Risks of rapid data center growth in PJM

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The rise of the data center industry in the mid-Atlantic states is driving a significant acceleration in load growth projections across PJM. This surge in demand is occurring in the context of a grid that is already preparing for increased load due to electrification efforts and ambitious climate goals. The projected data center load growth has the potential to significantly increase greenhouse gas emissions and raise energy costs for ratepayers.

In order to understand the importance of proactively planning for data centers, we analyzed electric system costs, CO_2 emissions, resource builds and residential bills. Utilizing capacity expansion modeling, we compared two prospective future scenarios. One scenario, the Base case, examined a future without any data center load growth. The second scenario, the Data Centers case, examined a future with data center load growth, absent any emissions mitigation strategies.

PJM annual energy consumption and peak load are projected to increase substantially through 2040

Figure 1 illustrates our load forecasts in each scenario. Data centers are projected to make up 313 TWh of PJM's annual load by 2040, representing a 28 percent increase above the Base case. Data centers are also projected to make up 49 GW of PJM's peak load in 2040, representing a 20 percent increase in peak load above the Base case. While there is uncertainty around future levels of load growth, our study relies on the latest available information to indicate the scale of potential impacts of data center growth.

Figure 2 shows the generation, loads and net imports in our Data Centers case. Without mitigation policies, new data center load growth is served half by additional gas generation and half by additional solar and wind generation. The system requires 114 GW of additional resource builds to be able to meet this load. Nearly two-thirds of the additional resource builds are new renewable energy resources and one-third consists of new gas capacity.

Figure 1. PJM annual load (TWh)

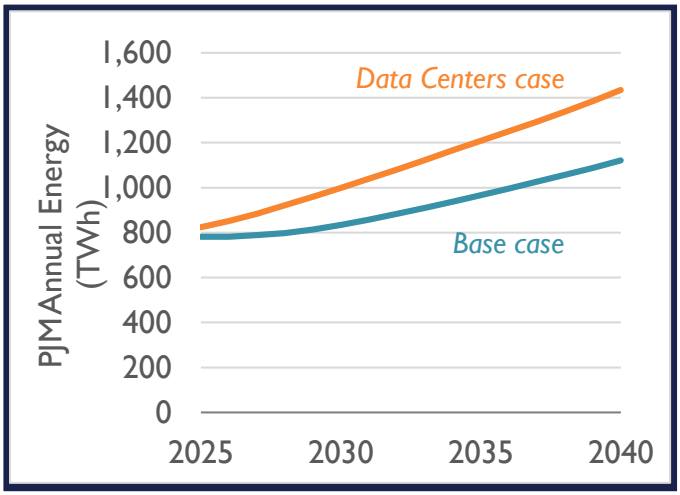
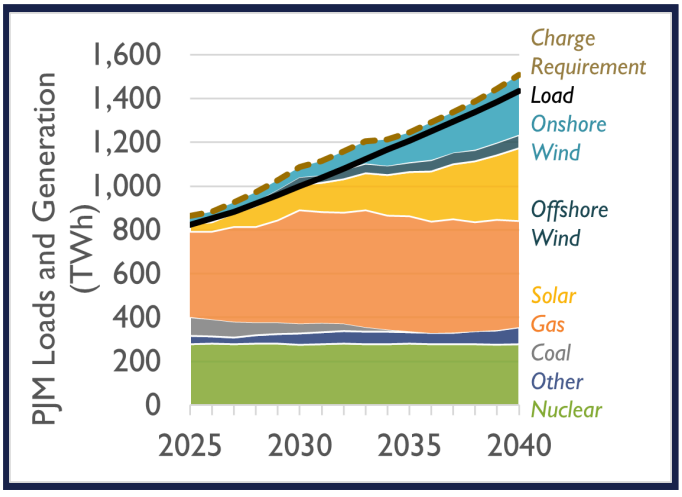


