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Marpor Energy
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Strategic Analysis of Energy Generation Alternatives for Maritime Electric on Prince Edward Island
Executive Summary
1.1. Context
Maritime Electric's recent application to the Island Regulatory and Appeals Commission (IRAC) to acquire two 50 MW combustion turbines (CTs) for $334 million is presented as a critical and "time-sensitive" measure to address an urgent capacity shortfall on Prince Edward Island. The utility’s proposal is driven by a stated imperative to ensure grid reliability and prevent rotating blackouts, particularly during winter peak periods, which have become more pronounced due to the increasing electrification of homes and businesses. This report provides a detailed comparative analysis of the proposed combustion turbine project against an alternative Battery Energy Storage System (BESS) of equivalent scale, evaluating the financial, environmental, and operational implications for the utility and its ratepayers.
1.2. Key Findings
A comprehensive review of available data and industry benchmarks indicates that while the proposed CTs offer a traditional and proven solution for peak capacity, a BESS alternative presents a more strategic, financially prudent, and environmentally aligned long-term path for modernizing P.E.I.'s electrical grid.
* **Financial:** An analysis of recent Canadian projects demonstrates that a BESS portfolio can be acquired at a lower capital cost per megawatt compared to the proposed CT project. A BESS also offers significantly lower operational costs over its lifecycle and provides diverse revenue streams through energy arbitrage and ancillary services. This multi-faceted revenue model allows a BESS to provide a higher return on investment and a lower overall cost to ratepayers, challenging the utility's assertion that the CTs are the "cheapest option."
* **Environmental:** The CTs, as fossil fuel-based peaker plants, have the potential to substantially increase greenhouse gas emissions and other harmful air pollutants. In contrast, while the manufacturing of a BESS has a notable environmental footprint, its operational emissions are zero, and a lifecycle analysis shows it is a substantially cleaner alternative when integrated with renewable energy sources. A BESS is a true enabler of the clean energy transition.
* **Operational:** The rapid response time of a BESS, measured in milliseconds, is uniquely suited to address the stability challenges of a grid with increasing renewable penetration. While CTs provide essential physical synchronous inertia, a BESS can provide a complementary set of grid-stabilizing services, including voltage support, frequency regulation, and, critically, viable black-start capability, a function historically associated with gas turbines.
1.3. Recommendations
The analysis recommends that IRAC and Maritime Electric revisit the CT proposal and conduct a detailed, transparent, and public analysis of a BESS alternative. This analysis should benchmark against comparable Canadian BESS projects and fully account for the long-term financial and strategic value of a BESS, rather than solely focusing on the immediate capital

