MICROGRID ON THE BIG ISLAND

How a Hawaiian cattle ranch is taking its energy future into its own hands
The seemingly free power of renewable energy is an enticing way to keep electricity prices down, but the complexity and cost of integrating that power into a transmission or distribution grid can be overwhelming to utilities, regulators and policy makers.

Customers across the country want to add renewable energy systems to lower their energy bills and sell the excess power they generate back into the grid. Policymakers often agree, but regulators and utilities struggle with the resulting grid reliability issues. In Hawaii, where utility generation is fired by expensive imported fuel oil, finding a solution is critical.

When the cost of electricity got so high that it threatened the prospects of Parker Ranch – one of the largest U.S. cattle operations on the Big Island of Hawaii – and the utility said it could not integrate more wind generation into the system to help lower costs, the ranch turned to Siemens for help.
The ranch is deeply connected to Hawaii history. It was founded in 1847 by John Palmer Parker, a Massachusetts native who jumped ship in Hawaii in the early 1800s. He returned to sea during the War of 1812, then returned – with a musket that Parker Ranch still possesses – and subsequently used it to help resolve the island’s issues with rampant wild cattle. He sold meat and hides from the cattle with the permission of King Kamehameha I, and salt beef soon became the island’s top export.

Parker learned to speak Hawaiian, married the king’s granddaughter and eventually established the ranch. It subsequently has preserved its ties to – and been central to the history of – generations of Hawaiians.

Since 1992, the ranch has been run by a charitable trust, whose mission is to help support the local community through its beneficiaries, the local hospital, a community fund and two private schools. Parker Ranch remains one of the largest ranches in the U.S. with about 130,000 acres of land and 26,000 head of cattle.

But today, the high cost of electricity has “wiped out” the margins on about half of the ranch’s operations, Neil “Dutch” Kuyper, president and CEO of Parker Ranch, said in an interview.

In order to identify and evaluate the ranch’s options for reducing the cost of electricity by using the renewable resources available on the ranch, Parker Ranch commissioned Siemens’ Power Technologies International (PTI) consulting, Siemens Building Technologies’ Pace Energy Services and partner Booz Allen Hamilton to develop an integrated resource plan for the ranch and the surrounding community.
“The result was a snapshot of what is possible from an economic and technical point of view,” said Kuyper. “We could beat the utility's rates whether we use their power lines or build our own.”

**Ranch takes energy future into own hands**

The ranch is looking for alternatives to transform the energy landscape on the Big Island over the next 10 years, Kuyper said.

Parker Ranch has some of the best wind and solar resources in the state, with wind resources alone estimated to exceed 400 MW. “It's really rare that you have a single entity with so many resources and capabilities – and also the needs for it,” said Jack Joyce, general manager of Siemens’ PTI Group.

The Big Island currently has 31.5 MW of wind generation in operation that is integrated into the island's transmission grid owned by Hawaii Electric Light, a subsidiary of Hawaiian Electric. But it has done little to reduce the island's 42 cents/kWh electricity rate because the pricing for the power purchase agreements with developers is tied to the long-term avoided cost of the utility's oil-fired generation.

When the ranching operation began to suffer from high electricity costs, Kuyper started looking at alternative uses for the ranch's land holdings that could offer more potential economic value. “If the utility doesn't want our wind, maybe the community does,” Kuyper said.

The price of a barrel of oil has now gone beyond the tipping point of $90 to $100, Kuyper said, and is on track to get worse. In its most recent IRP, the utility predicted power prices ranging from 48 cents/kWh to $1.00/kWh in 2033.

If the utility doesn't want our wind, maybe the community does.

Neil “Dutch” Kuyper
President and CEO, Parker Ranch
possibilities rather than focusing on a specific technology.

“We know we’re going to be in the energy business,” Kuyper said, adding that the ranch wanted to look at what combinations of resources was the most compelling economically and environmentally.

The question was how to create priorities and projects and how to allocate the energy resources without cutting deals that they would later regret, Kuyper said.

**IRP weighs up energy options**

The Siemens study's primary goal was to evaluate the economic feasibility of options for Parker Ranch to provide power for itself and to the Waimea and North Kohala communities, and to test their economic feasibility through a range of scenarios. The highest priority was lowering electricity costs for Parker Ranch, its beneficiaries and the two communities.

The study looked at four technology options, including wind generation with pumped storage, geothermal, a mix of renewables and reciprocating engines fueled with ultra-low sulfur diesel and a mix of renewables and combustion turbines fueled with liquefied natural gas. Each portfolio was analyzed as either connected to Hawaii Electric Light's existing transmission and distribution system or as a microgrid that would require the construction of an independent transmission and distribution system.

Under each portfolio, generation was added in two phases. In 2019, enough firm capacity would be added to meet the 18 MW needed to satisfy the demand of the ranch and the Waimea and North Kohala communities. Additional generation would be added in 2024 to meet another 70 MW of demand to satisfy 75% of the requirement on the western side of the Big Island.

