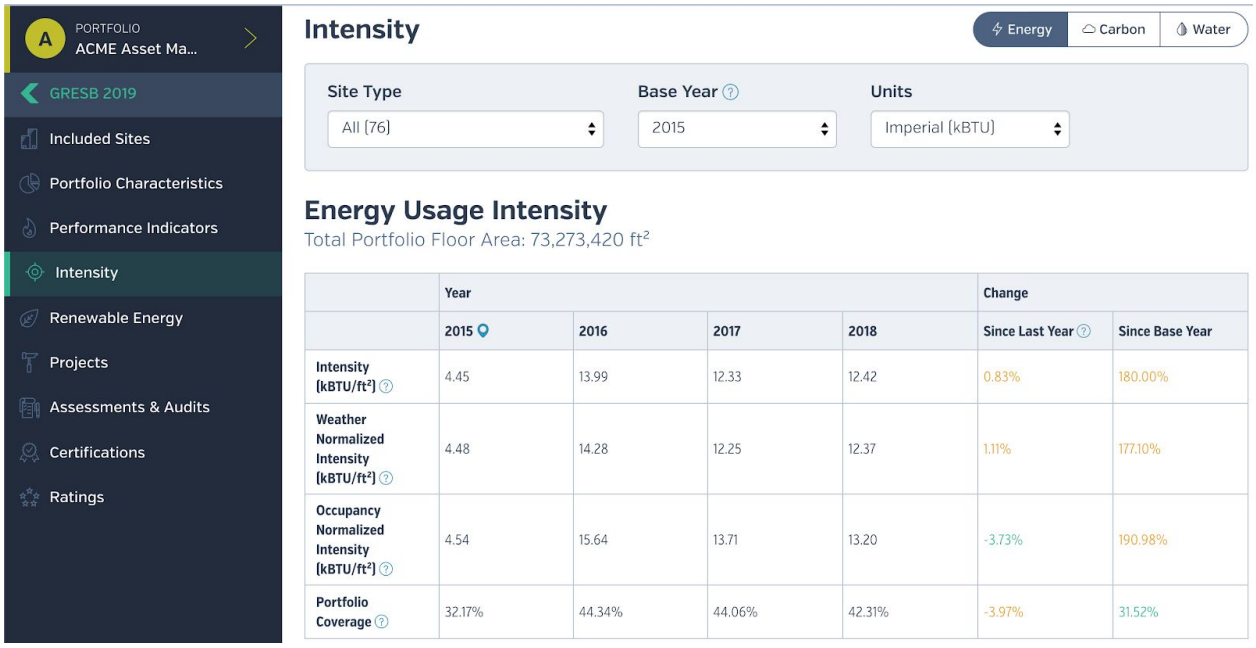
How are the “Intensity” tables calculated for GRESB?

The app calculates three intensity metrics within the “Data Summary” tab for GRESB.



	Year				Change	
	2015	2016	2017	2018	Since Last Year	Since Base Year
Intensity (kBTU/ft²)	4.45	13.99	12.33	12.42	0.83%	180.00%
Weather Normalized Intensity (kBTU/ft²)	4.48	14.28	12.25	12.37	1.11%	177.10%
Occupancy Normalized Intensity (kBTU/ft²)	4.54	15.64	13.71	13.20	-3.73%	190.98%
Portfolio Coverage	32.17%	44.34%	44.06%	42.31%	-3.97%	31.52%

Intensity
Intensity simply divides total usage (for energy, carbon emissions, and water) of sites included in GRESB by the floor area of those included sites. Sites are included if they are at least 20 percent owned (not leased), turned on (see the “Active” column on the “Sites” tab) and were owned by the reporting entity during the reporting period.

No usage is excluded: tenant usage and usage on indirectly managed sites is included in the numerator of the Intensity calculation.

For energy, the app first converts the total usage of each energy type (electric, fuel, district) into kBtu, then sums them together and divides them by total included floor area. Carbon emissions are converted to kilograms of CO_2-equivalent, and water usage is converted to gallons.

GRESB awards additional points for normalizing intensity by a couple of different factors, so the app provides occupancy and weather normalized intensity metrics.

Occupancy Normalized Intensity
The goal of this metric is to determine what the intensity would have been if the site were 100 percent occupied.

Occupancy normalized intensity sums up occupancy normalized usage for all sites included in GRESB and divides that usage by included floor area.

When calculating occupancy normalized usage for a site, the app first determines the percentage of a site's leasable area that was occupied during the reporting period (common area is treated as 100 percent occupied). The app then calculates what usage would have been with 100 percent occupancy by dividing total usage by occupancy percentage.

