

Resource Adequacy Stress from Rapid Electrification

ESIG 2024 Fall Technical Workshop, RI

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The strange case of Prince Edward Island: A perfect storm for heating electrification



ESIG Forecasting Workshop, Salt Lake
Session 4B: Power System Impacts of Rapid Electrification
June 12, 2024

Nick Miller, Principal, HickoryLedge ← Debbie Lew of ESIG doing her best imitation of Nick
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CLIMATE ACTION

Small Island

BIG ENERGY

Why should a little East Coast island be the first Net Zero jurisdiction?

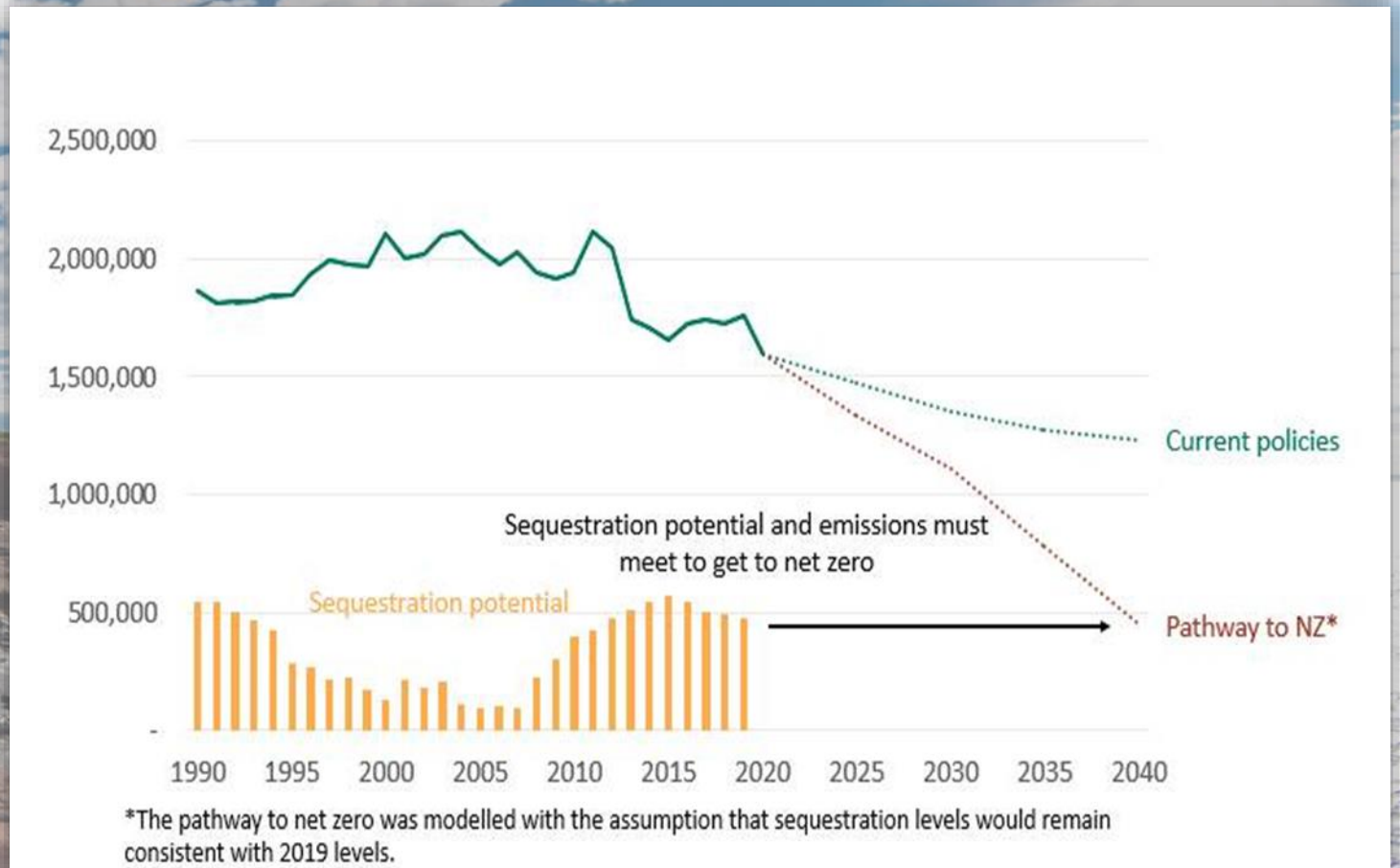


A Vision for Our Island:

To become Canada's first Net Zero Province, a model for Islanders to be proud of and for others to follow

How to achieve Net Zero GHG emissions:

- Reduce the amount of GHG released into the atmosphere.
- Offset remaining GHG emissions through carbon sequestration



Climate Impacts

Coastal Hazards



Negative impacts on mental health



Real estate market insurance industry and private homeowners



Damage to infrastructure



Endangered and at-risk species, changes to sand dunes and other ecosystems

Post-Tropical Storms



Coastline stability and hydrology maybe altered



Potential power outages



Bridge access disrupted, blocking critical access to the province and communities

Extreme Heat Events



Public health—morbidity in vulnerable population



Agriculture, fishers and tourism industries impacted



Potential power outages



Temperatures above 29°C for 3 consecutive days occur more

Heavy Precipitation & Flooding



Crop damage and contamination of adjacent waterways



Blocked access to some communities and disruptions to traffic routes



Hamper access to health care and EMS

Earlier & Warmer Springs



Sensitivity of lobster to water temperatures and may decrease beyond 2050



Increase in pests diseases and invasive species



Infrastructure damage from changes in freeze and thaw cycles

Severe Ice Storms & Freezing Rain



Potential power outages



Limitations on travel on ground and air



Downed trees and damage to property and infrastructure



High potential for loss of life and injury

Seasonal Droughts



Crop loss



Negative impact on mental health



Increased use of power and water

Climate change risks are interconnected and climate hazards can result in cumulative impacts.

The impacts of climate change will not affect all in PEI equally. Indigenous peoples and marginalized populations will be uniquely impacted.

PEI Has Committed to Reduce Greenhouse Gas Emissions to **1.2 Mt by 2030**

Prince Edward Island's GHG emissions are 13% below 2005 levels, or **36%** of the way towards the 2030 target.

Transportation **(41%)**

- 72% of our transportation emissions come from passenger cars and trucks.
- The remaining transportation emissions mostly come from freight transportation (like heavy trucks, marine transport, and aviation).

Agriculture **(24%)**

- Livestock, manure and fertilizer use generate GHG emissions.
- 81% of PEI's agricultural emissions come from growing crops and animals. Fuel use on farms only accounts for 19% of agricultural emissions.

Buildings **(18%)**

- Island homes, businesses, and industries burn fossil fuels.
- Heavy fuel oil generates the most GHGs (3 kg for every litre of oil burned), while propane generates the least (1.5 kg for every litre of propane burned).

PEI Universal EV Incentive Program

Eligibility

- Incentives available for vehicles purchased at on- and off-Island dealerships

Program Impact

- Nearly **900** vehicles have been incentivized since 2021



Incentives

- \$5,000 for new/used EV purchases
- \$2,500 for plug-in hybrid purchases
- \$750 charging incentive for Level 2 charger purchase/installation or charging costs



Additional Benefits

- Waived \$100 Electric Vehicle registration fee
- Up to \$10,750 off new EVs with combined Federal and PEI incentives



EV Experience Tour

- Collaboration with SafeDrivers PEI for EV test drives across the province

Combined Incentives: Islanders buying a new, fully electric vehicle may receive up to \$10,750 off the purchase price when combining the Federal Government incentive of \$5,000 with the PEI Universal EV and Charging Incentive of \$5,750.



Update on V2G Chargers and **Electric Bus Utilization**



V2G Chargers

2 on order from LION Electric (in partnership with Fermata Energy) for the North Rustico Lions Club, used as a warming center post-Fiona for 9 days.



Electric Buses

Exploring use of our 82-bus fleet (25% of total) for grid response and peak load shaping.



Collaboration

Working group with Maritime Electric to discuss distributed energy resources.



