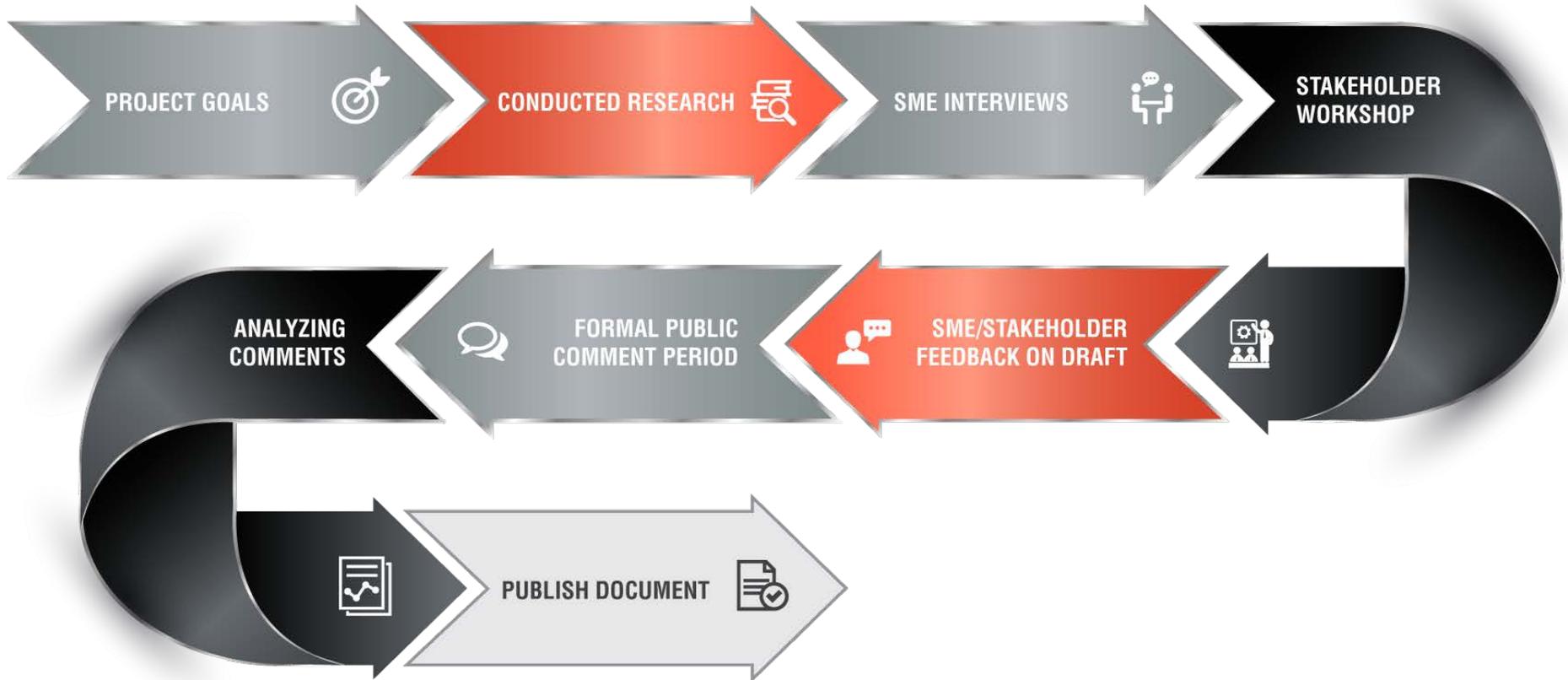


# Different Types of Zero Energy

- Site energy ZEB
- Source energy ZEB
- Zero Energy Cost Building
- REC-ZEB



# Definition Development Process Overview



# Zero Energy Building (ZEB) Definition

An energy-efficient **building**, where on a **source energy** basis, the actual **annual delivered energy** is less than or equal to the on-site renewable **exported energy**.

# ZEB Definition Variations

## Zero Energy Campus

- An energy-efficient **campus** where the **actual annual source energy** consumption is balanced by **on-site renewable energy**.

## Zero Energy Portfolio

- An energy-efficient **portfolio** where the **combined actual annual source energy** consumption is balanced by **on-site renewable energy**.

