How to Benchmark Properties with Onsite Renewable Energy

Users can track the generation and consumption of onsite renewable electricity from solar photovoltaic (PV) panels and/or wind turbines. This process can be more complex than just entering grid electricity consumption, especially if your utility is only providing you with "net metered" data. This document lays out the steps for accurate benchmarking to track the energy and emissions benefits of using onsite renewable energy.

1 Understand the Data Required by Portfolio Manager

There are numerous energy "flows" at buildings with onsite renewable systems that must be measured and recorded in order to benchmark correctly. The following diagram depicts these flows, and explains how certain flows are mathematically related to one another. This will be useful if your utility bill does not contain all of this information, as it is sometimes possible to calculate certain values manually.
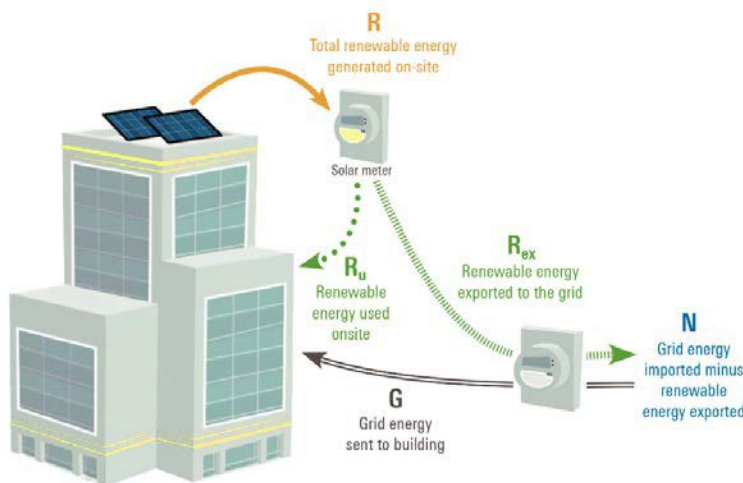
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Figure 1: Energy flows at a property

R: **Total amount of renewable energy generated onsite**
Properties with onsite renewables should have access to this quantity

R_{ex}: **Renewable energy generated onsite, exported back to grid**
Availability depends on metering (utility meter or owner submeter)

R_u: **Renewable energy generated onsite, used onsite**
Can be calculated as $R - R_{ex}$.

G: **Grid energy sent to building**
Availability depends on metering (utility meter or owner submeter)

N: **Net consumption of grid energy, accounting for exports**
Shows what a customer owes on utility bills. Equal to $G - R_{ex}$.

Total site energy required to operate the building: Equal to $R_u + G$ *or* $N + R$.

Total source energy required to operate the building: Must be calculated as $R_u + G$.

One common benchmarking error is to enter the "net-metered" electricity consumption (N) as the total grid energy consumed at the building (G). Further details are provided in Appendix A, but in short: **if you export any energy to the grid, then your net-metered electricity does not necessarily tell you how much total grid electricity your building actually used. Portfolio Manager needs your** <u>actual</u> **grid electricity consumption plus your** <u>actual</u> **onsite green power consumption in order to provide an accurate score.**

❷ Set up Your Meters

To account for the generation and consumption of all electricity at your property, you need to set up at least two electricity meters (if you need help setting up meters, see How to Get Utility Data Into Portfolio Manager):

Figure 2: Selecting the source of a property's energy

- ✓ One or more meters to track the total amount of electricity purchased from the grid; and
- ✓ One meter to track electricity generated onsite using solar panels and/or wind turbines.

NOTE: In any consumption period, your onsite renewable system may generate more energy than your property can use. The onsite renewable electricity meter allows you to differentiate between the renewable energy used onsite vs. that which you export back to the grid. See screenshots below.

❸ Enter Consumption Data for Both Electricity Meter Type

Now it's time to enter your consumption data. This is where it's important to remember the various electricity "flows" depicted in Step 1.

1. For each entry in your onsite renewable electricity meter, you will enter the total amount of "Energy Used Onsite" (R_u) and "Energy Exported Offsite" (R_{ex}) for the corresponding consumption period. You will also need to indicate whether you own the Renewable Energy Credits associated with the generation of this electricity (see this FAQ for more information about RECs).

	Start Date	End Date	Energy Used On Site kWh (thousand Watt-hours)	Energy Exported Offsite kWh (thousand Watt-hours)	Total Cost ($)	Estimation	REC Ownership
☐	1/1/2021	2/1/2021	950	50		☐	Owned ⌄
☐	02/01/2021 📅	03/01/2021 📅				☐	⌄

Figure 3: Entering meter information

NOTE: It is likely that you will need to manually calculate the value of "Energy Used Onsite" (R_u) for each period by subtracting the "Energy Exported Offsite" (R_{ex}) for a given period (typically provided by your utility) from the total amount of renewable energy generated onsite (R) for that period (typically obtained from your onsite renewable system). In other words, $R_u = R - R_{ex}$.

2. For each entry in your **grid electric meter**, you will enter the total amount of grid electricity consumed (**G**) for the corresponding consumption period.