Free Heat Pumps

Total Installations

11,712

Average Installation Cost

\$4,420

Household Income Threshold

\$100,000

- 6,600 applications in the 2022-2023 fiscal year
- 2,200 applications in the 2023-2024 fiscal year
- 6,000 completed installs

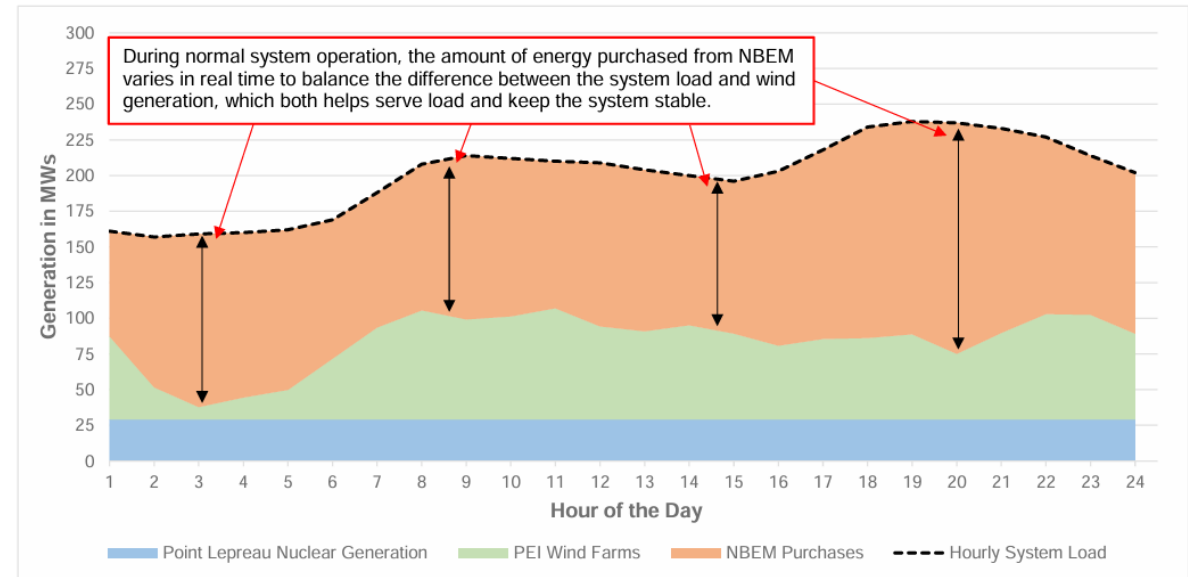


Electricity in PEI

- Sources of Electricity in PEI
 - Electricity mainly supplied through four submarine cables from New Brunswick (560 MW capacity; 300 MW cap)
 - More than 100 MW capacity of fossil fuel generators (MECL = 89 MW, Summerside Electric = 12.5 MW) supply electricity when needed
 - Point Lepreau Nuclear Generating Station in New Brunswick – 29 MW
 - 8 wind farms operating in PEI, 104 turbines, 204 MW
 - 90 MW is currently sold off-island
 - ELCC = 21 MW
 - Over 20% of PEI's electricity comes from wind generation (over 40% including that sold off-island)
 - 85 MW of solar operating in PEI
 - More than 30 MW commercial solar farms
 - 50 MW residential solar
 - ELCC = 0 MW
 - Because residential solar is behind the meter, the utility is unable to factor it into its load calculations
 - They are looking into converting all their customers over to smart meters, which could address this issue
 - MECL has budgeted for a combustion turbine in its capital budget application to the regulator (150MW)