Figure 2. Generation, loads and net imports for Data Center case



Without thoughtful rate design, data centers could raise PJM residential bills

Data centers increase the net present value of total system costs from 2025-2040 by $160 billion.[i] High loads and supply-side constraints related to the PJM interconnection queue drive greater dependence on inefficient and costly generation sources. As a result, data centers drive an increase in wholesale energy and capacity costs, resulting in higher bills (see Table 1).[ii] In the near term, this translates into a residential bill increase of around 10 percent. In the longer term, we project that the eventual resolution of supply-side constraints in PJM will enable cheaper and cleaner wind and solar resources to be built to serve data center load, reducing the magnitude of the bill impacts in the longer-term.

Different approaches to cost allocation could reduce or increase bill impacts

In order to avoid increasing costs for residential customers, data centers would have to pay more than 50 percent above their projected rates in the near-term and 11 percent above their projected rates in the long-term. If data centers were to be given reduced rates, as is currently being proposed by several utilities, residential customers could face even greater bill impacts. As the amount of data center load on the system grows over time, the potential risks of cost shifting to residential ratepayers grows too (see Table 2).

Data centers will increase CO_2 emissions from fossil fuel generation

From 2025-2040, data center loads are projected to cause an increase of 1,014 million short tons of CO_2 emissions in PJM. In the near term, increased load growth from data centers drives up existing coal and gas plant generation and causes some coal plants to stay online longer to meet the increasing demand. In the longer term, data center load drives an increase in new gas capacity and generation, resulting in increased CO_2 emissions.

Table 1. Monthly average PJM residential bills and bill impacts (2022 dollars)

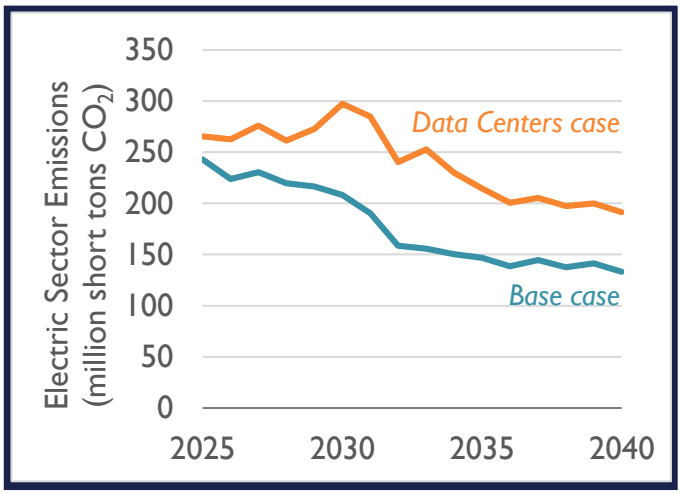
	2021-2023 (EIA historical)	2025-2030 (Modeled near-term)	2031-2040 (Modeled long-term)
Base case	**$126**	**$124**	**$146**
Data Center case		**$136**	**$152**
Bill impact of data centers		**+$11.9**	**+$5.7**
% Change in bills		**+9.6%**	**+3.9%**

The values shown in this table are averages for the PJM region. Impacts will vary by state depending on several factors, including the distribution of data center load growth.

Table 2. Estimated incremental impacts on monthly residential bills (2022 dollars)

Level of rate discount given to data centers	Resulting increase in residential bill	
	2025-2030	2031- 2040
10% Discount	**+$1.5**	**+$2.8**
20% Discount	**+$3.0**	**+$5.6**
30% Discount	**+$4.4**	**+$8.4**

Figure 3. PJM CO_2 emissions



Endnotes

[i] The total system costs include energy market costs, capacity market costs, transmission build costs and Renewable Energy Certificate (REC) costs. NPV calculation assumes a 7 percent discount rate

[ii] Capacity market and transmission cost allocation for data centers were based on their contribution to system peak load. Non-data center load costs were allocated to different customer classes based on historical data from EIA.

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