SCBR Capacity Generation Application Feedback

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Summary

- I support the effort by Maritime Electric to keep the future rates low for islanders while planning for capacity needs, and I largely agree with the project as-proposed.
- Per amount of CO2 produced by the proposed project, islanders are getting a large amount of reliability, potential cost benefits, and renewables support from the proposed systems.
- I believe the economic case for BESS is greater than represented in the report, and that it is worth looking into further.
- Electric car- and bus-controlled DSM has a large potential benefit.
- Thermal energy storage such as water heater DSM have a large potential benefit.
- I think the proposed synchronous condenser is a good idea.
- The analysis doesn't consider CO2e pricing risk or the risk of incentivizing fossil fuel infrastructure.
- Some fuel options mentioned for the RICE plant like hydrogen are not likely to be viable.
- Advertising times renewable energy is available could promote uncontrolled DSM.
- Some questions are included in bold, and are listed with context.

Argument for Additional Battery Capacity

BESS Flexibility Makes it More Valuable

- **Is providing a more-correctly-scheduled power of value to NB Power?**
    - Batteries provide more services than just load shifting, and so the price of CO2e saved is better estimated by a whole-system approach that weights all of their uses for load shifting, backstopping, ancilliary power, and selling renewable capacity.
    - The examples given in the main report Figure 27 talk about the importance of backstopping capacity, but when energy is available from renewables above what is scheduled then NB Power needs to reduce load sent to the PEI grid.
    - Since energy is scheduled on an hourly basis, electricity will sometimes be provided from renewables in excess of the scheduled amount of energy. Providing backstopping capacity adds a cost to the New Brunswick grid to tolerate the noise in this energy signal. Using BESS could allow PEI to provide a very high-precision scheduling signal to the NB Power grid as it reduces the need for backfill and also frontfill.
    - Another word for frontfill may be "selling excess renewable capacity to NB Power".
        - **Why not set up a contract to sell renewable energy to NB Power?**
        - If cleaner scheduling of power is valuable on both ends, then perhaps the value of BESS is underestimated in the report.
        - Cleaner scheduling of power above and below predictions may become more valuable as the level of renewables increases in other provinces.
    - Figure 9 shows how renewable energy curtailment is expected to occur more frequently once future wind and solar projects are installed. The more frequently curtailment would occur, the more valuable BESS becomes for load shifting.

More BESS Capacity is Useful at the Low End

- I believe there is a flaw in the conclusions in the main report section 8, Table 21.
    - This table lists the energy storage needed to reduce the system peak by a given

level of capacity in MW.

- The text explains that since a larger stored energy in MWh is needed to meet a capacity in MW above the first 10 MW, that it is too expensive to rely on BESS.
- However, since BESS are commonly installed to provide 4 hours of operation, e.g. 10 MW using a 40 MWh battery, Table 21 shows that the levels of energy needed are less than this industry best-practice.
    - e.g. The analysis shows that 20 MW of BESS capacity (which should be installed with 80 MWh of energy storage) could easily have met the 66 MWh of required energy to reduce the peak. The case for a 30 MW/120 MWh BESS is less strong since past system loads would have needed more than this energy at 166 MWh on average, however.
- It may be immediately economic to install 20 MW/80 MWh of battery capacity, such as 10 MW for auxiliary power and 10 MW to easily handle 20 MW of system peak.

Timing of Charging

- The report claims that Maritime Electric would not know in advance when to switch from charge to discharge.
    - The estimates being made by maritime electric would likely be sufficient for most loads, most of the time. This is the job of the system operator on a day-to-day basis and they should be quite good at this actually. Charging during the typical Low-load times of day should not be much of an issue.
    - I believe that a reasonable way to schedule BESS capacity could be to:
        - Charge when the weather produces more renewable energy than predicted, and to tend to discharge the batteries to backfill.
        - When the goal is to charge the batteries, then a higher ratio of storing energy can be set.
        - When the goal is to store energy in the batteries, a lower ratio can be set.
        - The battery systems can be operated more carefully below 20% and above 80% full to maintain their lifetime and high-priority capacity.
            - Lithium ion batteries degrade more slowly when they use only a portion of their capacity, such as cycling between 20% and 80% or 40% and 60%, so larger capacity stores in terms of MWh may last longer. However, since the cost of refurbishment is only about 15% of the total cost, this refurbishment cost may be worth it.

