

Net-zero, Off-the-Grid, and Regenerative Buildings

What do net zero, off the grid, and regenerative mean?

According to the U.S. Department of Energy's Net-zero Energy Commercial Building Initiative, "Net-zero energy buildings generate as much energy as they consume through efficiency technologies and on-site power generation." For example, buildings generate electricity and sell this electricity to the utility grid to receive a credit from the utility provider, which they use to buy electricity from the utility grid. At the end of the year, the goal is to break even or to sell more energy to the grid than the building uses. It is possible to construct a moderate-size, well-insulated home that operates as a net-zero-energy residence, with new-generation solar panels and high-efficiency HVAC systems, using off-the-shelf materials. This concept now is gaining acceptance in larger facilities and even hospitals.

"Off the grid" is a different term that takes energy usage to the next level, where the facility operates off the utility grid. This concept is not new. Large facilities and even hospitals have the capacity to operate off the utility grid for hours and in some cases for days at a time, particularly in the case of a power outage. Local utilities offer lower rates to facilities that can be taken off the utility grid during high-demand times. Hospitals are taking advantage of these two realities and using their generating systems to take the facility off the grid during regional peak load times. The reduced power rates result in savings that pay for the added equipment in two to three years.

"Regenerative" is yet another term used to describe buildings that generate more power than they use and share the power with other users. The basic concept is that the building goes beyond being a building that is less harmful to the environment than other buildings; it is a building that actually improves the environmental damage from other buildings. For example, buildings in urban areas take in contaminated air from the outside and filter it for the building occupants. The end result is that the air leaving the building is cleaner than the air outside the building, and people outside the building benefit from the cleaner air.

Water is different than energy. Energy can be shipped economically from exotic places around the globe to a building, while water cannot. Can buildings be water and sewer net zero, off the grid, or regenerative? Yes they can, and here are some ways they can do it.

REUSE WATER FOR COOLING TOWERS

In large facilities such as hospitals, cooling towers can use more water than the plumbing fixtures. For example, *Dry Run: Preventing the Next Urban Water Crisis* by Jerry Yudelson, PE, LEED AP, states that the cooling tower in a hospital in Florida used 43 percent of the total water used for the building, and in a building in Austin, Texas, cooling towers used 49 percent of the total water.

To reduce the amount of water used in a cooling tower, building operators should reduce the cycles of concentration following ASHRAE guidelines. Water supplying the cooling tower does not have to be drinking water quality or come from the utility water grid. Water sources are available on site that can be used, such as HVAC condensate, rainwater, or graywater. In many buildings, these water reuse systems can take the cooling tower off the grid.

EFFICIENT PLUMBING FIXTURES

Most plumbing engineers are aware of 1.28-gallon-per-flush and dual-flush water closets, urinals that use a half gallon or even a pint of water to flush, lavatories with a 0.5 gallon-per-minute (gpm) flow, and showers using less than 2 gpm. The use of these fixtures can reduce the water used for plumbing systems in a building by 30 percent.

Dry Plumbing Fixtures

Non-water urinals and composting toilets also are an option. Composting systems are an example of regenerative systems, since the composting material can be used in landscaping to bring nutrients back into the ground. While these systems may not be practical for large facilities, they can be used on many small to medium-size buildings that have access to system providers.

WATER REUSE

Utility companies are treating wastewater to a quality that can be used for many nonpotable applications. This water can be used for irrigation and, in some areas, for building mechanical systems and building flush systems.

Black Water

Some large companies make membrane bioreactors that treat black water waste streams, and local utilities are using them on the

community level to connect to the community water reuse system. These are efficient systems that use less energy and water when compared to the expensive piping distribution systems required to connect to large central wastewater treatment facilities.

Graywater

Graywater systems collect and treat water from showers and washing machines, so the water can be reused for flushing fixtures, irrigation, or mechanical uses.

HVAC Condensate

Air-conditioning condensate can be collected and used in the building cooling tower system, in mechanical systems, for flush fixtures, and for irrigation.

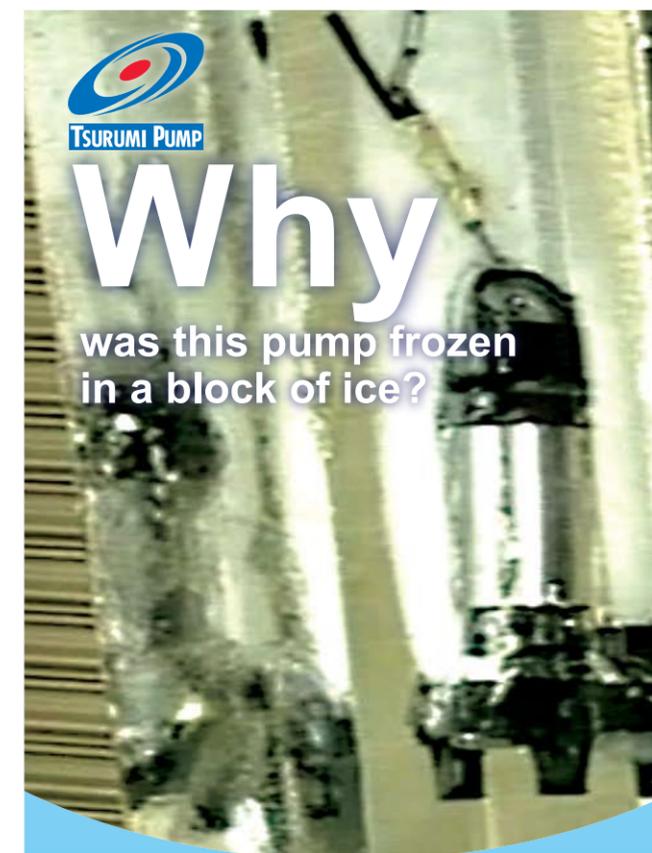
THE ULTIMATE BUILDING

If the sewer infrastructure in an urban area is over capacity, the community could suffer economically because businesses could not build new facilities or expand their existing ones. To help, the systems mentioned above can be clustered to make regenerative buildings. For example, a new facility in an urban area with a combined storm water sewer system can collect rainwater and condensate in a separate system and then treat and reuse the water in the building irrigation, mechanical, and flush systems. A hospital could operate a black water system that is large enough for the hospital and other, smaller healthcare businesses located nearby. This would take a load off the existing overloaded water, sewer, and storm water systems and allow new development in the area.

The end result is that a potentially depressed urban area can thrive again. With these types of changes, the cost to upgrade to a regenerative system is insignificant compared to the economic development opportunities in the area. **PSD**



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