

Plying the Sound while preventing pollution in the water and air

ONE-OF-A-KIND SOLAR-ELECTRIC POWERED PUMP-OUT VESSEL HOLDS PROMISE FOR TRANSFORMING BOATING

By Michael A. Pascucilla



Michael A. Pascucilla, director/CEO of the East Shore District Health Department, stands on the bow of the solar-electric pump-out boat. Photo: Peter Hvizdak

Growing up in Connecticut on the coastal waters of Long Island Sound, I have childhood memories of clamming, fishing, crabbing, boating, water skiing and jumping off the jetties and piers with my friends. I truly feel privileged and humbled to have had this special experience. Fondly I remember how my “old school” Italian grandmother would send me to the shore to collect a seafood bouquet of crustaceans to put over a bowl of homemade pasta with garlic bread for our traditional family Sunday dinner. Yummy!

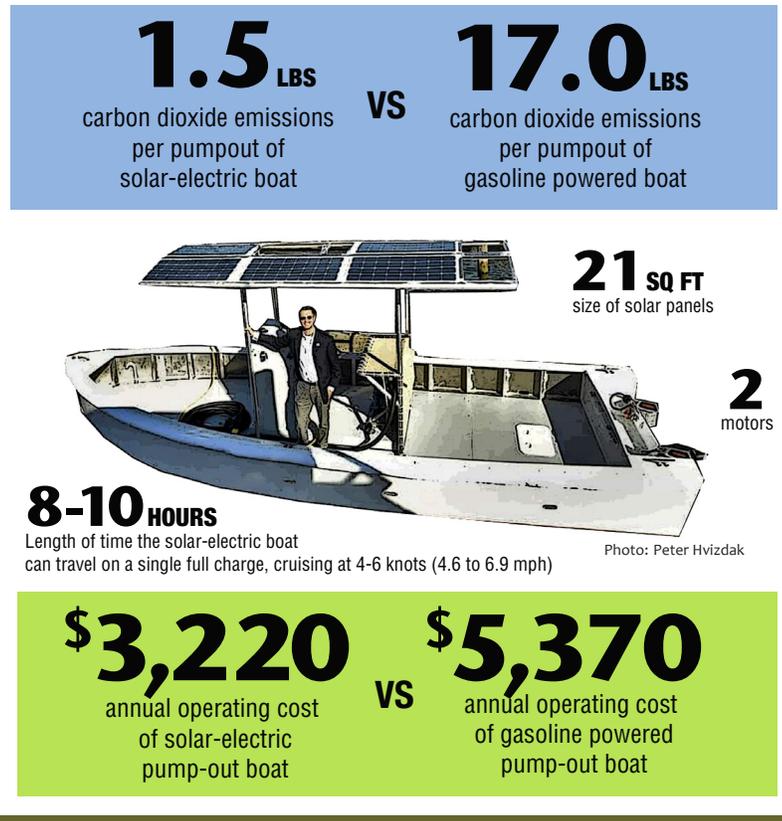
Today, I still enjoy the same activities on the Sound with my wife, children and friends in the eastern Connecticut shoreline town of Guilford. As I am well-traveled, I can say with confidence that we truly have one of the best tidal estuaries in the world. Once called the “American Mediterranean” and more recently described as “The Urban Sea,” Long Island Sound is one of North America’s most developed yet biologically diverse waterways.

As a local director of public health and a professor of public health at Southern Connecticut State University (SCSU) and lecturer of epidemiology at Yale University, the health implications of water quality and climate change — including diseases and natural disasters — are among my top priorities. My staff and I at the East Shore District Health Department, which serves East Haven, Branford and North Branford, work diligently every day to protect our communities and their treasured seashores, as do our colleagues in other shoreline towns. We regularly test the waters of the Sound and collaborate with many partners to ensure the beaches are safe to swim in, and that its prized shellfish, finfish and emerging products such as kelp are safe to eat.

