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## Introduction

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NOVEC requested an adjustment to the 2025 PJM Load Forecast to reflect continued expansion of the data center industry within NOVEC service territory (see Table 1 below for a yearly summary). The growth drivers and load profile of data centers are fundamentally different from those of other types of commercial load. As a result, modelling data center loads independently, as opposed to part of the broader commercial and industrial sectors, is essential to produce a sound and defensible load forecast.

This document is prepared and submitted following NOVEC's 2024 large load adjustment request and its preliminary acceptance by PJM in November 2024. In this report, we will provide a clear and detailed summary of NOVEC's data center forecasting process to promote transparency, development of best practices, and to fulfill the requirements stated in PJM Manual 19 Attachment B.

## Forecasting Process Overview

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NOVEC creates data center load forecasts through a structured, systematic process in two phases that incorporates in-depth information on committed data center projects together with fine-scale historical data on data center load behavior. NOVEC's data center forecasting process uses a "bottom-up" approach: NOVEC develops load forecasts for individual data center buildings that are then aggregated to create campus, substation, delivery point, customer, and system forecasts.

NOVEC updates its data center forecast once per year in sync with the PJM load forecast adjustment timeline. The same load forecast that we share with PJM is also used internally by NOVEC for planning, budgeting, and financial forecasting and analysis. NOVEC also shares the forecast with Dominion Energy for transmission planning and operational uses. All three groups, PJM, NOVEC's internal teams, and Dominion Energy, receive the same forecast with no changes in input data, assumptions, approach, or methodology.

## Project Identification and Vetting

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Data centers must pass through NOVEC's development queue process prior to receiving service. Our project queueing and contracting processes are the product of more than 20 years of experience working with our data center customers. NOVEC's development process provides a clear, consistent, streamlined process for our customers to get electric service to their projects as soon as possible. At the same time, NOVEC requires the customer to make substantial financial commitments at each stage of the process, encouraging customers to engage us on genuine projects that they fully intend to develop and discouraging customers from bringing projects that are speculative in nature. Overall, the process has been extremely successful on all fronts.



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The queue itself is a multi-year process with several stages associated with key contractual agreements and development milestones:

1. FS (Feasibility Study): FS in progress. Customer has provided initial inquiry and non-refundable deposit. NOVEC is developing a conceptual scope document.
2. LOA (Letter of Authorization): LOA executed. Customer has provided a draft site plan, development schedule, and additional funds in the form of a non-refundable deposit. NOVEC begins developing a plan for service.
3. WPD (Work Plan in Development): Plan for service has been developed, NOVEC staff are working through final details such as substation access, buffers, feeder routing, etc. Dominion Energy is engaged for conceptual engineering. NOVEC and Dominion Energy are developing a work plan including construction grade cost estimate and project schedule.
4. WPO (Work Plan Official): Work Plan executed. NOVEC has finalized the plan for service and customer has finalized their site plan. Customer provides first Contribution in Aid of Construction (CIAC) payment to finance initial electric infrastructure construction activities. NOVEC initiates construction activities with Dominion Energy.
5. E&C (Engineering and Construction Scope Document): E&C Agreement executed. Customer has committed to fully fund the construction of NOVEC infrastructure and begun making regular CIAC payments. NOVEC begins procurement of long lead equipment.
6. ESA (Electric Service Agreement): Final contract governing electric service and electric infrastructure signed.
7. In-service: Customer is energized.

For forecasting purposes, NOVEC only includes projects that are actively working their way through our development queue detailed above. NOVEC does not include any projects that are purely speculative in nature, for example based on rumors or industry reports. NOVEC also does not generate projections for potential sites that could exist, for example by extrapolating historical rates of development.

In addition, NOVEC staff thoroughly vet each individual project in NOVEC's data center development queue to identify any projects that are at a high risk of failure. High risk factors can include outstanding zoning issues, lack of firm site plan from the customer, technical issues related to electric service, among others. Any project that is deemed as a *high-risk* project by NOVEC staff is excluded from NOVEC's load forecast and can only be added to the load forecast after all outstanding issues have been resolved. NOVEC staff also ensure that customers have not submitted duplicate requests for the same project at multiple locations and that multiple customers have not submitted requests to develop projects on the same tract of land, eliminating the risk of double counting.



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In summary, NOVEC maintains a robust contracting and development process that effectively separates true, bona fide projects from projects that are unserious or speculative in nature. Additionally, NOVEC staff further screen each project to ensure that any projects at high risk of failing are excluded. The end result is that all projects included in the load forecast are backed by signed contracts and financial commitments, have been thoroughly vetted by NOVEC staff, and are extremely likely to come to fruition.

### Metered Load Forecast

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NOVEC's data center load forecast is a *metered load* forecast: predicting the expected demand on the electric system. In the project identification and vetting stage, we identify all the data centers that are in-service or expected to be developed, their timelines for construction, building capacities, and the electric infrastructure that will serve each facility; this constitutes a *capacity* forecast. In this second stage, NOVEC uses models developed with data center historical fine-scale load data and predicts the expected demand and energy at each data center, with the exception of high-risk projects that are excluded from the forecast, to produce a *metered load* forecast.

