Green-Energy Inspiration Off the Coast of Denmark

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By Diane Cardwell

Before dawn one morning in October, a handful of Americans gathered at a lonely pier on Samso, a small Danish island about four hours from Copenhagen. Bundled in layers of fleece and wool, the Americans, mostly from islands off the Maine coast, had come to get a closer look at a wind farm — 10 mighty turbines spinning in the Kattegat strait — that has helped make Samso a symbol for a greener future, one powered entirely by renewable energy.

Among them was Marian Chioffi, the bookkeeper at the electric company in Monhegan, Me., whose population of about 60 swells to include hundreds of residents and thousands of tourists in the summer. They — along with generations of artists like Edward Hopper, Rockwell Kent and Jamie Wyeth — have been drawn by the island's lost-in-time charm and picturesque setting in the Gulf of Maine.

Monhegan faces challenges as stark as its beauty. Foremost among them — and the spur for the journey to Denmark — is dependence on expensive, dirty fuels for heating and electricity. Even

with the recent fall in oil prices, Monhegan residents pay among the highest power rates in the nation — almost six times the national average — and the electric company, locally owned and operated, struggles to keep the lights on.

Twenty years ago, Samso faced similar problems. Its farming and fishing industries were in decline, and its electricity and heating costs, mostly from diesel and coal, were rising. Its young people were leaving the island to attend high school and choosing not to return.

But in 1997, the island began a long-term transformation. It won a government-sponsored contest to create a model community for renewable energy and, through a combination of wind and solar (for electricity) and geothermal and plant-based energy (for heating), the island reached green energy independence in 2005. That means Samso actually generates more power from renewable sources than it consumes over all. Attached by a power cable to the mainland 11 miles away, the island sells its excess electricity to the national utility, bringing income to the hundreds of residents who own shares in the island's wind farms, both on land and at sea.

Samso has attracted global attention for its accomplishments. Soren Hermansen, 55, and his wife, Malene Lunden, 49, worked for years to develop the program on the island and now have created an institute, the Samso Energy Academy, to spread their story and methods to international visitors.

Soren Hermansen, a creator of the Samso Energy Academy, atop a wind turbine. The academy educates international visitors interested in Samso's methods.Credit...Erik Refner for The New York Times

The Maine islanders, along with students from the College of the Atlantic in Bar Harbor, had traveled to Samso to attend the academy and hear the Danes' advice. If all went well, each islander would go home with a team of students dedicated to solving an energy problem using ideas borrowed from Samso.

Beyond that, the planners hoped, new Maine island projects could become templates for broader adoption of renewable energy. Because of their particular geography, islands often lack the resources and infrastructures to meet their own needs. Fuel, like other necessities, is often

imported — sometimes with great difficulty — and electric grids, when they even exist, are often underdeveloped or out of date, all of which leads to higher prices and less reliable service. With residents open to cheaper and better alternatives, islands are becoming seedbeds of innovation, living labs in which to test and refine technologies and approaches that are too new or expensive to establish on a mainland. And their small size makes the systems easier to manage and analyze.

Denmark is also studying the use of renewables on Bornholm, an even more remote island than Samso, in the Baltic Sea, said Rasmus Helveg Petersen, the country's minister of climate, energy and building. The Carbon War Room, the nonprofit organization started by the Virgin Group mogul Richard Branson, and NRG Energy, an independent power producer, are experimenting with solar, wind and geothermal sources to replace diesel in the Caribbean. And the Alaska Energy Authority has awarded several renewable energy innovation grants to offshore communities.

Suzanne MacDonald, the community energy director at the Island Institute in Rockland, which is helping oversee the Mainers' Denmark program, argues that such projects can be useful test cases. But, she added, they work only in places where people want to use the technologies and can organize and lead the effort.

"We can't just put steel in the ground and technology on the grid," she said, "unless people are a part of the process."

Hans Jorgen Buur is an investor in the offshore wind farm and, like other residents, times some solar energy use to when power is cheapest.Credit...Erik Refner for The New York Times

For Ms. Chioffi, seeing how the people of Samso had come to accept new technologies had particular significance. In 2009, the State of Maine designated a patch of ocean off Monhegan's coast that is part of the state's lobstering grounds as a test site to study renewable energy development, and plans were finally moving ahead for a long-term, public-private demonstration

project that would place two turbines there. There are not yet any full-scale offshore wind farms in the United States — projects like Cape Wind near Nantucket have been delayed by legal and financial challenges — so the Mainers were eager for a rare chance to see one up close.

