

## Energy Use in Wastewater Treatment Plants

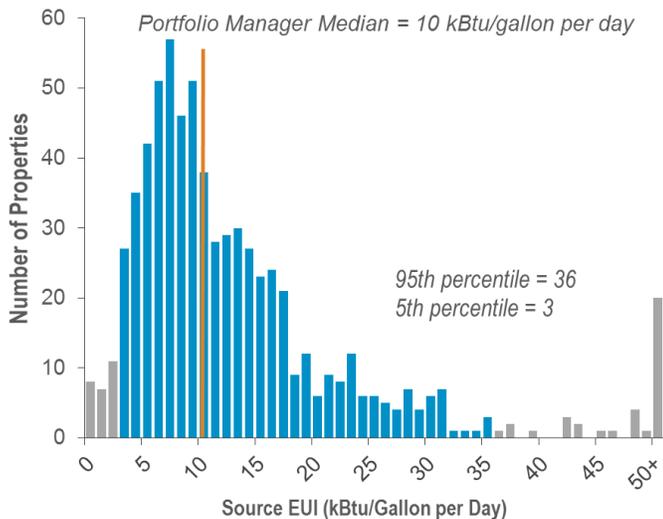
### Wastewater Treatment Plants Using Portfolio Manager

-  1,377 Properties
-  16.8 Billion Gallons per Day
-  **48** Average ENERGY STAR Score

The U.S. Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager is changing the way organizations track and manage energy. Because of this widespread market adoption, EPA has prepared the DataTrends series to examine benchmarking and trends in energy and water consumption in Portfolio Manager. To learn more, visit [www.energystar.gov/DataTrends](http://www.energystar.gov/DataTrends).

### What is a typical operating profile?

Energy use intensity (EUI) ranges from less than 5 to more than 50 kBtu/gallon per day (kBtu/GPD) across all wastewater treatment plants, with those at the 95th percentile using nine times the energy of those at the 5th percentile. The distribution has a negative skew, which means the most energy intensive plants are further away from the median than the most efficient. Plants may use more or less energy for many reasons, including variable equipment efficiency and energy management practices, as well as variations in climate and business activities.

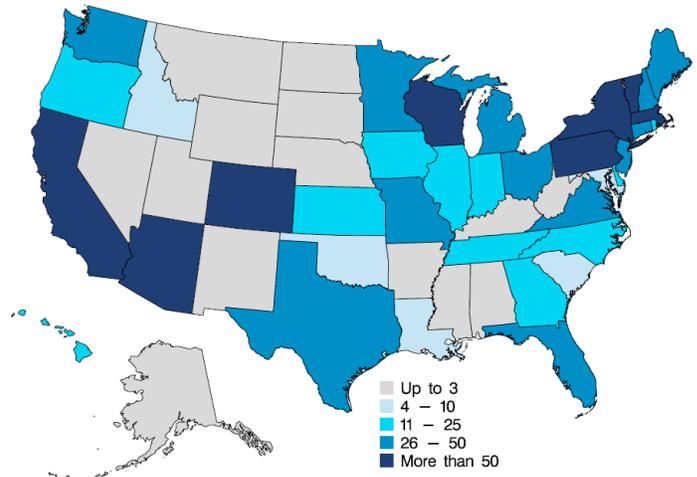


The size of wastewater treatment plants varies with the population served. The median wastewater treatment plant in Portfolio Manager treats approximately 3 million gallons per day (MGD), but some larger plants may process as much as 50 MGD or more. As you can see, there are plants of all sizes and types benchmarking in Portfolio Manager.

**What is Source Energy?** Source energy is the amount of raw fuel required to operate your property. In addition to what you use on site, source energy includes losses from generation, transmission, and distribution of energy. Source energy enables the most complete and equitable energy assessment. Learn more at: [www.energystar.gov/SourceEnergy](http://www.energystar.gov/SourceEnergy).

### Benchmarking by State

Number of Wastewater Treatment Plants

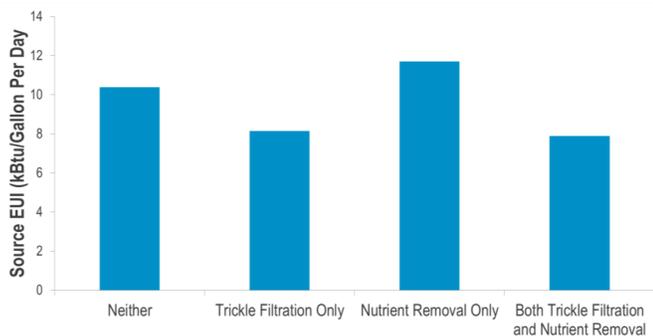
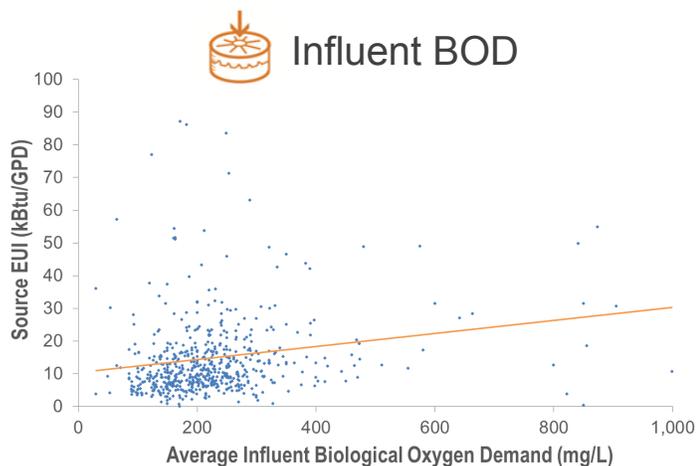