BESS can be Diversified Geographically

- Each substation is built to handle at minimum 10 MW of load. Since 10 MW BESS systems are what are being considered, multiple system like this could be sited around PEI. This could avoid the need to install high voltage transformers when installing BESS, and provide stability to different regions of the grid along with geographic diversity.
    - Since 10 MW BESS systems are what are being considered, multiple system like this could be sited around PEI at substations. This could avoid the need to install high voltage transformers, and provide stability to different regions of the grid along with geographic diversity.

Alternate Chemistries?

- Lithium batteries are best used for vehicles where the power to weight and volume ratios are needed, but grid energy storage can rely on other battery chemistries which are cheaper in exchange for being heavier or bulkier.

Carbon Savings May be Larger than Described

- The S&L Report Section 3.2.1. mentions how load shifting (storing energy for future use on PEI) has only moderate capacity savings due to the batteries' 85%-90% round trip efficiency, and how load shifting only has carbon savings (Table 3-5) if using renewable energy that would otherwise need to be curtailed. However:
    - The renewables mentioned in the S&L report didn't account for solar energy in its examples.
    - The carbon spent by using BESS charged with electricity from the NB Power grid for meeting capacity requirements is only a little more CO2 released, about 15%.
    - Not needing to burn diesel most of the time may be better than burning ~16% more diesel some of the time (through the NB Power grid).
    - The price of renewable electricity is lower than the price of diesel or other fuel used by the RICE plants and the planned CT4, even including the 15% increase due to the round-trip efficiency of the batteries.
    - Scheduling the batteries to store renewable energy in excess to on-island production means that the power is locally renewable, and the NB Power grid operates more predictably which can help their own efforts to decarbonize.
- Since the Summerside grid is roughly one-tenth of the size of the maritime electric grid, **why not propose ten times the amount of battery capacity for the Maritime Electric grid that has already been installed by the Summerside utility?**

Combustion Turbine Synchronous Condenser

- The inertia supplied by a synchronous condenser is important to support a large amount of renewable generation from inverters.
    - **Why not focus more on providing inertia to the grid with a flywheel as well?**
- Battery storage can assist by helping provide synthetic inertia, though they wouldn't provide 100%.

RICE Plant Fuels

- Being able to use multiple fuel types in the RICE plant is not that large of a benefit because:
    - Hydrogen is unlikely to ever be a cost-effective fuel. It is better used as a feedstock for chemical processes.
        - Also, storage of hydrogen would be even more expensive and complicated than for LNG.
    - Ammonia is likely to remain a chemical feedstock.
    - Building the infrastructure to transport CNG to PEI is moving in the opposite direction from meeting our climate goals.
    - Biodiesel will already work in the CTs.
    - Electrofuel diesel wasn't mentioned, but acts as a drop-in replacement for diesel. This is likely to be the best source of dense energy storage long-term, and can be produced using renewable electricity.

System Peak

- Solar can be included in handling the system peak when including BESS.
    - While there is no solar capacity available during the system peak, the evening peak around 5-6 pm occurs within a 4-hour timeframe after sundown.
        - The timing of BESS-stored energy during system peak can partially come from solar PV.
        - To be fair, the sunlight expected on a cold winter day is unlikely to be very much.

- Table 10 shows the capacity available at System Peak projected out to 2033. I think the estimates for capacity are displayed effectively, but it would be nice to include a depiction of controllable demand side management in this chart.

Biomass Plant

- If a biomass plant is used as a form of backup power generation, the lack of significant wood supply should not be an issue.
- Lacking a supply of wood would only be an issue if the intent was to burn biomass as a source of long-term energy.
- I agree that a biomass plant is unlikely to be the best solution to provide peaking load.

