The Cost of Net-Zero Electrification of the USA

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Executive Summary

Many governments have made promises to reduce greenhouse gas emissions by replacing fossil fuels with solar and wind generated electricity and to electrify the economy. A report by Thomas Tanton estimates a capital cost of US$36.4 trillion for the US economy to meet net zero emissions using wind and solar power.

This study applies a different analytical approach than the Tanton report used; it also provides new capital cost estimates using 2019 and 2020 *hourly electricity generation data*, rather than annual average conditions employed by Tanton.

This study analyzes electricity produced with fossil fuels on an hour-by-hour basis during several recent years – and calculates the amount of battery storage that would have been required to ensure the availability of the same energy using wind and solar power during windless and sunless periods in 2019 and 2020. This was done by scaling up actual wind and solar production during those years.

The study finds that the battery costs for replacing all current fossil-fuel-fired electricity with wind and solar-generated electricity, using 2020 electricity data, is *111 times that estimated by the Tanton analysis*.

Using 2020 data, *the total capital cost of electrifying the U.S. economy via wind and solar power is estimated at* ***US$290 trillion***, or 13.5 times the US 2019 gross domestic product.

Overbuilding the solar plus wind capacity by 18% reduces overall costs by 17% by reducing battery storage costs. Allowing fossil fuels with carbon capture and storage to provide 60% of future electricity demand dramatically reduces the total costs from US$290 trillion to US$20.5 trillion, a reduction of 92.9%.

Battery storage costs are highly dependent on the year's weather and the seasonal shape of electricity demand.

*Version 2 utilized the ratio of the efficiencies of internal combustion vehicles to electric vehicles. The factor of 0.21, was not considered in the Tanton Report. The battery efficiency was reduced from 90% to 80%, which increased the battery storage by 2.0%. The cost of carbon capture and storage was increased by 11%.