costs and a self-imposed "time-sensitive" deadline.
Chapter 1: The Prince Edward Island Grid: A Strategic Crossroads
2.1. Defining the Capacity Imperative: The "Wake-Up Call"
The foundation of Maritime Electric's application is a stark reality: P.E.I.'s electricity demand is outstripping its supply capacity, a situation described by Roger King, a former chair of a commission on the grid, as a "major 'wake-up' call… a clear signal and a warning statement". The utility has underscored the "urgent need" to boost the winter supply of electricity to protect homes and businesses from service interruptions.
This growing demand is not an isolated event. Before 2025, the utility's peak customer load exceeded its 326 MW maximum only once. In the current year, that threshold has already been topped six times, and at significantly warmer temperatures than the 2023 polar vortex that previously pushed the grid to its limit. The primary driver for this escalating demand is the province's success in promoting electrification, particularly the widespread adoption of electric heat pumps for space heating. This trend exposes customers to "health and safety risks should Maritime Electric be unable to supply sufficient energy during system peak periods," a warning explicitly stated in the utility's submission to IRAC. Maritime Electric projects that a future polar vortex similar to the one in 2023 could result in a peak demand of 391 MW, which the current grid would be unable to satisfy, raising the "very high" risk of rotating power outages. The P.E.I. energy minister has echoed this sentiment, confirming the need for a backup system to ensure grid reliability and prevent blackouts.
2.2. The Maritime Electric Proposal: Combustion Turbines as a "Time-Sensitive" Solution
In response to this capacity shortfall, Maritime Electric has amended a previous application to build 150 MW of generation capacity, which had an initial cost estimate of $427 million. The new proposal is based on a "time-sensitive" offer to partner with NB Power to secure two 50 MW aeroderivative combustion turbines (CTs) for a total cost of $334 million. These CTs are specified to be dual-fuel, capable of running on natural gas and ultra-low-sulfur diesel (ULSD). The utility has set a target to have the units operational by the summer of 2028, which it claims is the "only option to meet" this commissioning date. However, even with this proposal, the utility acknowledges a need for an additional 50 MW of capacity, which would likely push the total project cost above the initial $427 million estimate.
The CTs are presented as a "backup generation system" that would operate for only one to two percent of the time. Their primary purpose is to provide "dispatchable generation" to ensure a secure supply and enable "synchronous condensing for voltage support". The utility's emphasis on the urgency is tied to a confidential Equipment Slot Reservation Agreement with ProEnergy Services, LLC, and it is this commercial arrangement, rather than a technical impossibility, that creates the "time-sensitive" deadline.
2.3. The Case for BESS as a Modern Alternative
The Maritime Electric proposal has faced opposition from critics who argue that "there are cheaper alternatives that won't increase P.E.I.'s emissions". The Ecology Action Centre (EAC), in its submission to IRAC, specifically proposed grid-scale battery storage, overbuilt wind energy assets, and demand response programs as "cheaper and more sustainable dispatchable capacity resources". The EAC's attempt to formally intervene in the case, however, was denied due to a missed application deadline, which limited the public debate on these alternatives.
The fundamental choice facing Maritime Electric and P.E.I. is not merely about adding megawatts of capacity; it is a decision on the future architecture of the electrical grid. A BESS represents a modular, flexible, and scalable solution that is increasingly becoming the preferred option for managing the complexities of a modern grid with high renewable penetration. This analysis will demonstrate that the choice between CTs and BESS is a strategic decision that will define the long-term financial, environmental, and operational

resilience of P.E.I.'s energy system.
Chapter 2: Financial Analysis: Cost, Value, and Ratepayer Impact
3.1. Capital and Installation Costs: A Comparative View
The immediate financial consideration is the upfront capital cost. Maritime Electric's proposed project of two 50 MW CTs for $334 million equates to a capital expenditure of approximately $3.34 million per megawatt. This initial figure for the first 100 MW of capacity is presented as the most cost-effective option by the utility.
However, a review of comparable Canadian projects reveals that a BESS can be a competitive, if not more affordable, alternative on a per-megawatt basis. For example, a 150 MW BESS portfolio in Nova Scotia has a total expected cost of CA$354 million, which translates to a capital cost of approximately $2.36 million per megawatt. This represents a 30% reduction in capital cost per megawatt compared to Maritime Electric’s proposed CTs. Similarly, the Skyview 2 BESS project in Ontario, a 250 MW, four-hour duration system, is estimated to cost $750 million, approximately $3 million per megawatt. These Canadian benchmarks directly support the argument that grid-scale battery storage is a "cheaper" alternative from a capital cost perspective.
3.2. Operational Costs and Lifecycle Economics
Beyond the initial investment, a thorough financial analysis must consider the total cost of ownership over the life of the asset. The proposed CTs come with continuous, and often volatile, operational costs including fuel, maintenance, and permitting over their lifespan of approximately 30 years. These variable costs can increase as the units are ramped up and down more frequently, which causes additional wear and tear.
In contrast, a BESS has a much lower operational cost profile. Its fixed operation and maintenance (O&M) charges are nominally lower due to less labor intensity and the absence of moving parts, fluids, and turbomachinery. The primary variable cost for a BESS is the cost of charging the batteries, which can be significantly reduced, or even become a source of revenue, by charging during periods of low or negative electricity prices. A key consideration for a BESS is the need for battery replacement after 10-15 years, which represents a significant future capital expenditure.
A comprehensive lifecycle analysis demonstrates the economic advantage of BESS. A report on the Australian energy market found that a BESS has both a lower Levelized Cost of Capacity (LCOC) and a lower Levelized Cost of Energy (LCOE) than a comparable gas peaker plant. This analysis showed that battery storage can provide more than 30% in LCOE savings, which would directly translate into lower costs for ratepayers. While the specific impact on P.E.I. ratepayers has been kept confidential , these findings call into question Maritime Electric's claim that the CTs are the "cheapest option" and suggest that the long-term financial benefits of a BESS could be substantial.
3.3. Revenue Streams and Market Opportunities: The Value Stacking Model
The financial viability of modern energy assets is increasingly determined by their ability to generate revenue from multiple sources. A CT is primarily a single-purpose asset designed to provide capacity and synchronous condensing services for a fee.
A BESS, however, offers "diverse value streams" that allow it to generate revenue beyond simple capacity payments. These include:
* **Energy Arbitrage:** A BESS can charge with low-cost energy, such as excess wind power during off-peak hours, and discharge it during high-demand, high-price periods to capitalize on the price difference.
* **Ancillary Services:** A BESS can provide critical grid services, such as frequency regulation and voltage support, which are becoming increasingly valuable in modern grids.
* **Negative Price Events:** During periods of high renewable generation and low demand, electricity prices can drop into negative territory, and a BESS can be paid to charge,