#### Property Characteristic

Property Characteristic	Range of Values		
	5th percentile	Median	95th percentile
 Influent Flow (MGD)	0.2	3	74
 Influent Biological Oxygen Demand (mg/L)	102	200	391
 Effluent Biological Oxygen Demand (mg/L)	1	5	20
 Plant Load Factor (%)	25	60	100
 Trickle Filtration?	13% say yes		
 Nutrient Removal?	57% say yes		
 Heating Degree Days	928	5,343	7,877
 Cooling Degree Days	223	910	4,243

# What characteristics affect energy use in wastewater treatment plants?

In wastewater treatment plants, energy consumption is often correlated with the magnitude and type of pollutant load, which can influence the treatment methods and technologies used in a plant. Wastewater treatment plants that have more influent biological oxygen demand (BOD) use more energy, on average, as shown by the slope of the orange trend line in the graph below. The bar graph below shows that plants that utilize trickle filtration have lower energy intensity on average, while plants that utilize nutrient removal in the treatment process have higher energy intensity on average. Nutrient removal is often necessary near sensitive waters.



## Wastewater Treatment Terminology



**Biological Oxygen Demand (BOD)** is the measure of the amount of oxygen required by bacteria for stabilizing material that can be decomposed under aerobic conditions. BOD is a commonly used determinant of the organic strength of waste.



**Plant load factor** indicates how closely the plant is being operated to design capacity. Most plants are used at between 40% and 100% of design capacity.



**Trickle Filtration** is a process used to reduce BOD and ammonia nitrogen levels. Trickling filters are composed of a bed of porous material. Wastewater is distributed over the surface of the media for aerobic treatment.

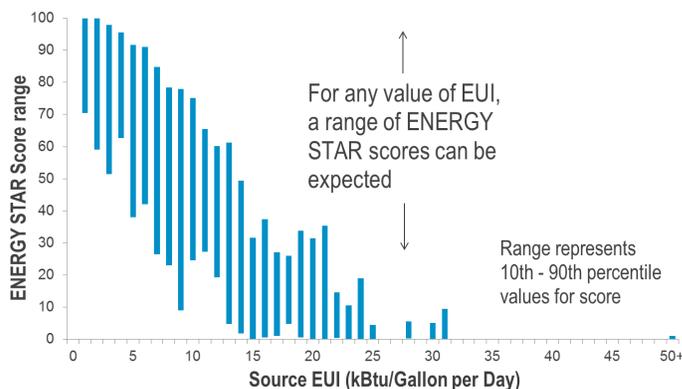


**Nutrient removal** is considered to be any process included for the purpose of removing nutrients. This may include biological nitrification, biological denitrification, phosphorus removal, or recirculating sand filters.

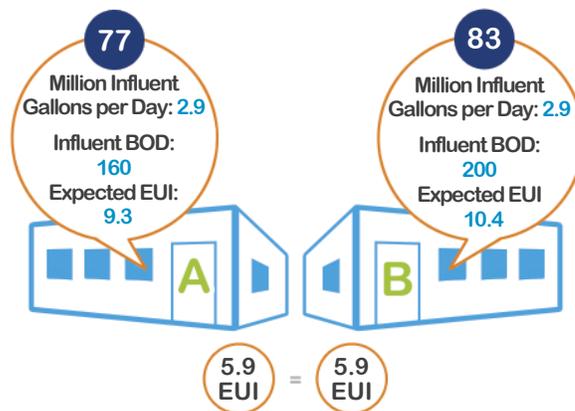
# How does EPA's ENERGY STAR score vary with energy use?

EPA's ENERGY STAR score normalizes for the effects of operation. While properties with lower EUI generally earn higher scores on the 1-100 scale, an individual property's result depends on its business activities. For any given EUI, a range of scores is possible.

## Score Range for Wastewater Treatment Plants



Let's look at two wastewater treatment plants, Plant A and Plant B. They have the same EUI of 5.9 kBtu per gallon per day, and are identical except that Plant B has more influent biological oxygen demand. Because Plant B has more BOD it is expected to have a higher EUI than Plant A, based on ENERGY STAR scoring models. Since Plant B is *expected* to use more energy, but *actually* uses the same energy, it earns a higher score.



**Note:** Total number of plants benchmarked and total flow rate reflects cumulative data through 2013. Analysis of energy use and property characteristics includes 698 properties benchmarked in the most recent 5 years. The data is self reported and has been filtered to exclude outliers, incomplete records, and test facilities. Portfolio Manager is not a randomly selected sample and is not the basis of the ENERGY STAR score. To learn more, visit: [www.energystar.gov/DataTrends](http://www.energystar.gov/DataTrends).