September 28, 2023

Comments on Maryland's Climate Pathway Report

The Maryland's Climate Pathway is a decent policy study with the exception of the electric power section which fails to provide evidence that Maryland's goal of net zero by 2045 can be met with renewables

Eliminating fossil fuel starts with electric power. Zero GHG electric power is essential for electrification strategies to be an effective tool for net zero economy wide. If the electric power representation is inaccurate, any conclusions that depend on clean electric power cannot be trusted. This memo identifies major problems with the electric power portion of the Pathway report.

1. The top Key Finding, that Maryland' net-zero climate goal by 2045 is unproven, indeed contradicted by data in the report. While Fig. 2.4 shows zero GHG Maryland generation, figure 2.5 shows that on average, 32% of the electricity consumed in Maryland in 2045 would come from dispatchable imports. Note that the 32% is net average. Instantaneous (hourly) imports/exports can be much larger, equal to (imports) or multiples of (exports) average load. Major results should not be trusted.
2. The study used GCAM-USA. The electric power modeling is based on Load Duration Curves (LDCs). The LDC is a stochastic methodology invented in 1972 as a way to estimate the reliability of a system of generators with independent forced outages. It works reasonably well for that application. Since 1996 it has been known that the LDC method is inaccurate when applied to wind & PV. It ignores temporal correlation, understating the impact of intermittency. State-of-the-art today is chronological hourly dispatch modeling.
3. No validation report could be found for GCAM electric power system modeling. An engineering best practice is to compare model predictions with physical system data to quantify modeling accuracy. Without validation, modeling needs to be regarded as academic speculation, not investment quality.
4. Pathway ignores the only proven solution, new nuclear. All of the big clean grids around the world (France, Quebec, Ontario, Sweden, Norway, British Columbia, Paraguay and Switzerland) are some combination of nuclear and hydro.
5. Our chronological dispatch modeling of PJM based on NREL/ATB unit costs concludes that the low-cost technology combination is nuclear fission at 70% of peak capacity, 98% of system energy, supported by green fueled combustion turbines at 30% of peak capacity, 2% of system energy. Small amounts of wind and PV can be tolerated although intermittent generation always adds cost to a nuclear/peaker system.
6. GCAM employs interstate power transfers without a market price model. Market prices for large interstate transfers is unknowable.
7. Climate pathways present no system cost estimation. Our chronological dispatch modeling shows 100% wind + PV + storage is theoretically feasible but impractical as overgeneration and seasonal storage drives system costs to 5-15x current cost.

Conclusion

Maryland's Climate Pathway is a policy study that steps beyond policy attempting to engineer a new electric power system. The policy analysis based on the assumption of clean electric power may be sound. The engineering analysis of how to generate reliable electric power is not. Maryland should consider combining this effort with the 100% Study and enlisting the support of experienced systems engineers. The 100% Study is at least employing a sound electricity generation model.

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