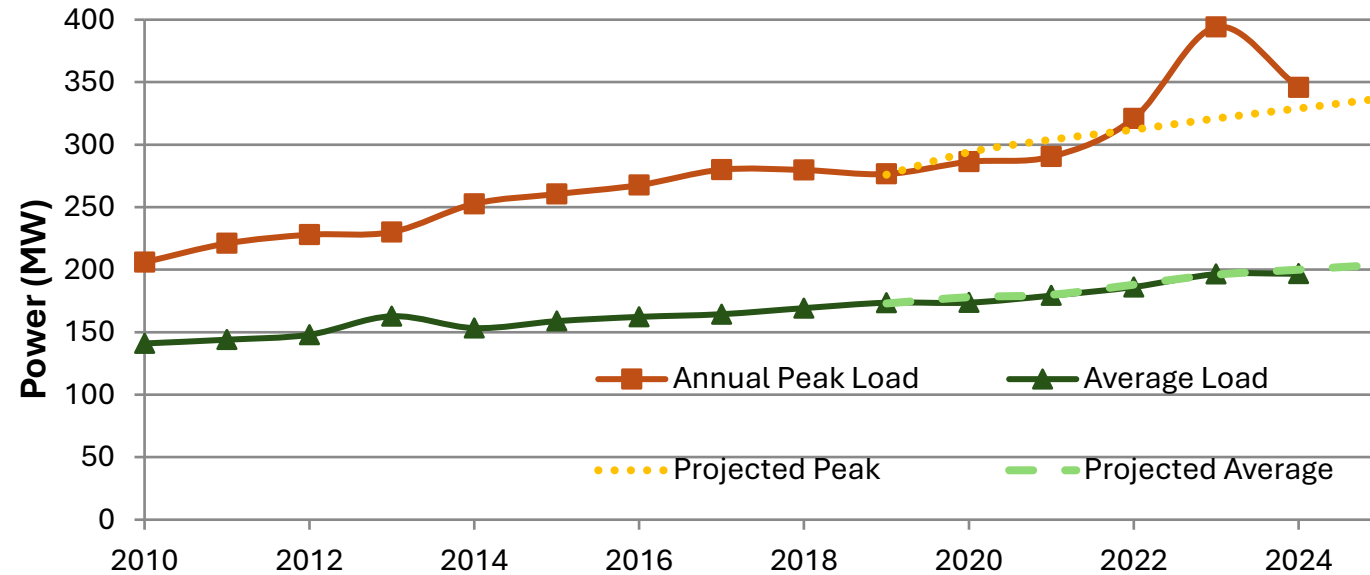
December 9, 2022

Figure 2-2 — Typical Winter Day System Dispatch



Source: Capacity Resource Study; Sargent & Lundy, December 2022