Controllable Demand Side Management (DSM) Suggestions: Water Heaters

- Thermal TES is the most direct way of attempting to solve the issue of space heating timing.
    - Different equipment that support DSM include laminar flow water heaters, the highly-insulated tanks like in Summerside, or heat pump water heaters.
    - Laminar flow water heaters may increase the proportion of people who choose to install them because hot water is always "available" from the tap as long as the tank is charged.
        - They should save a similar amount of capacity compared with standard electric water heaters.
    - Heat pump water heaters are nice because they save energy as well as capacity when running in heat-pump mode.
    - Also, the brick heat storage systems that have been used in Summerside are simple devices that have been working for years.

Electric cars for controllable DSM and car-to-grid (C2G)

- Maritime Electric estimates there will be about 16000 electric vehicles on island roads in 2033. This will be roughly 10% of the fleet, and is a lower number than the desired amount of EVs.
    - If 10% of the battery capacity of these 16000 vehicles is available (assumed 5 kWh of energy storage per car) then 80 MWh of energy is available from the fleet, and 20 MW of power can be drawn from them.
- Similarly, Maritime Electric could partner with Maritime Bus and the school board's electric busses to time their charging and potentially use V2G.
    - The city buses do not run at night for the most part, which is when the largest capacity requirements will likely be needed.
- The estimated system peak can be directly reduced for each EV which opts-in to controllable DSM.
- The 150 MW of new capacity could support 43000 houses. Assuming 10% of these houses have one electric car subscribed to controllable demand side management, and 10% of their battery is available for charging, then about 5 MW/20MWh of battery capacity is available from those houses. This means about 1/30 of the demand can be met by controlling timing of electric vehicle charging.
- If electric cars can be opt-in C2G, then each electric car can act to reduce the predicted system load as well as provide power during the winter.
    - This can nearly double how effective electric cars are at reducing the peak capacity requirements.
    - Because electric cars are a load that gets shifted and also a source, it reduces both sides of the system load equation.

Economics

- It is not clear that the cost of the proposed RICE plant will be siginficantly lower than larger amounts of BESS.
    - The price of batteries will likely fall even further in the future than it already has, so it is likely wise to install BESS capacity over time as that price decrease occurs.
        - Since the capital cost of batteries is currently very close to a RICE plant, its NPV is mainly caused by the expected lifetime of the RICE plant over the BESS.
        - It is likely that most of the operating cost of the BESS will be much lower than the RICE plant due to the simplicity of the installation, the components being used, the low land requirements, etc. This makes the cost estimate of the BESS likely near the higher end of its range.
- The project, as listed, does not account for the cost risk of carbon tariffs or taxes on future capacity.
    - Assuming the amount of fuel burned increases proportional to the system load, **what would the cost of a carbon tax be on energy production in the future?**
        - In 2023, the report mentions the amount of the CO2 equivalent emissions released was just over 3,000 tons, or about $300,000 in terms of the price of CO2e emissions.
        - At 100 $/tonne CO2e, about $1 million per year if the CO2e emissions triple from on-island generation.
        - This doesn't include the CO2e generation by purchasing energy from the NB Power grid.

Other points

- There is a real cost to choosing to place investment into oil generation resources.
    - It's not just about the capital cost and O&M costs.
    - Even if PEI is a relatively small electricity market, placing $400 million dollars of investment into fossil fuel generation equipment incentivizes its use.
- The report mentions that replacing the existing CTs is a separate discussion from this current application.
    - Perhaps this proposed project should be the project that replaces those turbines.
- Clearly advertising the availability of renewable energy to people could help reduce demand. For example, Maritime Electric could partner with the Weather Network to display the estimated energy forecast.
- The report cites how heat pumps can operate at 100% efficiency, but many cold-climate heat pumps installed on the island will still operate around 200% efficiency at -25 deg C.

Conclusions

Thank you for your time and attention reading this feedback. Overall, I think the submission by Maritime Electric does have a lot of good thought put into it and that their conclusions are mostly correct. Their industry is one that must provide a stable source of electricity for Islanders above anything else. The estimates for energy produced need to fall on the conservative side, and cost is important to keep low while balancing emissions and other factors. The backfilling support of renewables is a topic I wasn't familiar with before reading this report, but it makes sense that these kinds of practical considerations are what we need to contend with to reach 90% renewable energy use in the Maritimes.