

Alan Pierce  
[pierceaj@techtoday.us](mailto:pierceaj@techtoday.us): on Twitter [@TechToday-US](https://twitter.com/TechToday-US)

## Wind Generated Electricity on a Windless Day

Many coast lines today are filled with wind turbines that produce a lot of clean, renewable electricity on a windy day. However, when the wind drops off so does their ability to generate electricity. The big problem is that the amount of electricity generated every second of every day must exactly match electricity demand to prevent brownouts or even worse full electricity blackouts.

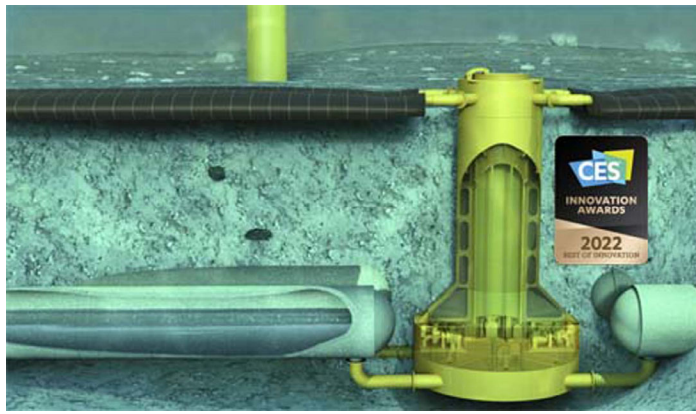
Researchers at the University of Groningen, which is located in Holland, have recently developed a water battery system that could let ocean wind generation farms produce electricity even when the air is completely still. The company Ocean Grazer was spun off by the university to further develop, build, sell and install the ocean battery system to ocean wind farms. At this year's CES Ocean Grazer won a prestigious award for their Ocean Grazer Hydro Powered Battery System. See photos 1 and 2. Grazer is a water powered battery that uses the same technology that one finds inside every hydroelectric power plant. In these plants millions of gallons of water are diverted from going over the falls into a pipe system. The water pressure of this water spins hydro generators to create electricity.

Grazer system has four significant components which are all

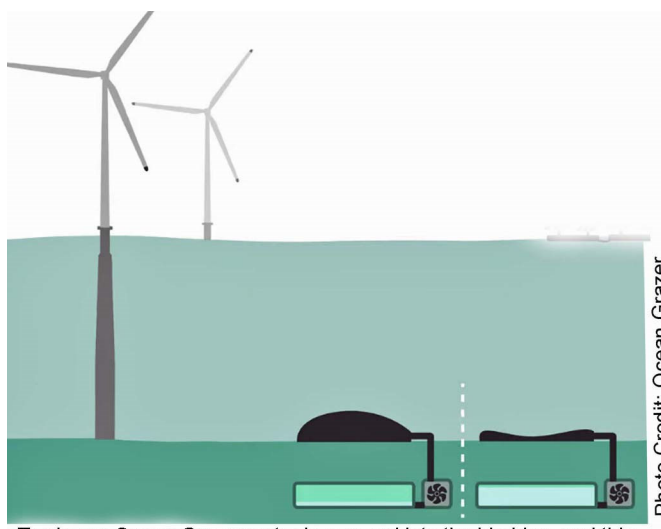
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*Alan Pierce, EdD, CSIT is a technology education consultant. Visit [www.technologytoday.us](http://www.technologytoday.us) for past columns and teaching resources*

located on the ocean floor. Its rigid reservoirs would be buried on the sea floor and they would hold filtered ocean water that is at the same water pressure as the ocean floor. These reservoirs are connected to pumps that use the excess electricity created by the wind turbines to



pump the water into the flexible bladders. As the flexible bladders expand, the water inside them becomes highly pressurized. When more electricity is needed, than the wind can supply, this water inside the flexible bladders is released into a pipe system that will send it to spin hydro turbines that are also located on the ocean floor. The wind turbines spinning above the ocean and the hydro turbines that spin on the ocean floor can even run together on days with moderate wind velocities. Combined they can produce the electricity needed to meet even larger demands. This Ocean Grazer video is a great visual to use to help your students understand how the ocean battery



To charge Ocean Grazer water is pumped into the bladders and this pressurizes the water. To generate electricity water flows from the bladder through a hydro generator and then back into its storage tank.

operates. You will find it online at: <https://oceangrazer.com>

If this system proves viable it could change the current mix of renewable electricity generation from what it is today. Preliminary data for 2022 indicates that today 60.8 % of our electricity still comes from fossil fuels and with all the discussions of shutting down nuclear power plants they still supply 18.9 of our nation's electricity. Today we get 2.8 % of our electricity from solar and 9.2 % from wind. You can find the full energy supply breakdown from the US Energy Information Administration online at: <https://www.eia.gov/outlooks/aeo>

**Taking it a Step further**  
Student STEM projects that relate to wind energy could range from having elementary school students use paper and scissors to construct Pinwheels to older students building model wind turbines.