

National Aquarium Nets Improved Sustainability With Efficiency Upgrades

Baltimore's National Aquarium works with Constellation on Energy Efficiency Project



DistributedEnergy



Challenge

Where can you find two-toed sloths and Black Tip reef sharks in one place? At National Aquarium in Baltimore, there are more than 20,000 animals from over 13 habitats, as far ranging as the deep ocean to tropical rain forests.

Maintaining these extremely diverse habitats is a challenge – lighting and temperature, both critical to the health and well-being of the animals, must mimic natural habitats. As part of that, over 2.2 million gallons of water are circulated and treated through a closed system requiring energy intensive pumps and motors with precise temperature control.

Because of the high consumption of energy necessary to maintain the exhibits, National Aquarium sought ways to improve its energy efficiency as well as increase its use of renewable energy.

The Solution

To reduce energy consumption, the Aquarium implemented \$3.7 million in energy and water conservation measures through a 15-year energy performance contract (EPC) with Constellation. The water conservation and energy efficiency improvements required no upfront capital from National Aquarium and are guaranteed to provide approximately \$235,000 in cost savings in the first year of the term, which escalates annually thereafter. The Aquarium will use the guaranteed savings and utility rebates to fund the efficiency upgrades.

The most significant savings came from upgrading the boilers that provide heat for the facilities, tanks and exhibits. Five modular condensing boilers replaced three 20-year-old cast iron hot water boilers to improve efficiency by capturing the heat in the exhaust, and exhausting cool air. High “turn down ratios” accommodate lower heating loads while maintaining efficiency.

National Aquarium knows at any given time exactly how many tons of cooling that it needs. New chillers enable the Aquarium to precisely match its operational requirements with chiller output. Constant-speed chillers and pumps were replaced with new, high efficiency equipment with integral variable frequency drives (VFDs). These chillers have a high turn-down capacity allowing them to be efficient over a wide range of output levels. These upgrades gave National Aquarium new flexibility to efficiently run one to four chillers as needed.

In addition to the boiler and chiller upgrades, other energy and water conservation measures included lighting upgrades and controls, building envelope improvements, and updated water fixtures and controls as well as transformer replacements. By reducing consumption, these energy conservation measures are expected to avoid the creation of more than 12,300 metric tons of carbon dioxide annually, based on emission rates provided by the U.S. Department of Energy.



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Highlights

Project

- 15-year energy performance contract
- No upfront capital required
- Approximately \$235,000 realized savings in the first year
- 40% of the Aquarium's total first year load of electricity supplied by a solar energy facility
- Aquarium to retain an equivalent amount of Solar Renewable Energy Certificates (RECs) as produced by the solar energy facility

Technical

- 4.3-megawatt (DC) grid-connected solar generation project located in Cambridge, Maryland and funded, constructed and operated by Constellation
- Solar PV is expected to generate approximately 5.8 million kilowatt hours of electricity in the first year
- Total carbon reduction for efficiency upgrades is 12,362 metric tons of CO₂ per year—the equivalent of taking nearly 2,600 cars off the road
- Total expected annual carbon reduction for the solar PV is 4,409 tons of carbon dioxide

National Aquarium also redistributed the mix of its energy sources to include renewables: nearly half of the electricity required is designed to come from solar power. To achieve this, Constellation funded, constructed and operates a 4.3-megawatt (DC) grid-connected solar generation project in Cambridge, Maryland, developed in conjunction with OneEnergy Renewables. Just in its first year, the system generated almost 5.8 million kilowatt hours – more than 40 percent of the Aquarium's first year electricity needs. Also, for a portion of the term of the contract, the Aquarium will receive solar renewable energy certificates equal to the amount of solar power produced by the solar power system as well.

With all these changes, National Aquarium can focus more on maintaining the 13 habitats for its more than 20,000 inhabitants, ensuring a captivating experience for its more than 1.4 million annual visitors.

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