Actionable Strategies

Case Study: Microgrid with Renewables and Energy Storage

Client Profile

Bella Coola is located in British Columbia, about 250 miles north of Vancouver. It is home to Bella Coola natives also called Nuxalk people, an indigenous First Nation of the Pacific Northwest Coast. The community is located on the Bella Coola River. Peak power demand is 3.8 MW, which occurs in the winter.

No Grid Connection

Due to its remote location, Bella Coola is not connected to BC Hydro's provincial electricity grid. The community was powered by greenhouse gas-emitting diesel generators and by a run-of-river power facility. The hydro facility did not meet the full power needs of Bella Coola and had no storage capability.

Hydropower

The supply from the Clayton Falls hydroelectric plant was intermittent with a capacity of 2 MW. In the winter, small run-of-river hydroelectric power stations don't run at capacity because most of the water is trapped in the snowpack. Run-of-river generating stations lack reservoirs behind their dams. While less disruptive to the environment, the power supply is not continuous when the flow of water is reduced.

Production was limited to 2 MW necessitating additional generation capacity.

Diesel Generation

Diesel generation was used to ensure the continuous provision of power. Their capacity was 7 MW so the power supply was reliable, but with significant environmental and cost impacts on the people of Bella Coola.

Project Background

The Hydrogen Assisted Renewable Power (HARP) project in Bella Coola, British Columbia provided clean energy to the indigenous community. The energy storage project securely powers the remote community of Bella Coola while reducing environmental impact. Actionable Strategies' consultant played an instrumental role in both the concept and technical implementation.

Technical Implementation

The Hydrogen Assisted Renewable Power (HARP) project combined energy storage and hydrogen generation to reduce reliance on diesel power and incorporate additional clean power generation.

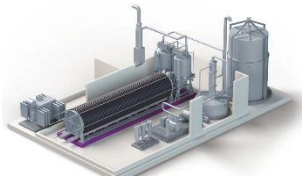
Energy Storage

The HARP system stored energy from the run-of-river power facility using modern energy storage technologies. This reduced the dependence on diesel generators by storing surplus power for use during peak demand. HARP used Vanadium Redox Battery technology.

Smart Grid Automation

HARP was automated using a microgrid controller which automatically responds to changes in supply and demand. Smart Grid technologies ensured efficient energy management and power generation.

Hydrogen Generation



At off-peak times, hydroelectric generation powers an electrolyzer which breaks water molecules into hydrogen and oxygen. The hydrogen is compressed and stored in gas cylinders to feed a fuel cell. Oxygen is released into the atmosphere which is beneficial to the environment.

When additional power is needed, the fuel cell is used instead of diesel generation. Stored hydrogen is put through a fuel cell to generate power. The fuel cell processes the hydrogen into electrons for electricity and water as the byproduct.

Project Benefits

Using diesel generators created issues for the Bella Coola community and the surrounding region. This drew the attention of the Canadian national government. The Minister of Energy, Mines and Petroleum Resources said, "this project is a great example of how we can use innovation and technology to strengthen B.C.'s clean energy future.

Thanks to BC Hydro's commitment to helping remote communities acquire clean power and Bella Coola's commitment to an efficient supply of electricity, we are setting an example for the rest of the country."

Pollution

Pollution from the diesel generators affected the community and surrounding regions because it would not dissipate from the river valley. Pollution hung visibly in the valley similar to the smog that accumulates in the Los Angeles basin. The project lowered greenhouse gas emissions by 600 tons annually.

Cost

Because of the remote location, diesel generation was exorbitantly expensive. Diesel fuel had to be flown in for a net price of $80/gallon while market rates were under $3. The project reduced annual diesel consumption by over 52,000 gallons (200,000 liters) or $4.2 million.

Social Benefits

The Canadian government declared a number of social benefits which were delivered to a remote, indigenous population.

- Stimulating Canada's green economy
- Creating jobs
- Helping protect the environment

Replicable Model

BC Hydro is hoping that the lessons from the HARP project in Bella Coola might be used at 30 or 40 other remote communities, helping to reduce the communities' carbon footprint as well as easing their vulnerability to volatile fuel prices.