Here's how it works:

$$\frac{\text{Actual Usage}}{(\%\ \text{Leasable Area} * \%\ \text{Occupancy}) + \%\ \text{Common Area}}$$

Example:
Step 1

$$\frac{\textbf{100,000 kBtu}}{(\textbf{90\%}\ \text{Leasable Area} * \textbf{90\%}\ \text{Occupancy}) + \textbf{10\%}\ \text{Common Area}}$$

Step 2

$$\frac{\textbf{100,000 kBtu}}{(\textbf{81\%}\ \text{leasable space occupancy}) + \textbf{10\%}\ \text{Common Area}}$$

Step 3

$$\frac{\textbf{100,000 kBtu}}{\textbf{91\%}\ \text{Occupancy}} = \textbf{109,890 kBtu}$$

Step 4
Let's say this site was 5,000 square feet.

$$\frac{109{,}890\ \text{kBtu}}{5{,}000\ \text{square feet}} = \textbf{21.978 kBtu/ft}^2$$

Weather Normalized Intensity
The goal of this metric is to calculate what the intensity would have been if the site had experienced a “normal” weather year for its area.

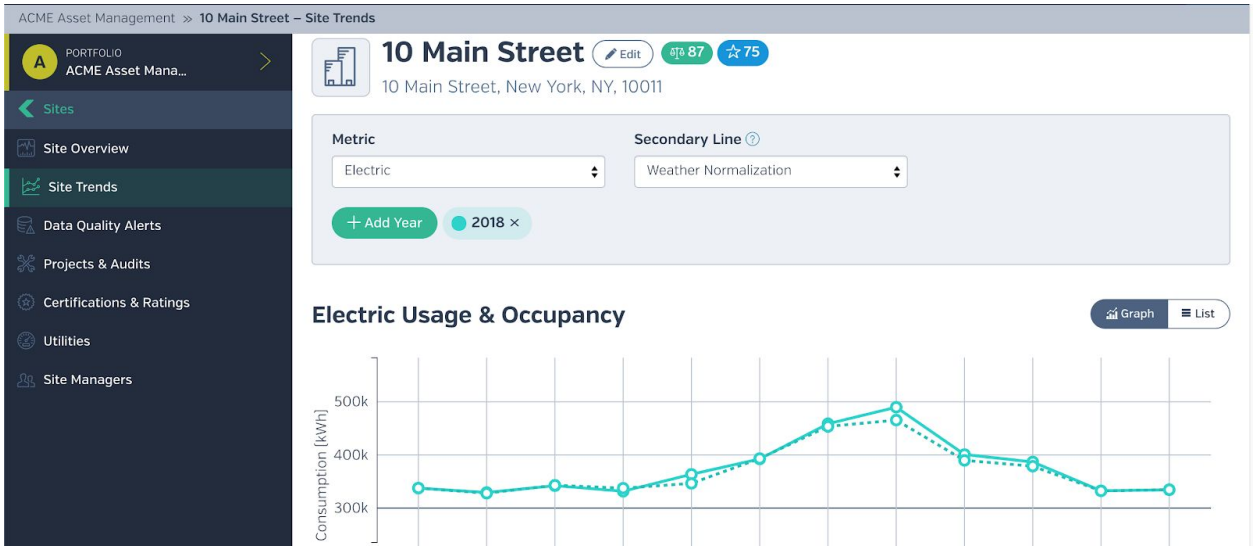
The app determines what a “normal” weather year is for a site using data from its weather station going back 10 years. The app links a site to a weather station by using its address to plot its latitude and longitude coordinates and then finding the closest weather station.

For this metric, weather is measured by heating degree days (HDD) and cooling degree days (CDD). HDD and CDD are scientific measures of how far from “neutral” the temperature is, with “neutral” being 65 F.

HDD captures the heating burden when temperatures are below 65 and equals (65 - Daily Temperature). A 35 degree day would be equal to 30 HDD (and 0 CDD).

CDD is for temperatures above 65 and equals (Daily Temperature - 65). An 80 degree day would be equal 15 CDD (0 HDD). The app gets weather station HDD and CDD data from https://degreedays.net, which also provides additional details on the regression process.

The app normalizes electricity and natural gas usage, since those are the two fuels where there’s a proven, statistically significant effect of temperature on usage. You can see monthly values for weather normalized electric and gas usage on the “Site Trends” tab.



Using the site’s assigned weather station, the app prepares a table of CDD and HDD data for the past 10 years (on a monthly level) which functions as the site’s long term climate average. The app uses those ten years of data points to create a regression model, regressing usage against the monthly degree days. The app normalizes electricity usage against CDD and natural

gas usage against HDD. The result is the regression model which is ultimately used in "normalizing" usage for weather.

The final step is that the app takes the last 12 months of usage data for a given building and feeds it into the regression model described above. The app takes (1 - slope) of that model and multiplies that value by the annual usage data for the site. The end result is the Weather Normalized Usage value for the site. Weather Normalized Usage is then divided by gross floor area to calculate Weather Normalized Intensity.