In 2014, our office decided to convert our aging automobile fleet to hybrid and electric vehicles through a Connecticut Department of Energy and Environmental Protection (CT DEEP) grant opportunity. Around the same time, our pump-out boat needed to be replaced. For those unacquainted with the term, a pump-out boat empties human waste out of the holding tanks of recreational vessels, then carries it to shore for treatment so that raw sewage is not discharged into open waters. Pump-out boats provide a vital service for mitigating the environmental impacts of boating by managing the waste generated on recreational vessels. But their operation — just like the operation of any gasoline-powered boat — contributes to climate change, ozone depletion and water pollution.

This presented a conflict – a vessel designed to prevent pollution was itself a contributor. So I pitched a conceptual idea to build a solar-electric powered pump-out boat to our partners at CT DEEP. Kathryn Brown, our state liaison, not only embraced the idea, but championed it to federal funders at the U.S. Fish & Wildlife Service as a potentially groundbreaking project. At the time, only

SOLAR-ELECTRIC PUMP-OUT BOAT BY THE NUMBERS



small, experimental pilot electric pump-out vessels existed. With their support and funding, I worked with my staff on this multi-year project to research, design and build the world’s first full-sized solar-electric pump-out vessel.

We had *lots* of partners! One of the main ones was Pilot’s Point Marina in Westbrook, which assisted in the design and construction of the first-of-its-kind solar-electric pump-out boat. Together with Pilot’s Point, we created a new aluminum boat hull from scratch, intending to maximize energy efficiency and onboard battery capacity without sacrificing maneuverability and ease of use. The result is a vessel that operates just like a gasoline-powered pump-out boat, making the new technology easy to adopt by pump-out boat operators accustomed to gasoline-powered machines.

A CT DEEP Clean Vessel Act grant covered 75 percent of the \$200,000 cost. Our local public health department engaged local businesses and communities to help raise the other \$50,000 as 25 percent matching funds. Undergraduate interns from SCSU assisted in the project, which included community/business fundraisers, working with local community foundations, creating a GoFundMe page and holding raffles. Although this was the first time our local health department hosted fundraisers, the experience was fun and the support and response from our communities was amazing.

To name the boat, we engaged our elementary schools in a boat-naming contest. Students in the winning class took a

field trip to Bruce & Johnson's Marina in Branford to visit the vessel they had named "Solar Shark." They also received a pizza party paid for by the health department.



These students from Grove J. Tuttle Elementary School in East Haven were part of the class that came up with the winning name for the boat, "Solar Shark" as part of a contest for local schools. Photo: Nathan Hughart/The Courier

Since then, we have continued to focus our public health educational efforts with our schools to promote this program and the importance of everybody's role in protecting our water, air and reducing climate change emissions, especially among our children and youth. But marinas, restaurants, grassroots environmental organizations, fisheries and shellfish industries, residents and visitors alike also have an interest in how the solar-electric vessel protects our waterways, so we are working with these groups, too. Our logo sums it up: "Clean water is everyone's business."

What's innovative about our vessel is that it uses ecologically friendly electric motors and solar panels to perform the essential functions of a pump-out boat without the greenhouse gas emissions associated with using a conventional internal fossil fuel combustion engine. In doing so, the East Shore District Health Department

has introduced much-needed technological advancement to the worlds of recreational and commercial boating. There are some 12 million recreational boats in the United States alone, and their combined use emits at least as much carbon dioxide per year as the operation of 1.3 million cars. The health district's new technology is partially autonomous — power generated by the onboard solar panels meets much of the energy needs of the boat. The rest of the electricity is supplied by recharging the battery through a land-based hookup connected to the main power grid.