## Zero Energy Community

- An energy-efficient **community** where the **actual annual source energy** consumption is balanced by **on-site renewable energy**.

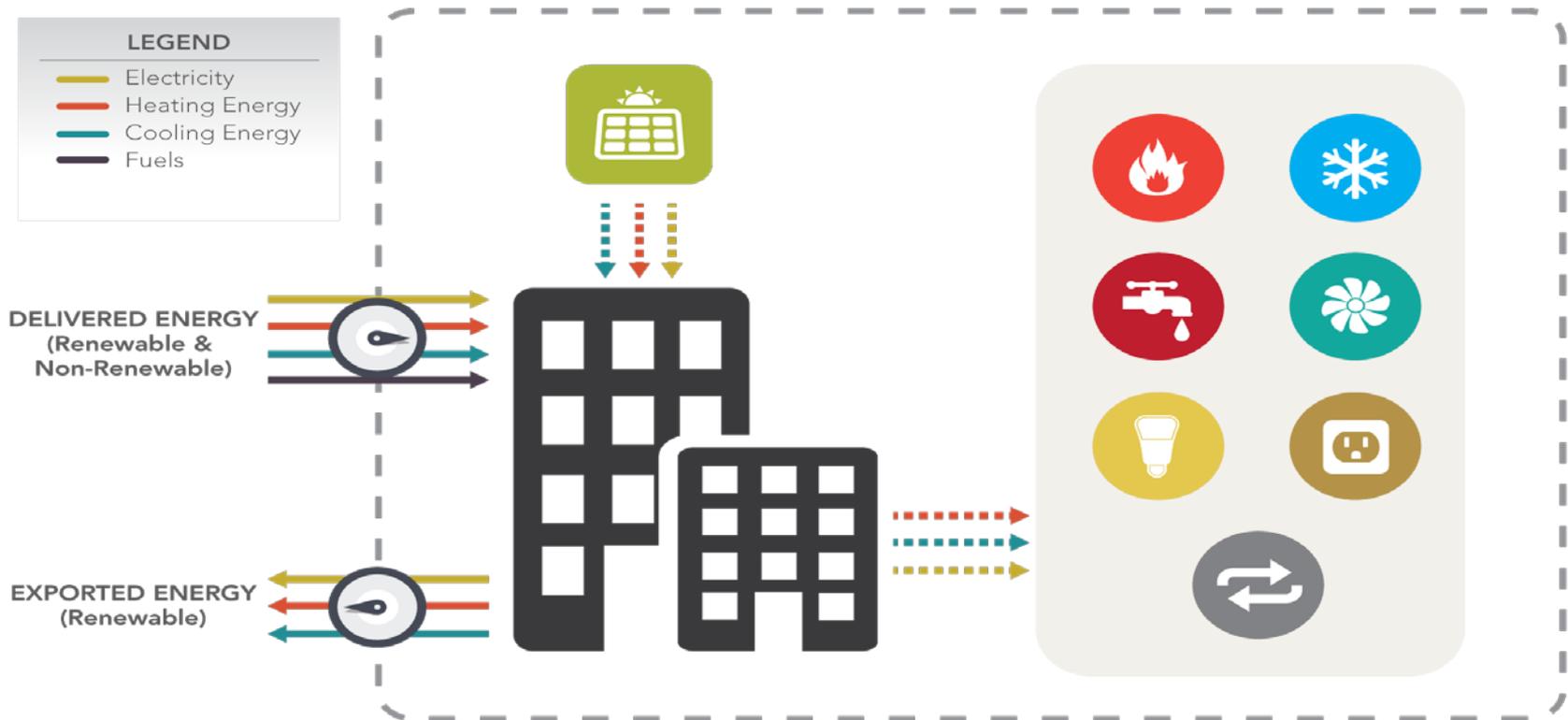
# Nomenclature

- Annual
- Building
- Building energy
- Building site
- Campus
- Community
- Delivered energy
- Energy
- Exported energy
- Geothermal energy
- On-site renewable energy
- Portfolio
- Renewable energy
- Site boundary
- Source energy

