Nutwood

Letter from America: Transmission Queues Costly

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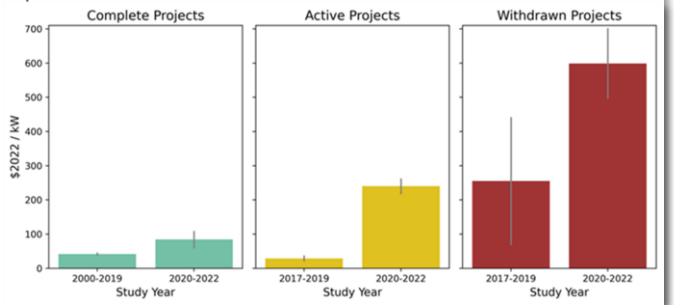
Getting connected to the grid has turned into a serious bottleneck

The big push to decarbonise the electricity generation mix is gaining momentum nearly everywhere as more renewable resources are brought online. This has resulted in a host of challenges from finding the parts and components that go into solar plants and wind farms to shortages of skilled labour required to install and maintain them and managing the inherent variability of renewable generation. Another problem that has become pronounced in recent years is how to connect and integrate all the new renewable plants into the existing transmission system, which in many parts of the world is already operating at or beyond its design capacity. The issue has turned into the biggest bottleneck in the US decarbonisation efforts. It takes too long to process an application to interconnect and – even if permission is obtained – it takes even longer to upgrade the transmission network or add new capacity. The net result is that the existing long interconnection queues are getting even longer, frustrating the developers, investors and plant operators. Delays in integrating more renewables also hurts customers who stand to gain from the lower costs and the environmentalists who are pushing for an accelerated transition to a low carbon future.

PJM interconnection costs rising over time

Grouped by status. bars show simple means, gray lines represent standard error



Source: LBL, Jan 2023

Research by the Lawrence Berkeley National Laboratory (LBL) documented the scale of the interconnection queues as well as the rising associated costs in a number of the US wholesale markets. In January 2023, another LBL report presented similar findings for the PJM Interconnection, the largest organised US electricity market. It said: “For projects with completed studies and plants now in service, costs have doubled. For active projects still in the queue, estimated costs have grown eightfold since 2019.” LBL said substantial interconnection cost increases have occurred in parallel with the tremendous growth of PJM’s interconnection queue in recent years. The study, which covers data through December 2021, said PJM had 259GW of generation and storage capacity actively seeking grid interconnection. Of these; 116GW was solar, 42GW standalone battery storage, 32GW solar-battery hybrids and 39GW wind. The PJM data includes projects no longer seeking interconnection either because they are already in service – 79GW – and those whose applications have been withdrawn – 432GW – the latter presumably because the queue was too long and/or the costs of interconnection too high. “PJM’s queue has ballooned in recent years, with 2021’s active queue increasing by 240% compared to year-end 2019. The capacity associated with interconnection requests is nearly twice as large as PJM’s peak load in recent years (~155GW).”

“This explosive growth of interconnection requests along with lengthy study timelines and high project withdrawal rates motivated PJM to reform its interconnection process in 2022. PJM adopted a ‘first-ready, first-served’ cluster study approach and increased study deposits that are at risk when projects withdraw.”

LBL examined over 1,100 projects or 86% of all new generators in PJM between 2000 and 2022. It noted: “The paucity of easily accessible interconnection cost data poses an information barrier for prospective developers, regulators and policy makers, resulting in a less efficient interconnection process.”

As in prior studies, LBL examined interconnection cost data for 3 types of projects including:

- Those that have completed all required studies, including plants now in service, referred to as “complete”.
- Those actively working through the study process, referred to as “active”.

- Those that have withdrawn from the queue, referred to as “withdrawn.”

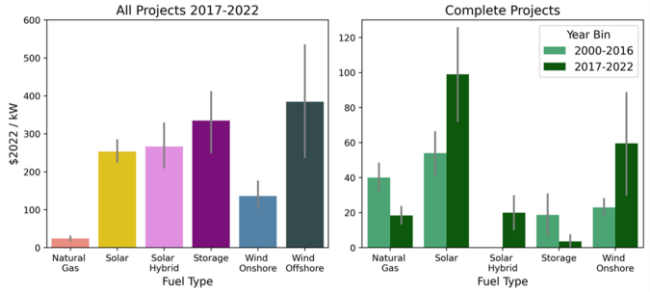
It found that PJM interconnection costs have grown across the board:

- For complete projects, average costs have doubled relative to costs from 2000-2019 (mean: $42 to $84/kW, median: $18 to $30kW).
- Mean costs for active projects have grown even more, from $29/kW to $240/kW (2017-2019 vs. 2020-2022, median: $8 to $85/kW).
- Withdrawn projects face the highest costs (mean: $599/kW, median: $156/kW) - likely a key factor in the withdrawals.

Project costs, however, vary widely within the sample with a small number of high-cost projects pushing average costs to rise above median costs. The main driver for the cost increases is the network upgrade costs. LBL said the average costs for upgrades beyond the interconnecting substation have risen sharply since 2019, to $71/kW for complete projects, $227/kW for active projects and $563/kW for withdrawn projects. Some generators experienced lower network upgrade costs by choosing interconnection services as an *energy* instead of a *capacity* resource. This is an important technicality that comes with severe consequences. Project developers who select energy resources forfeit preferential treatment during high load hours, cannot participate in PJM’s capacity market and may face increased curtailment. The LBL study reported wide variations in average interconnection costs for different types of resources (visual next page): $24/kW for natural gas, $335/kW for storage, $253/kW for solar and $136/kW for onshore wind, $385/kW for offshore wind.

PJM interconnection costs by fuel type (left) and over time for complete projects (right)

Bars depict means, gray lines: standard error



Source: LBL, Jan 2023

Among recently completed projects, interconnection costs have fallen for natural gas ($18/kW) while increasing significantly for both solar ($99/kW) and onshore wind ($60/kW) relative to 2000-2016 costs. Costs for active and withdrawn storage and solar hybrid projects were surprisingly high ($337/kW), much less for complete projects (storage: $4/kW, solar hybrid: $20/kW). The January 2023 report on PJM is the second in a series analysing interconnection costs in the US wholesale electricity markets. An October 2022 study covered MISO. LBL expects to publish analyses of NYISO, ISO-NE, and SPP later in 2023. What are the underlying reasons for the long queues, how serious are they and are they limited to the US?

- The fundamental driver is the sheer increase in applications from renewable developers who are driven by state and federal decarbonisation targets and wish to take advantage of the recently passed Inflation Reduction Act (IRA), which offers attractive subsidies. There are simply too many for the existing transmission network to handle; and
- The delays in getting connected to the network are serious because developers cannot make any money if they cannot sell the output of their plants in the market.

The phenomenon is global because getting the necessary permits and building additional transmission lines has never been easy anywhere. It is simply getting worse. According to *The Financial Times*, renewable projects now face 10-year wait to connect to the UK’s electricity grid. Similar numbers are common across Europe and elsewhere. In Australia, where some states are planning to retire their coal-fired plants and replace them with wind, solar and storage, this has resulted in intense competition among project developers to get connected to the grid. According to a 30 January 2023 article in *RenewEconomy* the competition among battery storage projects is most intense. It says recent applications for planning approvals in New South Wales (NSW) show at least 8 big battery projects located within a few hundred meters of a competing project. The ultimate decisions are likely to be decided by the NSW roadmap, which will be selling “access rights” as part of its plans for more than $21bn of new generation and storage over the next decade. Clearly, different regions of the world are experiencing similar issues and are exploring different means of dealing with the interconnection queues.