Annual Loads in PEI

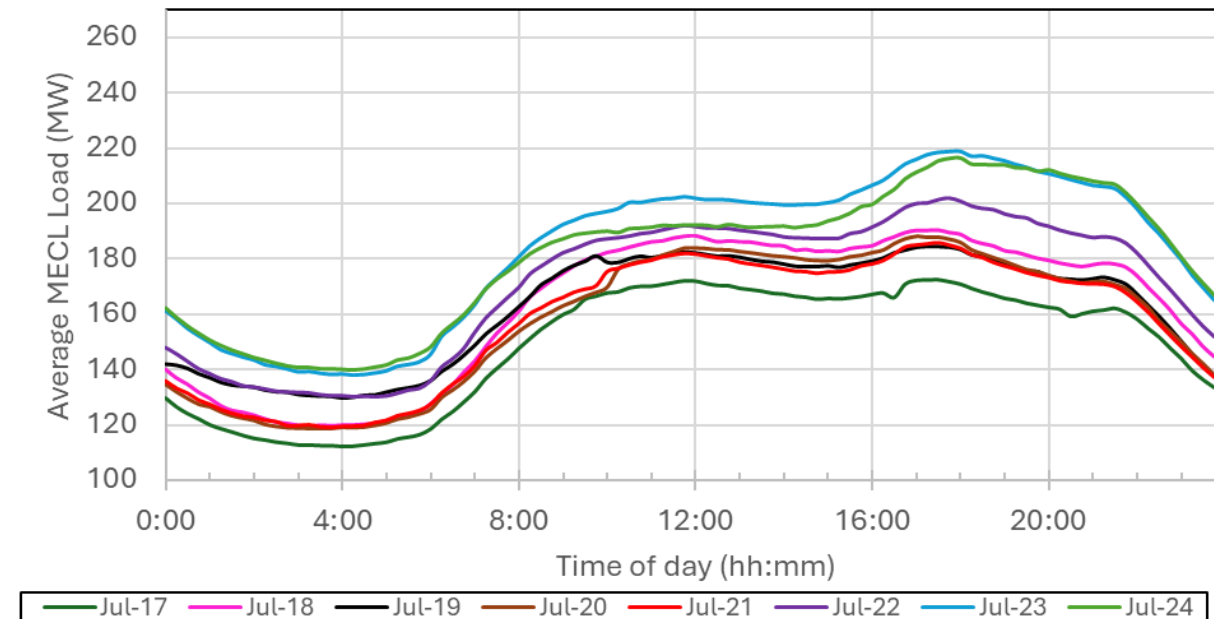
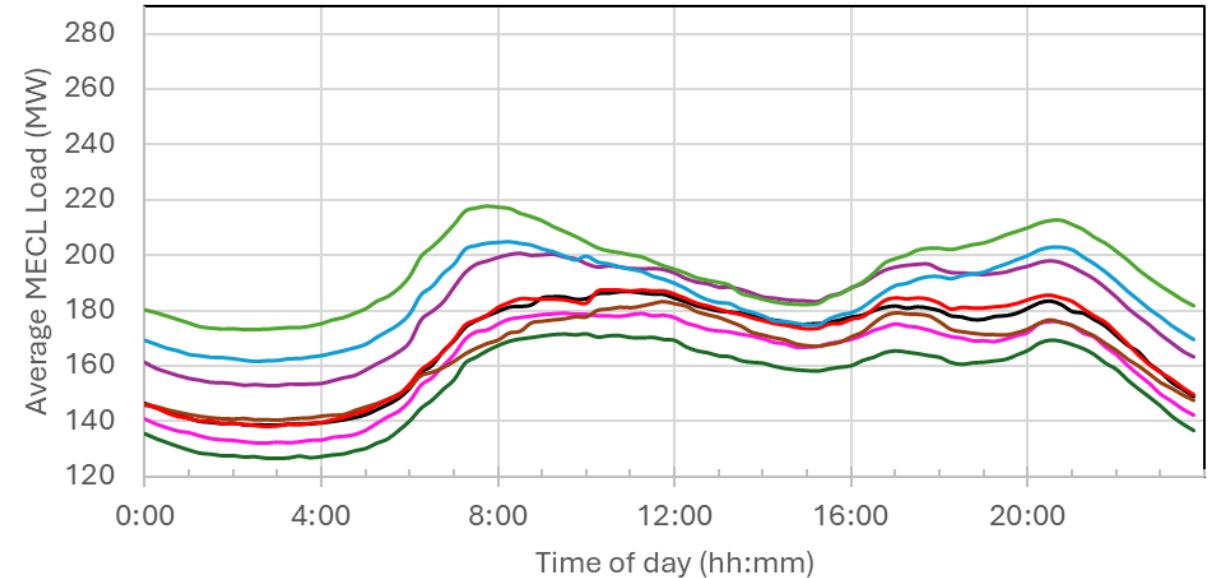
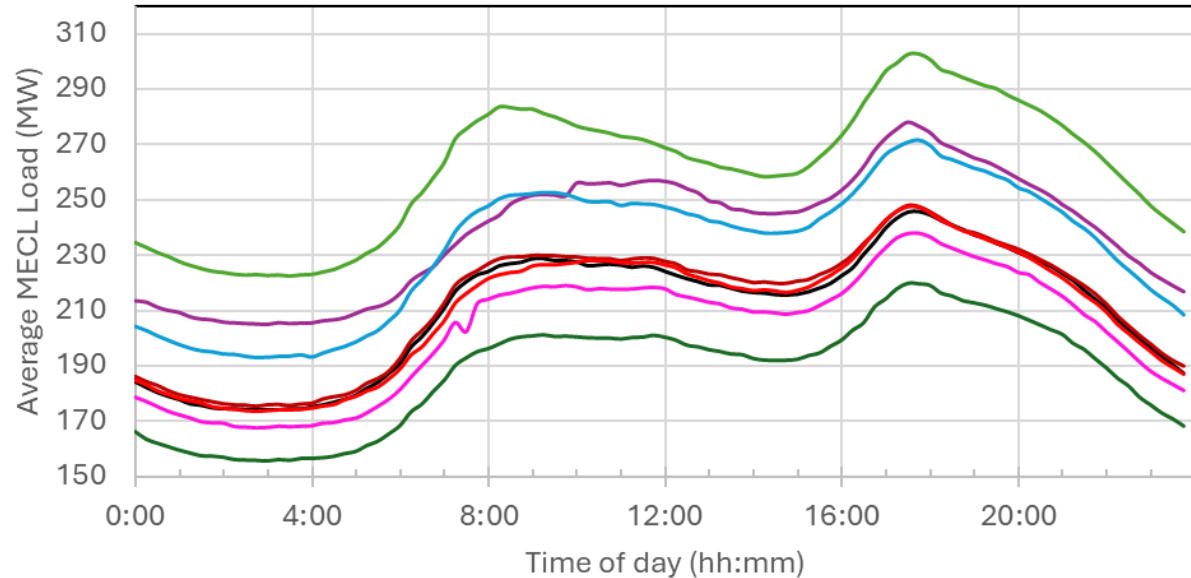


