

A MID-TRANSITION FOR ALBERTA’S ELECTRICITY?

As wind and solar generation grows in Alberta – how does that impact dispatchable natural gas power plants?

Alberta is seeing significant growth in renewable energy sources, namely wind and solar. This energy mix transformation is reshaping the operating and market conditions for existing generators. In a [recent paper](#), we explore these dynamics including what the recent and future renewable growth in Alberta means in terms of generation requirements and costs for new and existing natural gas power plants.

Wind and solar are weather dependent and generate variable renewable electricity, but when they do generate electricity, they can displace natural gas consumption lowering greenhouse gas emissions. The growth of renewable capacity in Alberta is shown in Figure 1. As of Nov 2023, Alberta had 5.6GW of wind and solar capacity, an increase from 3.1 GW in Nov 2021, and a figure that is set to grow to 8.8GW during the current construction phase, and ultimately reach 11.9GW upon the completion of approved projects. Forecasts show that this could result in over 35% of demand met directly with renewable energy, reducing the emissions intensity in Alberta from 311.4 kgCO₂/MWh to 221.9 kgCO₂/MWh.

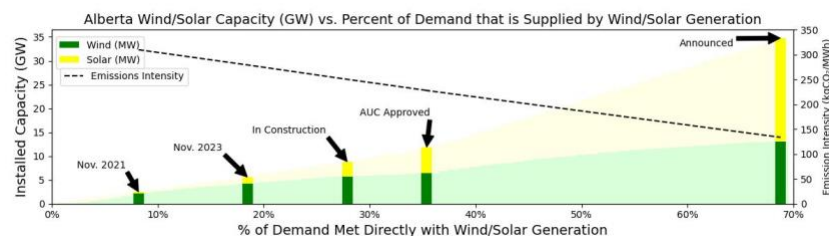


Figure 1. Past, Present, and Forecasted Wind and Solar Capacity in Alberta and their predicted generation as a % of overall Demand.

This will change the patterns and shape of natural gas dispatch, as illustrated in the histograms in Figure 2. The bar height shows how many hours require a natural gas dispatch within that 500MW binned range and the widening curve demonstrates the increased flexibility from firm dispatch that will be required to balance growing variable

generation. When all approved projects are built, 1/3 of all hours could require less than 5000MW of firm dispatch, and we would start to see hours where renewable energy will exceed all demand.

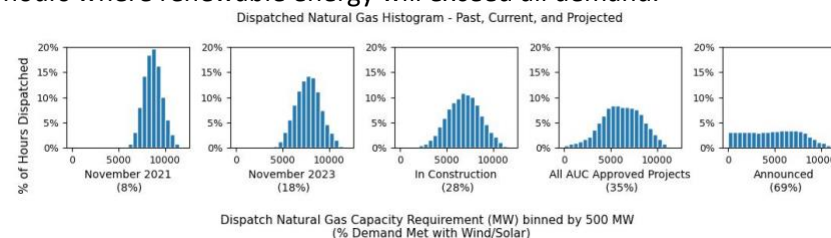


Figure 2. The hourly dispatch required to fill the renewable gaps.

Even with changing dispatch patterns and lower generation, natural gas remains an affordable option to balance wind and solar generation.

Wind and solar generation impact pricing in two ways, costs are lower when low-cost renewables are generating, but the costs for natural gas plants, used to balance supply, must be recovered over fewer hours of generation—raising costs. Our analysis showed that as renewable generation expands, generating costs or the levelized cost of electricity (LCOE), begin to climb when renewables meet 35% of demand and renewable curtailment begins. However, if all announced projects are built, the combined system generation costs are projected to be 59.4 – 71.2 \$/MWh, which are in line with the past 10 year average pool price of 67.3 \$/MWh and well below the past 3 years high average pool price of 132.8 \$/MWh.

With changing dispatch patterns and a greater share of renewable energy, natural gas power plants are an affordable option for balancing variable renewable generation. However, in Alberta’s energy only market, changes are required to reward the flexibility required to support growing renewable power.