To understand the environmental impact of the technology it developed, the health district commissioned a study to analyze the carbon dioxide emissions — known as the carbon footprint — of the new solar-electric pump-out boat compared to its gasoline-powered equivalent. The study, conducted in collaboration with Dr. Robert Dubrow and students at the Yale University School of Public Health, tabulated the carbon footprint of different kinds of pump-out boats over the course of their entire lifetimes, from construction to use to disposal and recycling. The students found that a conventional gasoline-powered boat emits about 17 pounds of carbon dioxide for each holding tank it pumps out — about as much carbon dioxide as is released by driving a car with an average fuel efficiency of 25 miles per gallon for 23 miles.

The new solar-electric boat, however, emits as little as 1.5 pounds of carbon dioxide per pump-out. This

is a 90 percent improvement over the conventional standard, a quantum leap in sustainable boating technology that has the potential to help transform recreational and commercial boating into an industry that contributes minimally to climate change. We have just finalized the research study with Yale and plan to submit the manuscript about the findings to an international journal for future publication.

Since Connecticut began making pump-out boats a regular part of life on the Sound in 2000, more than 8 million gallons have been extracted from recreational vessels and kept out of the estuary. In its 2019 inaugural boating season, the solar electric pump-out boat was used for 1,023 pump-outs keeping 19,956 gallons of marine waste out of the Sound. Its performance has exceeded our expectations. Getting recharged by the solar panels while underway, the electric motor rarely drops below 75 percent to 50 percent full power.

Recreational boating is not an activity that many individuals might think about when they consider how to reduce worldwide greenhouse gas emissions. Nonetheless, the boating industry has a considerable impact on climate change, and directly impacts the world's fragile and valuable marine ecosystems. The health district's projects in sustainable pump-out boat technology represent outstanding examples of the creative and multifaceted approach that future leaders need to take when combatting climate change.

The solutions that the agency has developed — including the research it led with Yale, the unique academic-public-private partnerships it formed

with Pilot's Point Marina and other organizations, and the solar-electric boating technology it engineered — have the potential to



Left, the pump-out boat is lowered into the water at Bruce & Johnson's Marina in Branford on May 5 for the start of the boating season. Right, vessel operator Vinny Suppa steers the vessel towards the dock after its launch. Photos: Judy Benson

impact not just the pump-out boating community, but the entire world of recreational and commercial boating.

Innovations that will have a lasting impact on combatting global climate change need to meet a number of critical requirements. They need to involve technologies that have demonstrably lower emissions than the conventional standard and are economical. Those technologies need to be brought to scale through multifaceted collaborations, partnerships and policy actions. And finally, they need to engage relevant stakeholders to address concerns and to coordinate future action. The East Shore Health District's projects in solar-electric pump-out boat technology satisfy these needs and more, and show the promise of innovations that successfully reduce emissions for the benefit of the environment and of human health.

In partnership with Torqeedo, a partner and the electric motor manufacturer, we are taking the project to the next step by studying the noise level of a traditional gasoline-powered engine compared to an electric-powered one. We are also measuring noise levels and their impacts on marine life working with Professor Sean Grace, co-director of the Werth Center for Coastal and Marine Studies at SCSU.

As a local health department, we understand that combatting climate change means getting future generations to take the lead on important environmental issues. The Sound has suffered — and will continue to suffer — from the effects of anthropogenic climate change, with long-term consequences on the ecological and economic well-being of the region. While the East Shore Health District has shown that solar-electric boat technology is a viable and sustainable option for recreational and commercial boating, this is only one example. If we are to truly address climate change, we all must change our ways to protect our planet, our communities and its gems like Long Island Sound.



To see “*Climate, Health and Cost of Solar-Electric Pump-out Boats*,” poster from research project with the Yale School of Public Health and the Yale Climate Change and Health Initiative, visit: <https://seagrant.uconn.edu/?p=6406>

Vessel operator Vinny Suppa, at wheel, and Michael A. Pascucilla, director/CEO of the East Shore District Health Department, ride the boat from the launch ramp to the dock at Bruce & Johnson's Marina in Branford on May 5. Photo: Judy Benson