# Measurement and Implementation Guidelines

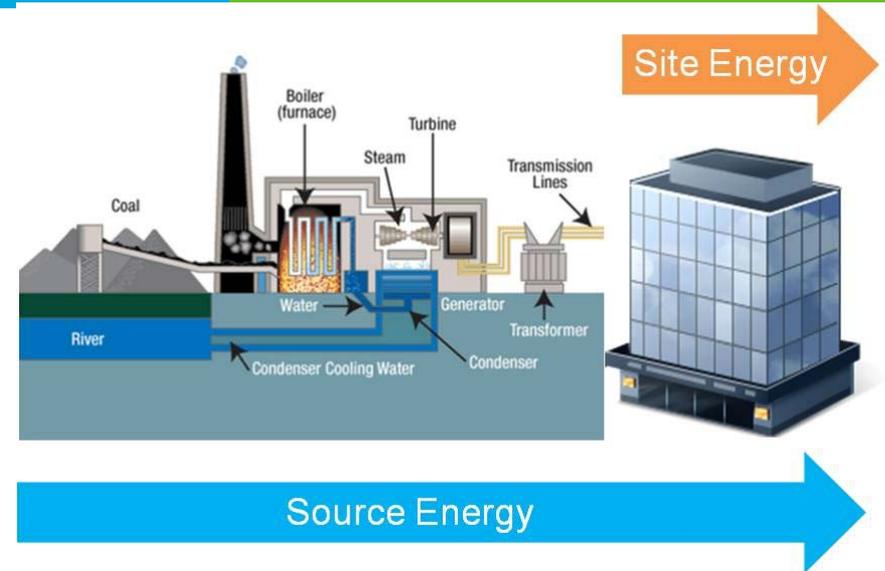
1. Measurement boundaries for all definitions
2. Energy accounting and measurements
3. Source energy calculations

# Site Boundary of Energy Transfer



# Energy Accounting and Measurement

- Energy measurement at site
- Convert to source energy



- True reflection of total energy use
- Gives PV equal “credit” to grid electricity
- Better aligns with customers economic decisions to balance site energy usage with PV
- Calculated with national average conversion factors
  - Recognizes that the focus of ZEB definitions is on the building, not the energy supplier or resulting emissions

# Source Energy Calculations

Energy Form	Source Energy Conversion Factor (r)
Imported Electricity	3.15
Exported Renewable Electricity	3.15
Natural Gas	1.09
Fuel Oil (1,2,4,5,6,Diesel, Kerosene)	1.19
Propane & Liquid Propane	1.15
Steam	1.45
Hot Water	1.35
Chilled Water	1.04
Coal or Other	1.05

**National Average Source Energy Conversion Factors** – source ASHRAE Standard 105

$$E_{source} = \sum_i (E_{del,i} r_{del,i}) - \sum_i (E_{exp,i} r_{exp,i})$$

Where

$E_{del,i}$  = delivered energy for energy type  $i$ ;

$E_{exp,i}$  = exported on-site renewable energy for energy type  $i$ ;

$r_{del,i}$  = source-site energy ratio for the delivered energy type  $i$ ;

$r_{exp,i}$  = source-site energy ratio for the exported energy type  $i$ ;

# Using “Zero Energy Building” Designation

- Only buildings that have demonstrated through actual annual measurements that the on-site renewable exported energy is greater than or equal to delivered energy.
- Buildings designed to be zero energy, but have not yet had a full year of operation are encouraged to identify their intent to be a *Zero Energy Building*.