It was still dark as the group boarded the Ocean Cat, a former whale-watching boat, outfitted with a kitchen, black leather seating and a large television screen. Willy Mortensen, the captain, started making coffee and chatting with the visitors. He and his mate are on call to ferry repairmen to the wind farm, which starts about 2.2 miles from Samso's coast. That's what they were doing on that damp morning, with the Mainers tagging along.

The repair crew often works for 12 hours on a visit, so the captain passes the time watching episodes of "Deadliest Catch." Mr. Mortensen said: "There's a lot of trouble with the turbines. You're repairing and repairing and repairing. By the time you get one fixed, the next one doesn't work."

Indeed, when Mr. Mortensen nudged the bow of the boat through the heaving waters to settle near turbine No. 6, another stood idle, victim of a cracked bearing that would require a special crane boat to fix. As the workmen put on harnesses and climbed off the bucking deck to a small platform encircling the steel tower, Ms. Chioffi craned her neck to look at the machine looming overhead, its long white blades temporarily stilled in the cold, gray morning air.

"Does seeing these give you more of a sense of the reality?" asked Sam Saltonstall, a retired Maine schoolteacher who now lives on Peaks Island, near Portland.

"Yeah," she said softly, stunned by how big they were. "But the ones they're talking about putting up are twice as high as that."

Coffee Diplomacy

One sunny afternoon during their weekslong stay on Samso, the five Maine islanders and about 15 students rode on bikes with Mr. Hermansen to an open field. Huge, plastic-encased bales of hay sat alongside a large plot of a dense, tufted plant called elephant grass. On the island, many private houses and public buildings connect to central heating plants established as part of the energy project. The heating plants burn hay to heat water, which then circulates through underground pipes to radiators and heat exchangers for warmth and hot water. But the plant near the academy is experimenting with elephant grass as a new source of biomass, Mr. Hermansen told the group, because it grows faster and has a higher energy content than hay.

"We are still looking for the elephants," Mr. Hermansen joked of the dense field.

Part of the appeal of using the biomass is that even with low oil prices it is cheap — about one-eighth the cost of oil, which is heavily taxed in Denmark, he said. But as with some of the other renewable technologies in use on Samso, the system is not so easily replicated elsewhere. The island has open, fertile land and ground soft enough to bury the hot-water pipes. Maine's flinty landscapes are not so accommodating. Mr. Hermansen and Ms. Lunden acknowledge as much,

but argue that specific natural resources and technologies are irrelevant to developing a green community without an appeal to people's direct and practical self-interest.

Arne Kremmer Jensen, director of the district heating plant, placing hay bales, used for heating, on an assembly line.Credit...Erik Refner for The New York Times

"I'm not on a mission of saving the polar bears in the Arctic or changing the climate — I am on a mission of saying it is not good for us to be depending on imported fossil fuels," Mr. Hermansen said. "It's better to be in control and produce your own energy, and you can do that with green technology. So it's actually more of a practical thing, like a farmer getting a new combine harvester."

Mr. Hermansen and his wife were the project's catalyzing figures. Mr. Hermansen, who helped prepare the island's winning proposal, grew up on a farm on Samso, but left at age 15 to attend high school on the mainland. He spent 10 years away, working on fishing boats in Norway, farming in New Zealand and teaching in a democracy-building project in Lithuania. He moved back to the island and took over his father's farm for a time, meeting Ms. Lunden, a photographer with a background in group dynamics and leadership training, there in 1984.

When the energy project came along, Mr. Hermansen was the obvious candidate to run it. "He can talk to everybody," said Charlotte Villadsen, who runs a campground near the energy academy. "He's very good at analyzing, 'How should I present it to this group, and how should I present it to that group.' " Plumbers were worried about losing business if people got rid of their oil burners; Mr. Hermansen took them out for beers, Ms. Villadsen said and explained that if they learned how to install and service the new heat pumps they could move into that business. Much of the 44-square-mile island is devoted to agriculture, and to the farmers he pointed out that selling hay to the collective heating plants would provide a new income stream. Now one-quarter of Samso's hay goes to heating.