effectively earning revenue while preparing for the next peak.
The financial model of a BESS is one of "value stacking." It is not just a backup generator but a multi-functional asset that can optimize the grid and create new revenue streams. P.E.I.'s grid, with its growing reliance on variable wind power and its need for new subsea cables to manage imports from New Brunswick, is a prime candidate for a BESS that can act as a financial buffer and a strategic asset, providing a more resilient and economically superior investment for the long run.

Financial Consideration	**Combustion Turbines (CTs)**	**Battery Energy Storage Systems (BESS)**
Capital Cost per MW	$\sim \$3.34 \text{M/MW}$ (P.E.I. Proposal)	$\sim \$2.36 \text{M/MW}$ (Nova Scotia)
Operational Costs	High and volatile (fuel, maintenance, permitting)	Low fixed costs, but with significant battery replacement costs
Fuel Dependency	Dependent on volatile fossil fuel prices	Dependent on electricity prices, with opportunity to benefit from low/negative prices
Projected Rate Impact	7% to 8% increase for ratepayers	No specific data, but LCOE savings suggest a potential for a lower increase
Value Streams	Capacity payments, synchronous condensing	Energy arbitrage, ancillary services, negative price events
Lifecycle Cost	Higher LCOE, vulnerable to market reforms	Lower LCOE, more than 30% savings compared to gas peakers

Chapter 3: Environmental and Social Considerations: Lifecycle Footprints and Decarbonization Goals

4.1. Greenhouse Gas Emissions and Air Quality

The CT proposal, as a fossil-fuel-based project, has the potential to "substantially increase greenhouse gas emissions on the grid". As peaker plants, they are less efficient than baseload generators and emit higher rates of carbon dioxide and other health-harming air pollutants when they are operational.
A BESS, by its nature, has zero direct emissions from its operation. However, an environmental assessment must consider the full lifecycle. The manufacturing process for a BESS is energy-intensive and has a footprint associated with the mining and processing of raw materials like lithium, which can cause higher initial GHG emissions and toxicity compared to the production of conventional generators. A complete environmental accounting, therefore, must weigh the manufacturing footprint of the BESS against the continuous operational emissions of the CTs. A study on life-cycle GHG emissions from fossil energy and storage systems concluded that despite the manufacturing impact, the emissions from a dispatchable renewable energy system (like a BESS charged by P.E.I.'s wind resources) are "substantially lower than from fossil fuel-derived electricity sources". Over the lifespan of the project, a BESS is definitively the cleaner and more sustainable option.