- Reasons for the peak power increase:
 - Population growth – 142K in 2010, 179K in 2024
 - Electrification of grid – heat pump uptake; EV uptake
 - Polar vortex in Feb 2023
- Other factors changing our power profile
 - Solar incentives
 - Energy efficiency incentives – free insulation, free water heaters, greening retrofits

PEI Energy Efficiency Incentive Uptake

- Heat pump rebates
 - 65,000 total households in PEI (50% of households)
 - 12,000 fully free heat pumps
 - 23,000 heat pumps under additional rebates
 - 1,200 heat pumps in businesses
 - 1/10 of those who make use of the heat pump incentives engage in home insulation incentives
- Solar Installs
 - 5,000 solar installs under incentives from Efficiency PEI
 - Generally range from 9 kW to 12 kW
- Peak power usage day has changed recently.
 - Historically it tended to be around Christmas. Now we are peaking later in the winter – January or February, when it's colder

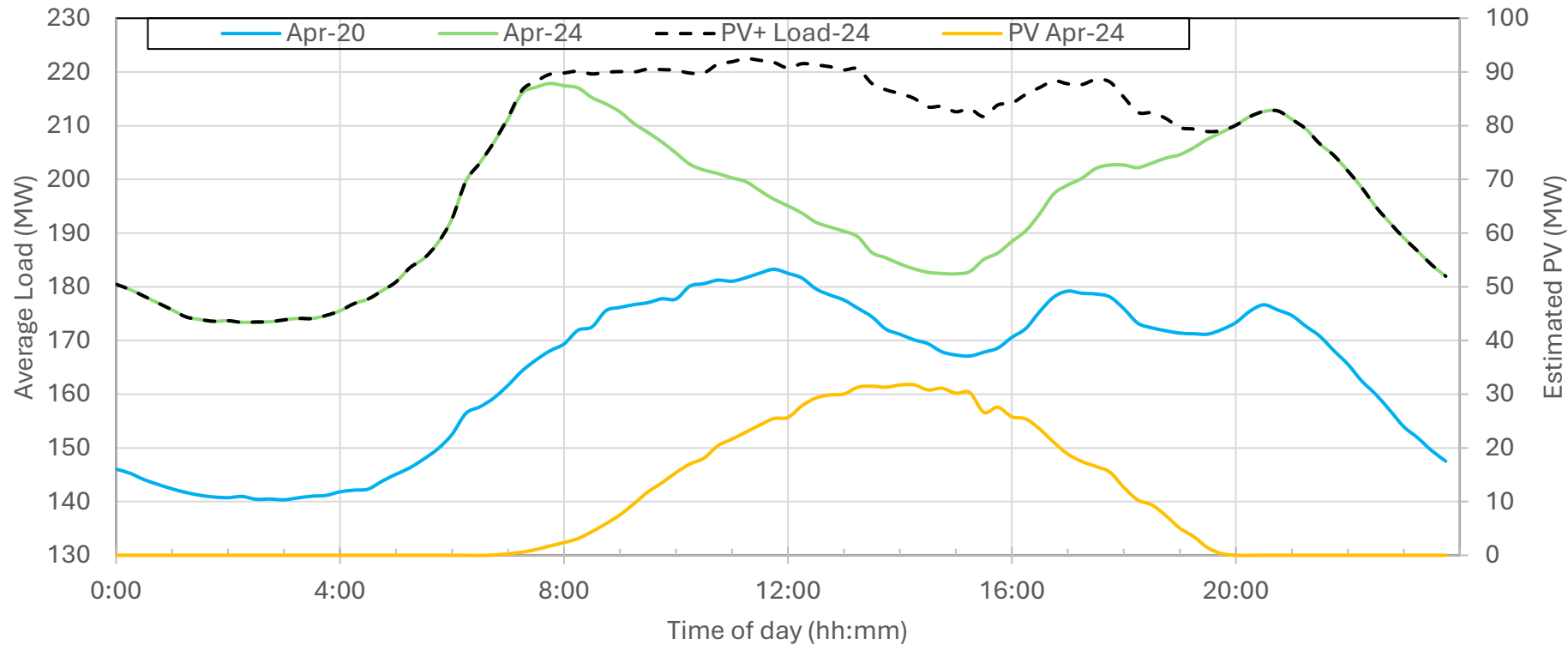
Growth of Loads in PEI



- MECL load collected in 15 minute intervals from public web site
 - Average all days in month to produce average load profile for the month
- 2017-2020 Average load curves have similar profiles by month with modest growth from each year
- Post 2021 load profiles jump across all seasons
- During colder months load increases, but at a higher percentage

Load data collected from <https://www.princeedwardisland.ca/en/feature/pei-wind-energy#/home/WindEnergy/WindEnergy>

Residential Solar in PEI



- Residential Solar Estimate
 - Scale output of 1 of WEICan's arrays to estimated 50 MW installed residential solar
 - Average 15 minute intervals to match load data interval, then average those same as load data
 - Averaging helps normalize environmental effects of real data
- 2024 load profile shows a “Duck” like curve compared to 2020 data
 - Adding in the estimated solar output provides a similar, but increased load profile between 2020 and 2024.

City of Summerside

- Summerside is a city in PEI with a population of almost 15,000 people, that owns and operates its own electric utility, Summerside Electric
- Summerside Electric purchases, sells, produces, transmits, and distributes electricity to more than 7,000 commercial and residential customers