# Additional Considerations

1. Definition for a Zero Energy Building that uses Renewable Energy Credits (RECs)

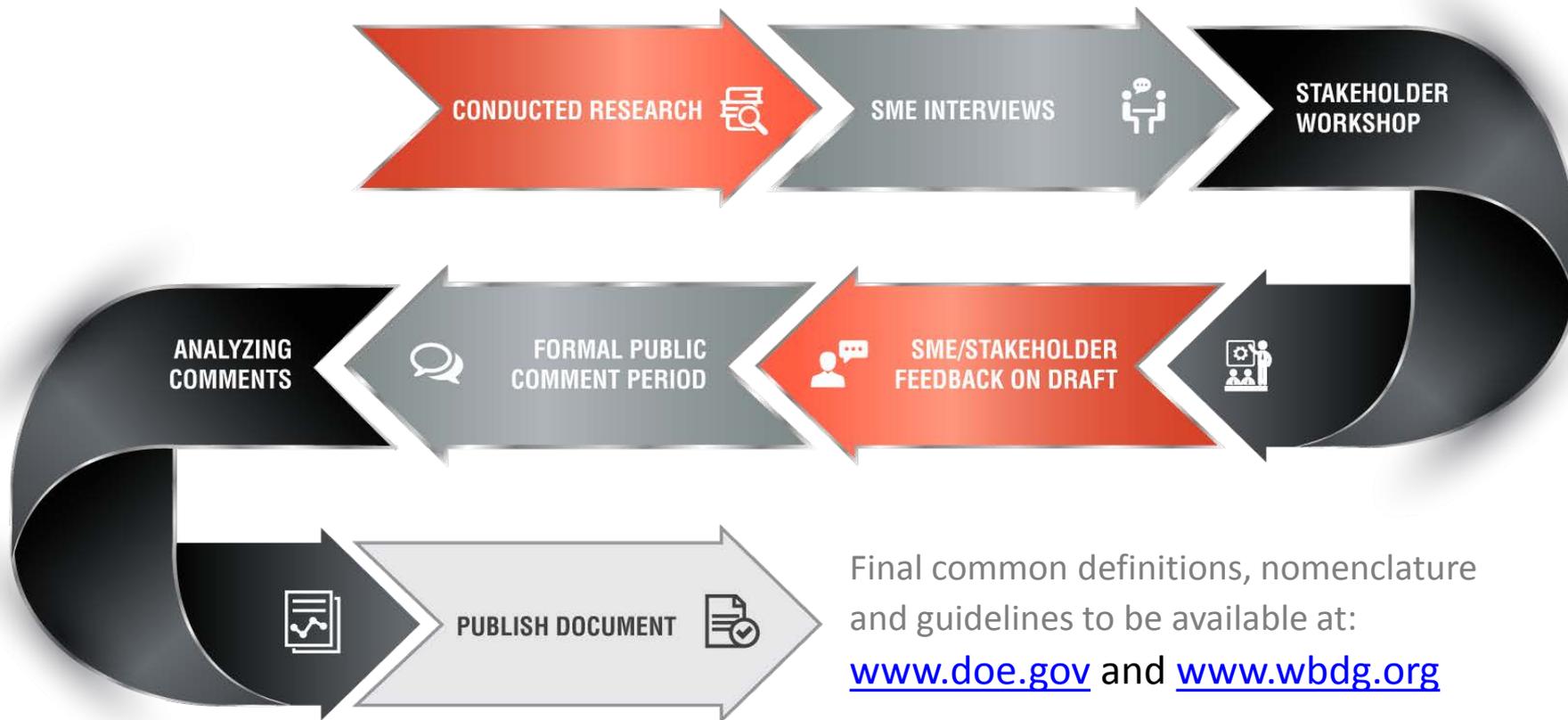
## **Renewable Energy Certificate - Zero Energy Building (REC-ZEB)**

An energy-efficient building where on a **source energy** basis, the actual **annual delivered energy** is less than or equal to the on-site renewable **exported energy** plus **Renewable Energy Certificates (RECs)**.

2. *Zero Energy Ready (ZER)* Building

A highly energy efficient building that could conceivably become a ZEB in the future with the addition of renewable energy.

# Status



# Contact Information

**Roger Grant**

[rgrant@nibs.org](mailto:rgrant@nibs.org)

**Kent Peterson**

[kent.peterson@p2seng.com](mailto:kent.peterson@p2seng.com)

**Paul Torcellini**

[paul.torcellini@nrel.gov](mailto:paul.torcellini@nrel.gov)

**Cody Taylor**

[cody.taylor@ee.doe.gov](mailto:cody.taylor@ee.doe.gov)

More information:

[www.doe.gov](http://www.doe.gov)

[www.nrel.gov](http://www.nrel.gov)

[www.nibs.org](http://www.nibs.org)

[www.wbdg.org](http://www.wbdg.org)