The Optimal Geographic Concentration of Alberta's Wind Energy Fleet

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ABSTRACT

Wind energy in Alberta has historically been largely concentrated in the southwestern portion of the province. While this concentration of wind farms takes advantage of exceptionally strong and consistent winds typical in the region, their electricity generation saturate the market at similar times. This results in lower prices for the electricity due to the greatly increased supply of electricity. The lowered price from this saturation is referred to as the "wind discount". This wind discount is discouraging to investors interested in building economical wind energy in Alberta.

This research will evaluate the profitability of building new fleets in the various regions of the province, ranging from regions with high wind speeds to unique regions that may not have the same wind resource but can avoid the wind discount. The research will identify the optimal geographic concentration of Alberta's wind energy fleet moving forward to instill confidence in potential investors.

The research simulates Alberta's electricity market with added wind farms using Energy Exemplar's Aurora software. The added wind farm locations will be selected strategically, with some near existing wind farms, and others distant from existing wind farms but close to existing power lines. This is done to simulate a variety of options where the connection costs are comparable.

The software requires a wind energy profile for each location, which will be estimated by adapting the approach outlined in a thesis completed by University of Alberta alumni Natalia Bonilla. The analysis will use the revenue generated over the lifetime of a typical wind farm to assess the most economic locations to build new wind energy based on the wind and the electricity market alone.

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