Figure 4: Entering grid electricity consumed

If your utility bill reports net-metered consumption but does not report the total amount of grid electricity that you purchased, you may be able to calculate this value.

For instance, the following data (solar generation system data plus utility bill) does not include total grid consumption:
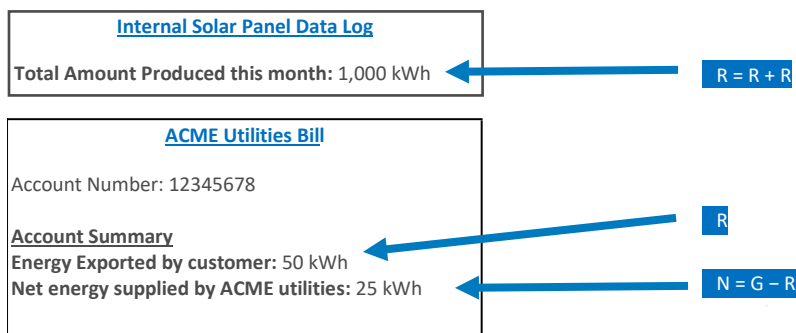

Figure 5: Sample net-metered consumption

However, the necessary inputs can be calculated as follows:

- ✓ **To get value R_u** take value **R** (total amount of renewable energy generated onsite) that you obtained from onsite measurements of energy production during the relevant billing period (in this case 1,000 kWh) and subtract R_{ex} (50 kWh). Enter the result (950 kWh) in the "Energy Used Onsite" column of your onsite meter, as shown above.
- ✓ **To get value G** take value **N** from your utility bill (25 kWh) and add Rex (50 kWh) to calculate the total amount of energy the building used that was physically supplied by the grid (75 kWh). Input this value in your Electric Grid meter, as shown above.

Note that values R and N, by themselves, are not sufficient to obtain all values required for benchmarking. You will need to obtain either R_u, R_{ex}, or G, in addition to the net-metered consumption (N) and the total onsite generation (R), to calculate the values required to benchmark your property completely and correctly. If you cannot obtain the necessary values, then you will need to take an alternate approach (see Appendix A).

Learn More!

- About Portfolio Manager: energystar.gov/benchmark

- ENERGY STAR Guide for Licensed Professionals
energystar.gov/LPGuide

- ENERGY STAR for Buildings: energystar.gov/buildings

Appendix A: How Portfolio Manager Accounts for Onsite-Generated Electricity vs. Grid Electricity (And What If My Utility Doesn't Provide the Information Portfolio Manager Needs?

Portfolio Manager applies different site-to-source conversion factors for onsite renewable electricity generation (regardless of REC ownership) vs. grid electricity (1.0 vs. 2.80, respectively; see page 6 of the Source Energy technical reference).

Because the ENERGY STAR score is based on source energy, a property that is over-accounting for consumption of onsite-generated renewable electricity (and/or under-accounting for grid electricity consumption), will receive an incorrectly high ENERGY STAR score.

If your utility only provides net-metered consumption data, without additional information that can be used to calculate the required energy "flows," then you may not be able to obtain the data required for benchmarking in Portfolio Manager.

A common mistake among Portfolio Manager users facing this situation is to enter the net-metered consumption value into the "Usage" field of your grid electric meter (i.e., entering value N instead of value G), and to enter the full onsite generation value into the onsite renewable electricity meter as "Energy Used Onsite" (i.e., entering value R instead of value R_u).

In this case, it's true that the sum of net-metered consumption plus onsite generation is mathematically equivalent to total building energy usage [N + R = (G – R_{ex}) + (R_u + R_{ex}) = G + R_u]. However, this is only correct in terms of site energy. Once site-to-source conversation factors are applied, you would be over- accounting for your property's onsite renewable electricity consumption and under-accounting for your property's grid electricity consumption, resulting in an artificially high ENERGY STAR score. If you were to benchmark your property in this manner and apply for ENERGY STAR Certification, your application would be denied.

In this situation, we recommend you treat all electricity consumption – both grid electricity and onsite renewably-generated electricity – as "grid electricity." In doing so, your building's score/metrics will be conservative (since you will not receive the benefit of the 1.0 site-source conversion factor for the renewable electricity that you generated and consumed onsite). However, if your property is able to achieve a score of 75 or higher when benchmarking in this manner, you will be eligible to receive ENERGY STAR Certification (since your "actual" score would be even higher, if you had the data needed to properly account for onsite green power consumption).

Note that this approach is a "workaround" for situations when additional data cannot be obtained, but you still wish to benchmark your property. If you find yourself in this scenario, you may wish to contact your utility to determine whether there is additional data that they are tracking within their systems (e.g., amount of electricity exported from building to grid; total grid electricity provided from grid to building), but that does not get included on monthly bills. Ultimately, this will depend on the meter technology installed at your property (e.g., "net" vs. "bidirectional"), as well as which type(s) of meter data flows the utility is capturing and storing. While many bidirectional meters can track on separate channels the electricity flowing from the grid to a building and the electricity flowing from a building to the grid, if a utility's customer billing system is not set up to handle this level of data, then it may not be possible for the utility to provide the data required by Portfolio Manager as part of the standard monthly billing process.