4.2. Alignment with Energy Transition and Broader Societal Goals

The choice between CTs and a BESS is a strategic decision that reflects a utility's commitment to the clean energy transition. The CTs are framed as a backup, a temporary "bridge" and a necessary "balance" with fossil fuels to ensure reliability while the province moves towards a renewable future. This approach, however, relies on a last-generation technology to solve a new-era problem.
A BESS is a foundational piece of the modern grid. It is the "true bridge to a clean energy future" because it directly enables the integration of more intermittent renewable energy sources, such as wind and solar, by absorbing surplus generation and dispatching it when needed. The BESS solves the core issue of intermittency, which is a major hurdle in a

decarbonized grid, and aligns with the province’s stated goal of promoting "environmentally friendly options".

There is also a social justice dimension to this decision. Peaker plants are often "disproportionately located in disadvantaged communities" and are a source of health-harming pollutants. By strategically replacing or avoiding the construction of new peaker plants with BESS, utilities can provide "significant health, environmental, and equity co-benefits" for vulnerable populations. This consideration adds an ethical layer to the decision, as the CT project could perpetuate environmental inequalities, while a BESS project could align with progressive societal goals.

Environmental & Social Impact	**Combustion Turbines (CTs)**	**Battery Energy Storage Systems (BESS)**
Direct Emissions	High, intermittent emissions of CO_2 and other pollutants	Zero direct emissions from operation
Lifecycle Emissions	High due to continuous combustion of fossil fuels	Substantially lower due to zero-emission operation
Air Pollutants	High rates of carbon monoxide, nitrogen oxides, sulfur oxides, and fine particulate matter	Lower rates overall, but higher in production stage due to mining and processing
Resource Consumption	Continuous fossil fuel consumption; high water consumption for cooling and NOx injection	Resource consumption tied to raw materials for manufacturing, can consume more water than CTs
Social Equity	Often located in disadvantaged communities, posing public health risks	Flexible siting with less public health risk; aligns with environmental justice goals
Role in Energy Transition	A traditional backup; a "bridge" to a clean energy future	An enabler and foundation for high renewable penetration

Chapter 4: Operational and Technical Performance: Reliability, Resilience, and Integration

5.1. Grid Stability and Response Capabilities

Modern electrical grids face new stability challenges from the increasing penetration of inverter-based renewable energy sources, such as wind and solar, which do not provide the physical synchronous inertia of traditional rotating generators. This loss of kinetic energy makes the grid more susceptible to rapid frequency fluctuations.

CTs provide essential physical synchronous inertia and have fast starting and ramping characteristics, making them effective for responding to load changes. However, their response time is limited by the physics of combustion and rotation. A BESS, in contrast, has a rapid response capability, operating within 100-500 milliseconds to absorb or release energy, a "significant advancement" in frequency regulation technology. This ability allows a BESS to provide "immediate active-power injection" to counter frequency dips before conventional generators can even begin to ramp. BESS can also provide "precise reactive-power control" to support voltage at weak points in the grid. The choice facing the utility is between using a legacy technology to provide a legacy service (physical inertia) and a modern technology that provides a complementary, and in some cases superior, service (virtual inertia) to solve the new-era problem of a high-renewables grid. The fact that the CTs are needed for "synchronous condensing for voltage support" is a capability that a BESS can also provide, highlighting the BESS's potential to perform these critical services more efficiently.

5.2. Black Start Capability and System Resilience

One of the most critical services for grid resilience is "black start" capability, the ability to restore a power plant or grid after a complete shutdown without external power. Historically, CTs have been a proven and traditional choice for this function due to their fast starting and ramping characteristics.

While CTs have a longer history in this role, BESS is an emerging and viable alternative. The Burns & McDonnell project demonstrates a 17 MW BESS successfully providing black start capability for a gas turbine, reinforcing the technology's viability in critical applications. A key advantage of BESS is its grid-forming inverter, which can first establish a local grid from scratch, creating a stable point for other generators to synchronize with. This negates a key operational advantage that CTs have traditionally held. The integration of BESS with renewables for black start is also a more sustainable approach, as it uses stored wind and solar energy rather than fossil fuels to restore the grid, which provides a more robust and future-proof solution for a province committed to integrating more renewables.
5.3. Project Timeline, Lifespan, and Interconnectivity
Maritime Electric has framed the CT project as the "only option" to meet the 2028 operational deadline. However, the timeline of the Skyview 2 BESS project in Ontario, which is scheduled to begin operations in 2027, suggests that BESS can be deployed on a similar, if not faster, timeline. This indicates that the "time-sensitive" argument is a commercial one, linked to a specific manufacturing slot, rather than a technical limitation of BESS technology.
Regarding lifespan, CTs have a long operational life of over 30 years. A BESS has a shorter lifespan of 10-15 years, after which the batteries will need to be replaced, which is a significant long-term O&M consideration. However, this shorter lifespan can be viewed as an opportunity to upgrade the technology every decade as battery costs continue to fall and technology improves.