- Summerside Electric's electrical system is made up of:
 - Summerside Wind Farm – Four 3 MW wind turbines - 2011
 - 12.5 MW Diesel Generation Plant
 - Heat for Less Program – Installed smart meters and started selling electric thermal storage units in 2011
 - Convert electricity to thermal energy to store it in the form of a space heater, a home furnace, and a water heater
 - 550 kW solar PV array and 250 kW/890 kWh battery energy storage system - 2017
 - 26 MW solar PV array and 10 MW/20 MWh battery energy storage system - 2024
- Expectation is 62% of Summerside's electricity comes from wind and solar





Grid Integration Research at WEICan

- WEICan is interested in researching methods to overcome challenges seen with an increasingly electrified grid with high renewable energy penetration:
 - Generation sources such as wind and solar are variable by nature, making their generation uncertain
 - Wind and solar generators replace conventional power generators which traditionally provide ancillary services

Examples of Grid Integration Research Projects:

- Demonstrating capability of BESS and renewables providing ancillary grid services
 - Wind R&D Park and BESS AGC signal following, peak shifting, and generation offset with Maritime Electric and AESO
 - Combination Wind and BESS AGC and frequency regulation with NS Power and Cowessess First Nation
 - Demonstrating PV solar and BESS ancillary grid services
- NRCan Utility Forum Secretariat (2019-2023)
 - Planned out research and field demonstrations with utilities and system operators across Canada that had a high identified need and a high research potential



Canada

Wind Energy
Institute of Canada



Institut de l'énergie
éolienne du Canada

Summary and Next Steps

- PEI has made considerable investments in incentives for renewable energy and energy efficiency as we work towards net zero goals
- Increased renewable energy and grid electrification has had consequences on the load on the grid
- WEICan is interested in working with utilities/system operators and governments to research methods to overcome challenges seen with an increasingly electrified grid with high renewable energy penetration

Questions

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