The total amount of generation needed to meet the demand would be more than 200 MW to accommodate the intermittent nature of the large amount of renewable generation in each of the portfolios.

Parker Ranch is blessed with a “renewable-rich environment,” Jack Joyce said, but “the big nut to crack is really the energy storage aspect of it.”

An independent microgrid also would need enough reserves to balance instantaneous generation and load requirements, regulate frequencies and fulfill generation and transmission contingencies with no load shedding.

The results showed that grid-connected options have lower costs than the microgrid, but only by 2% to 6%. A more detailed analysis is needed, the Siemens preliminary report said. It recommended that the ranch refine the costs estimates and explore the legal and regulatory
paths that could support the distributed generation plus microgrid options.

Companies interested in investing in the project ultimately will define its scope, Kuyper said. “The attractiveness of the opportunity to third parties would depend on the relative quality of the renewable energy resources,” the study said, noting that further measurements of the resources are needed.

There are other questions to consider such as whether to partner with the utility or bypass it and create an independent grid, Kuyper said.

At press time, Paniolo Power, a subsidiary set up by Parker Ranch, had issued a Request for Qualifications (RFP) for the engineering, procurement and construction of an up to 200 MW pumped-storage hydroelectric system on the ranch.

“Nobody has ever done this before and put it all together in one location,” Joyce said of the integration of solar and wind with the storage capacity of pumped-storage hydro on both the transmission and distribution level, plus the creation of a community microgrid to supply energy to the Parker Ranch’s beneficiaries.

“The optionality of power is a lot greater than it was before,” Joyce said. “Before you had one choice. Now, you have a lower-cost choice with multiple generation capabilities.”

‘Canary in the coal mine’

Parker Ranch has many variables in its favor, including its location in a nearly continuous wind region that gives it a viable source of power and the elevation and the water source for pumped storage hydroelectric generation.

But the ranch still has found it increasingly difficult to keep rising energy prices from affecting its operating margins. This is largely due to the amount of water that electricity pumps across the ranch for its agricultural operations, according to Kuyper.

“Not every ranch has to pump water on the orders of magnitude that we do,” Kuyper said. “Basically, half the ranch’s operations require that we pump water and the margin on that half has been wiped out.”

Parker Ranch may indeed be the “canary in the coal mine” for what mainland businesses, utilities and policy makers can expect to face in the not to distant future, said Paul Patterson, an analyst with Glenrock Associates. “They are beginning to have grid integration and cost issues resulting from the widespread public support of renewable energy as the price of adding it drops,” he said.

Hawaii is on the leading edge of the issues that everyone will have at some point, said Ken Geisler, Vice President of Strategy for Siemens Smart Grid.

The Parker Ranch situation is highlighting the need to evolve current regulatory policies that govern the vertically integrated utility, Geisler
“Businesses are being threatened by these [legacy] structures.”

The mechanisms do not exist for dealing with the future of the changing electric utility model, he added.

Hawaiian Electric Light simply cannot accommodate more renewable generation and still maintain reliability on the grid, said Peter Rosegg, a spokesman for Hawaiian Electric. In addition to the 31.5 MW of wind generation, it has 41.5 MW of rooftop solar on the Big Island.

“The situation is a postcard from the future to the mainland,” he said.

The utility is not opposed to Parker Ranch’s efforts and has no plans to interfere with their plans, he said. “We just don’t have the capacity to do it.”

As the move towards more distributed generation and added renewables continues, it will take a business model with a different concept, one that accommodates more integration with the costs fairly distributed, Geisler said.

“This is what the Parker Ranch story is about,” Geisler said. It will take all parties, regulators, utilities, governments and customers, coming together to find a solution. Parker Ranch got involved because its leadership realized there had to be an alternative. Siemens is working with all parties to have a win-win situation for both the utility and Parker Ranch, he said.

Lorraine Akiba, a member of the Hawaii Public Utilities Commission, agreed that a cooperative process is needed to transform the utility delivery model in Hawaii. The model of the future will be less centralized, she said. “But it shouldn’t be seen as antithetical. It’s transformational.”

The utilities in Hawaii already understand the world is changing, Akiba said. “The grid has to be operated differently and the technology is there to do it.”

The PUC in April released four major decisions and orders that require Hawaiian Electric’s utilities to develop and implement plans to aggressively pursue energy cost reductions. The utilities must proactively deal with renewable energy integration problems and improve the interconnection process applied to solar generation systems owned by customers.

Akiba considers the Siemens IRP for Parker Ranch as positive with a thoughtful and well thought out approach. She is not opposed to a microgrid, which she said could help make the utility’s system more reliable.

“We need leadership like the Parker Ranch,” Akiba said.

www.usa.siemens.com/microgrid