While the islanders — there are 3,800 of them — had a strong tradition of collaboration developed over centuries of collective farming practices, it was nonetheless tough to get everyone behind all the new green projects. One breakthrough was a government energy-

efficiency program that served as an entry to selling the whole enterprise, Mr. Hermansen said. The program gave grants for updating old houses; the couple approached the older residents who often owned the eligible properties, meeting over coffee and cookies in their homes to help them figure out how to qualify for the money.

Sheep grazing on Samso's golf course keep grasses low.Credit...Erik Refner for The New York Times

“I drank so much coffee I was practically galvanized inside,” Mr. Hermansen said, laughing. But, once on board, those residents served as ambassadors for the larger self-sustaining green energy plan, spreading the word to their children and grandchildren.

Now, it seems, people from all across the island are participating. Many residents who live too far from the biomass heating plants have their own sustainable sources of warmth, including in-ground heat pumps and heavily insulated wood stoves that look almost like pizza ovens. At the municipal government headquarters, a large solar array on a canopy over the parking lot feeds the building as well as charging stations for a fleet of city-owned electric Citroëns. Countryside rooftops sparkle with solar panels, for which residents receive incentives; some have smart appliances that allow them to time washing clothes and dishes to the hours of cheapest power to cut their bills further.

Even the golf club is part of the program: Members carry hand weeders on the links and pry up errant plants, reducing the need for herbicides, and sheep graze to keep tall grasses in check. Since the members can also arrange to buy the meat, said Jesper Roug Kristensen, a golf club member who works at the energy academy, “you can eat the golf course.”

It has taken $80 million in investment, about 20 percent from government subsidies, to turn the island into a renewable-energy community, Mr. Hermansen estimates. But in the end, the island’s accomplishments seem to stem not so much from government policies and subsidies as from Mr. Hermansen’s ability to show people how the changes could benefit them. The wind turbines, for instance, faced opposition from residents who said the modern machines would ruin the charm of their villages. So the planners moved some turbines from the most sensitive areas, but also added to their appeal by allowing locals to buy shares in the projects.

Ole Kaempe, a teacher who can see the turbine he and his wife invested in from between the rows of wine grapes near his farmhouse, said that the income made the low mechanical hum sound better. “Otherwise it would be noise,” he said, “but now, it’s beautiful music.”

An Imperfect Model

Samso’s energy independence suggests that Denmark’s aggressive goal of becoming fossil-fuel free by 2050 is feasible, said Mr. Petersen, the energy minister. “We need front-runners,” he said, “and they are just that.” The country as a whole is well on its way: Last year, Denmark drew almost 40 percent of its electricity from wind, up from 33 percent the year before. Over 60 percent of Danish houses get their heat from central sources, like Samso’s, that are already using renewables or can be easily converted, Mr. Petersen said. The hardest challenge, he said, is ridding its transport system of fossil fuels, so he is looking to Samso for ideas. “I hope that they can crack that nut first.”

To that end, the island is promoting the use of electric vehicles and plans to test using gas from decomposing waste as fuel for a new ferry set to arrive next month. Yet while the national government is expecting useful results from Samso’s efforts, there are signs that its consensus and momentum could flag. Mr. Hermansen, who says he is on the road about 100 days a year promoting the island’s story, is beginning to talk of doing other things. The academy is working with islands in Europe and Japan that are adapting Samso’s approaches, and he mused that he might shift more of his time to creating partnerships like those.

And although many residents express pride in the island’s green image, others point to shortcomings. It still relies on fossil fuels when the wind does not blow or the heating plants break down. Only 10 to 15 percent of the population has invested in the wind farm production, and electricity bills have stayed high, in part because of Danish tax and energy policies.

On Vinalhaven island in Maine, Island Energy Conference attendees toured the Fox Islands Electric wind site.Credit...Craig Dilger for The New York Times

Building support for the projects based on financial self-interest can have a downside when the economics shift. At an evening reception at the end of the Mainers’ program, Jorgen Tranberg, a farmer who is chairman of the consortium that manages the offshore turbines, said that his

investments had fizzled because of falling prices for wind power and lower-than-expected output.