NOVEC has been serving data centers for more than 20 years and during that time has devoted substantial resources to studying the load profile and usage patterns of our data center customers. While each facility has its own unique operating behavior, we have observed several common features across data centers:

- Data centers tend to have a pronounced two stage life cycle. At initial energization, the customer will have little to no load. New facilities go through a *ramping* phase, gradually increasing their demand over a period of several years. Eventually the facility reaches a *mature* phase where demand remains relatively steady over time.
- Mature data centers tend to have very high load factors and power factors, compared to typical residential and commercial customers.
- Data center demand follows typical calendar patterns with a daily, weekly, and annual cycle. However, the magnitude of the calendar-driven demand fluctuations tends to be far smaller than the typical patterns for residential and commercial demand.
- Data center demand responds to ambient weather conditions. Data center demand increases in response to hot ambient temperatures, but at a rate far lower than typical residential and commercial demand. In our experience, data center demand does not respond to cold ambient temperatures in any measurable way. Thus, mature data centers often experience peak demand in the summer.

These unique features highlight the need to model the demand of data centers with methods specifically tailored to the characteristics of data center loads, as opposed to standard commercial or industrial load models.



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NOVEC develops a metered load forecast for each individual data center building using a set of econometric models developed by NOVEC staff. The models are designed to capture all the critical features of the data center load profile related to the ramping process as well as calendar and weather fluctuations. The models are trained using NOVEC's repository of historical load data which spans more than a decade of hourly, building-level data center load readings. This rich data set allows us to generate a unique metered load forecast for each building that takes into account how that customer has operated facilities at other campuses, how the customer has operated other buildings on the same campus, and how they have operated that specific facility (when available).

#### NOVEC August 2024 Data Center Forecast

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In September 2024, NOVEC provided PJM a monthly coincident peak load forecast for 2024-2045. This forecast was generated in August 2024 using projects identified through the end of July 2024 as well as econometric models estimated with metered load data through the end of July 2024. This same forecast was also provided to NOVEC's internal teams and Dominion Energy. The forecast is summarized in Table 1 below.

In the near-term, NOVEC is anticipating unprecedented growth in data center load. Over the next five years, NOVEC expects that data center summer peak loads will grow from roughly 1,050 MW in 2024 to nearly 5,900 MW in summer 2029. This load growth will be driven by the construction and energization of more than 100 data center buildings within NOVEC's service territory. Additionally, several major customers currently limited by transmission constraints in Eastern Loudoun County, VA, will be able to access their full contracted capacity as these constraints ease over 2025 and 2026. This will further support near-term growth. Based on the projects currently in planning and construction, NOVEC anticipates robust growth will continue through the late 2020s and into at least the mid-2030s.

NOVEC provides a long-term forecast through 2045 to meet PJM's need for a 20-year outlook. However, NOVEC's forecasting process is based solely on committed data center projects with signed contracts; the vast majority of these projects are scheduled for delivery within the next decade. NOVEC does not perform any type of extrapolation or estimation of potential projects that could be developed; the forecast is limited exclusively to actual projects that are currently in development. As a result, load growth slows markedly over the final years of the forecast. This trend reflects the lack of projects with signed contracts for delivery during that timeframe and should not be interpreted as a projection that growth will not or could not continue at a robust pace during that period. Based on our current project queue, we expect data center loads to grow to more than 11,700 MW in 2034 and 12,500 MW by 2039.

Note that the values reported in the forecast are projections of *metered demand*. The totalized *capacity* of facilities included in NOVEC's data center forecast is approximately 16,500 MW.



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## Future Developments

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NOVEC receives new customer inquiries for data center projects on a regular basis. As noted, each project will need to work its way through NOVEC's strict contracting and vetting process before it can be included in the load forecast.

As of January 2025, NOVEC has an additional roughly 3,000 MW of new data center inquiries which are now at the LOA stage that were not included in the 2024 forecast. These projects, as well as future projects NOVEC receives, may be included in future forecasts if, and only if, they meet our strict contracting and vetting standards at the forecast cutoff date.

## Conclusion

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NOVEC has developed a robust and systematic process to produce data center load forecasts. Our approach uses a bottom-up methodology, combining detailed information on upcoming projects under contract and strict vetting by NOVEC staff, together with careful demand modeling using historical load data. The result is a sound and defensible forecast that can be used with confidence by PJM, Dominion Energy, and NOVEC's internal teams.

In this report, we have provided a summary of our approach not just to fulfill the requirements of PJM Manual 19 Attachment B, but also to promote transparency and the development of best practices across the industry. Rigorous forecasting and planning are critical to managing the challenges created by rapid load growth. NOVEC remains committed to developing solutions to these challenges and to providing safe, reliable, and affordable electric service to all of our members.



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*Table 1: NOVEC Data Center Coincident July Peak Load Forecast (August 2024)*

	Year	MW
Actual	2024	1,049
	2025	1,408
	2026	2,204
	2027	3,170
	2028	4,480
	2029	5,861
	2030	7,243
	2031	8,887
	2032	10,196
	2033	11,075
	2034	11,703
Forecast	2035	12,070
	2036	12,251
	2037	12,353
	2038	12,437
	2039	12,510
	2040	12,567
	2041	12,595
	2042	12,611
	2043	12,618
	2044	12,620
	2045	12,616

Note: Forecast developed by NOVEC August 2024 based on projects identified through the end of July 2024 and econometric models estimated with metered load data through the end of July 2024.