Researchers and energy entrepreneurs at Stony Brook University are tackling a $1 trillion challenge: How to curb energy use and nudge users toward sustainable power sources.

That number — what Americans spent on energy in 2016, according to a federal agency — offers a powerful incentive to develop more efficient and cleaner technologies. So do government targets such as New York State’s goal to generate half of the state’s electricity through renewables by 2030.

Scientists at Stony Brook’s 49,000-square-foot Advanced Energy Research and Technology Center — which was built with $35 million from New York State — are taking on about 35 projects, including self-cleaning solar panels, a natural gas-fired heat pump and water heater, fast-charging electric car batteries and others.

“Our focus is on big societal problems — it’s why we selected energy as a major thrust,” said Fotis Sotiropoulos, dean of the College of Engineering and Applied Sciences. The goal is not simply research, but concepts that can become businesses: “We really focus on research that has a translatable component.”

Customers are expressing interest in some of the products. One company at the center, Unique Technical Services, is working with UPS on converting diesel delivery vehicles to electric and fuel-cell power.

David C. Hamilton, director of operations at the center, is a former executive at fuel cell, utility and satellite radio companies. He mentors researchers in creating a brand, writing grant

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Ben Lawler, a professor of mechanical engineering at Stony Brook, is leading an effort to harness renewable energy and tackle cutting-edge energy technologies. Lawler is overseeing the Advanced Combustion Laboratory at Stony Brook.

The laboratory, about a dozen researchers, is working on special research engines' timing, compression and air-fuel mix to increase efficiency. Lawler bristles at the notion that electric cars are clean while internal combustion engines are “dirty, old and antiquated.” He said, “There are people who do ‘well-to-wheel’ analysis. Some show conventionally powered vehicles are more efficient than electric vehicles when they get all their power from coal,” he said.

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Lawler hopes to save the traditional auto engine by modifying...
Ben Lawler, a professor of mechanical engineering at Stony Brook, is leading an effort to make the internal combustion engine more efficient.

Efficient climate control

ThermoLift Inc. is an early-stage company that is close to launching its product. The company, founded in April 2012, is developing a compact heat pump that operates as an air conditioner, heater and hot-water heater.

Heat pumps transfer heat energy either inside or outside a building to heat or cool it, depending on the season. Unlike conventional electricity-powered heat pumps, ThermoLift’s Ultimate Heat Pump can be powered by natural gas and function as a heater even when outside temperatures dip as low as minus 17 degrees, chief executive Paul Schwartz said.

The system also is far more efficient, saving $957 a year in a 2,000-square-foot home compared with the cost of new equipment, he said.

Schwartz said the system uses no refrigerants and could also be adapted to run on heating oil.

Prototypes are being tested in the company’s Ann Arbor, Michigan, office and at Oak Ridge National Laboratory in Tennessee.

The company has raised $16 million from private investors. About half of another $25 million fundraising round has been completed.

Among the investors is the center’s chairman and utility veteran Catell. The company has enlisted a manufacturer, Linamar Corp., based in Guelph, Ontario, and plans to launch a commercial product in 2020.

Letting the sun shine in

Solar panels convert sunlight to electricity. When they get dirty, the sunlight is blocked, reducing their efficiency.

The panels can be cleaned with water or rain. But some solar installations are in arid regions where water is not readily available.

Alexander Orlov, a Stony Brook materials science and chemical engineering professor, is borrowing an idea that NASA considered for solar-powered Mars rovers and is working to refine it for use on Earth. The concept is to develop special electrodes that would create an electrical field to repel dirt.

Researchers are working to reduce the amount of electricity required to create the field and increase the transparency of the electrodes to admit more sunlight.

“This is still a work in progress,” Orlov said. He said an analysis of return on investment suggested a payoff for solar panel users in three to six years. Solar panels themselves typically last for about 25 years.

The project has received $150,000 in funding from the state’s PowerBridgeNY program. The incremental funding running through April 2019 requires that Orlov create prototypes and conduct interviews with utilities and solar panel companies to understand the marketplace.

Another step: Testing the system using different types of dust under different types of weather conditions as required to meet industry standards.

Orlov said a sample of Arizona dust is on order.

From cancer care to wave energy

When Reed Phillips, an inventor and entrepreneur, was 5 years old, he was hit by a wave, sucked out by the undertow and almost drowned.

That near miss triggered a lifelong interest in the untapped energy of the ocean’s movements.

He majored in physics at Stony Brook, but veered into medicine as an oncologist and palliative care specialist. Though he still occasionally fills in at Glen Cove Hospital, Phillips, now 70, said he has “largely retired” from medicine to devote time to his new career of “harvesting energy from the ocean,” he said.

In 2012, he started Energystics Ltd. and so far has funded the company himself with about $275,000.

Phillips hopes to roll out his first product at the New York Boat Show at the Javits Center in January. It would be a generator on the boat that would produce power from the rocking of the waves.

Vertically mounted magnets in the generator bounce on springs to the motion of waves. As their magnetic fields pass through surrounding coils of wire, a trickle of electricity is produced that could keep a marine battery fully charged. This “drip charge” would let boaters avert the common problem of a dead marine battery due to disuse. Phillips has 10 patents related to the generator.

Plans call for making prototypes of a follow-on generator buoy tethered to the boat that would harvest energy by bobbing in the water.

“It’s very expensive to call the seaworn AAA,” he said.