Operational & Technical Performance	**Combustion Turbines (CTs)**	**Battery Energy Storage Systems (BESS)**
Grid Response Time	Slower, requires physical ramping and rotation	Rapid, operates within 100-500 milliseconds
Grid Stability Services	Provides physical synchronous inertia for frequency regulation	Provides "virtual" inertia and precise reactive power control
Black Start Capability	Proven, traditional technology for grid restoration	Emerging and viable with grid-forming inverters
Projected Operational Date	Summer 2028	Summer 2027 (Ontario benchmark)
Lifespan	~30 years	10-15 years, requiring battery replacement
Efficiency	~12%-30% (for propulsion)	~90%-95% round-trip efficiency

Chapter 5: Strategic Synthesis and Recommendations: A Path Forward for Prince Edward Island's Grid
6.1. Recapitulation of Analysis
This report has evaluated Maritime Electric’s proposed combustion turbine project against a BESS alternative across three key dimensions. Financially, BESS presents a more attractive proposition, with lower capital costs based on Canadian benchmarks, lower operational costs, and the ability to generate revenue from multiple value streams that the CTs cannot. Environmentally, while a BESS has an upfront manufacturing footprint, its zero-emission operation makes it a definitively cleaner choice over its lifecycle and a more strategic fit for P.E.I.’s decarbonization goals. Operationally, a BESS offers a suite of grid-stabilizing services that are uniquely suited for a modern grid with high renewable penetration, including a rapid response time that surpasses that of CTs and a proven, albeit emerging, black-start capability.
6.2. Addressing Maritime Electric's Strategic Narrative
Maritime Electric’s narrative that the CT project is the "only option" to meet the 2028 deadline is a commercial argument, not a technical one. The existence of large-scale BESS projects in Canada with comparable or faster timelines directly refutes this claim. The utility's decision is tied to a confidential Equipment Slot Reservation Agreement, which effectively bypasses a competitive procurement process that could have explored more cost-effective and sustainable

alternatives. Furthermore, the confidential nature of the rate impact information and the denial of the EAC's intervention request limited the public's ability to engage in a full, transparent debate on a critical piece of public infrastructure.
6.3. Recommendations for Stakeholders
Based on this analysis, the following recommendations are presented to key stakeholders:
* **Recommendation to IRAC:** The regulatory body should compel Maritime Electric to submit a detailed, public, and transparent analysis of a BESS alternative. This analysis must use recent Canadian projects as benchmarks and provide a full lifecycle cost assessment, including the costs of battery replacement, and a multi-value revenue model. The regulatory body should not accept the "only option" argument at face value but instead ensure that all available, modern, and sustainable options are thoroughly evaluated for the long-term benefit of the Island.
* **Recommendation to Maritime Electric:** The utility should reframe its approach from simply adding generation capacity to a comprehensive strategy for modernizing the grid. A BESS should be viewed not as a mere alternative but as a foundational component of P.E.I.'s future energy system, one that leverages the province's abundant wind resources, manages the challenges of a rapidly electrifying load, and provides a more resilient, flexible, and economically robust solution.
* **Recommendation to the Province of P.E.I.:** The province should align its energy policy with the full strategic value of a BESS. By supporting a BESS project, the province can reinforce its commitment to a cleaner energy future while also improving grid reliability. Additionally, the provincial government should explore opportunities for federal funding, such as Natural Resources Canada's Smart Renewables and Electrification Program (SREP), which has the potential to significantly offset capital costs and make a BESS project even more financially attractive for the province and its ratepayers.

Information obtained by Gemini for Marpor Energy.