Samso's wind farms produce about 105,000 megawatt-hours of electricity each year, of which roughly 80,000 are exported. Although the island earned a set rate for the first 10 years of production, it now gets a market rate that is lower in part because developers in Denmark and throughout the region have built so many wind turbines, cutting Samso's revenue from approximately $6.4 million a year to about $3.8 million.

That may be good for Denmark, but not so good for Samso's investors.

"In 10 years I don't think there will be wind turbines on Samso," Mr. Tranberg said. The aging equipment will need replacement one day, and new models are becoming ever larger as the wind industry seeks to lower costs by maximizing power production. It was so difficult to overcome concerns about noise and intruding on a bucolic landscape with the smaller turbines, Mr. Tranberg said, that he did not believe Samsingers would approve the bigger ones.

As the guests celebrated over hors d'oeuvres and wine, Mr. Tranberg added that he had been spending too much of his time on turbine repairs and renegotiating an unsatisfactory service arrangement. "The last three months it's three emails a week with bad things about the turbines," he said. Comparing that experience with the more cheerful message the Mainers were learning at the academy, he added: "That's another world than Soren and Malene here."

Bringing Samso Home

Before the event that last night at the academy, Mr. Hermansen handed large sheets of paper for the Maine islanders and students to list their lingering questions and concerns. The Americans were skeptical that they could replicate the Samso experience back home, where clean-energy policies and subsidies are neither as consistent nor as strong as in Denmark. "How do we transfer success under the Danish regulatory structure to projects in the U.S.?" read one. Another wondered, "How to translate-encourage Danish energy conservation pragmatism/culture to American 'comfort' culture."

In the months since, the islanders and their student partners have started to answer those questions in different ways, still convinced that conservation and renewables are better energy solutions than fossil fuels, despite the falling price of oil.

The main harbor at Vinalhaven, Me.Credit...Craig Dilger for The New York Times

On Peaks Island, which has more than 900 year-round residents, Mr. Saltonstall is working on a plan to decrease dependence on heating oil and propane and increase energy efficiency in residences and at the elementary school, which spent roughly $800 per student on fuel last year.

On Vinalhaven, a Maine island with a year-round population of almost 1,200, Patrick Trainor, a retired math teacher, and his partners are designing a solar field to complement an existing small land-based wind farm. The three turbines are a source of great pride to many island residents — though they are also the subject of a lawsuit — and Mr. Trainor is talking of forming an energy academy there.

On tiny Monhegan, the year-round residents are focused on Maine Aqua Ventus, a wind project with public and private financing that may arrive near their shores whether they want it or not. Conceived as a demonstration of the potential for offshore wind, it would put two enormous turbines — 300-foot towers atop 30-foot platforms, as opposed to the roughly 200-foot machines near Samso — in a pristine section of the Atlantic Ocean. Some residents say they like the idea of potential benefits of the farm, including better broadband service and access to central Maine's grid, which would relieve them of the burden of running and maintaining their own system. But they also worry that it could harm tourism and lobstering, as well as birds and marine life.

Ms. Chioffi's project is intended to help Monhegan work through those questions by borrowing engagement strategies from Mr. Hermansen and Ms. Lunden. So far, the approach is having some effect. When the Danish couple visited Monhegan in October, most island residents showed up for a discussion, and were still talking about it along the dirt roads the next day.

For Ms. Chioffi, that alone is a kind of success and, she hopes, the beginning of a process that could finally help her island inch closer to something like Samso. Seeing the offshore farm in Denmark allayed some worries — a bird adjusted its flight path that morning to avoid the spinning blades — but made clear just how big the turbines would be. But even if Monhegan is

not the best place for the Aqua Ventus wind farm, she said, it has already had one benefit: “The thing that it did for Monhegan was it got people talking about renewable energy again.”

Correction: Jan. 25, 2015

An article last Sunday about how the Danish island Samso achieved renewable energy independence misstated the amount of electricity produced and exported by Samso’s wind farms. They produce 105,000 megawatt-hours, not 105, and export 80,000 megawatt-hours, not 80.