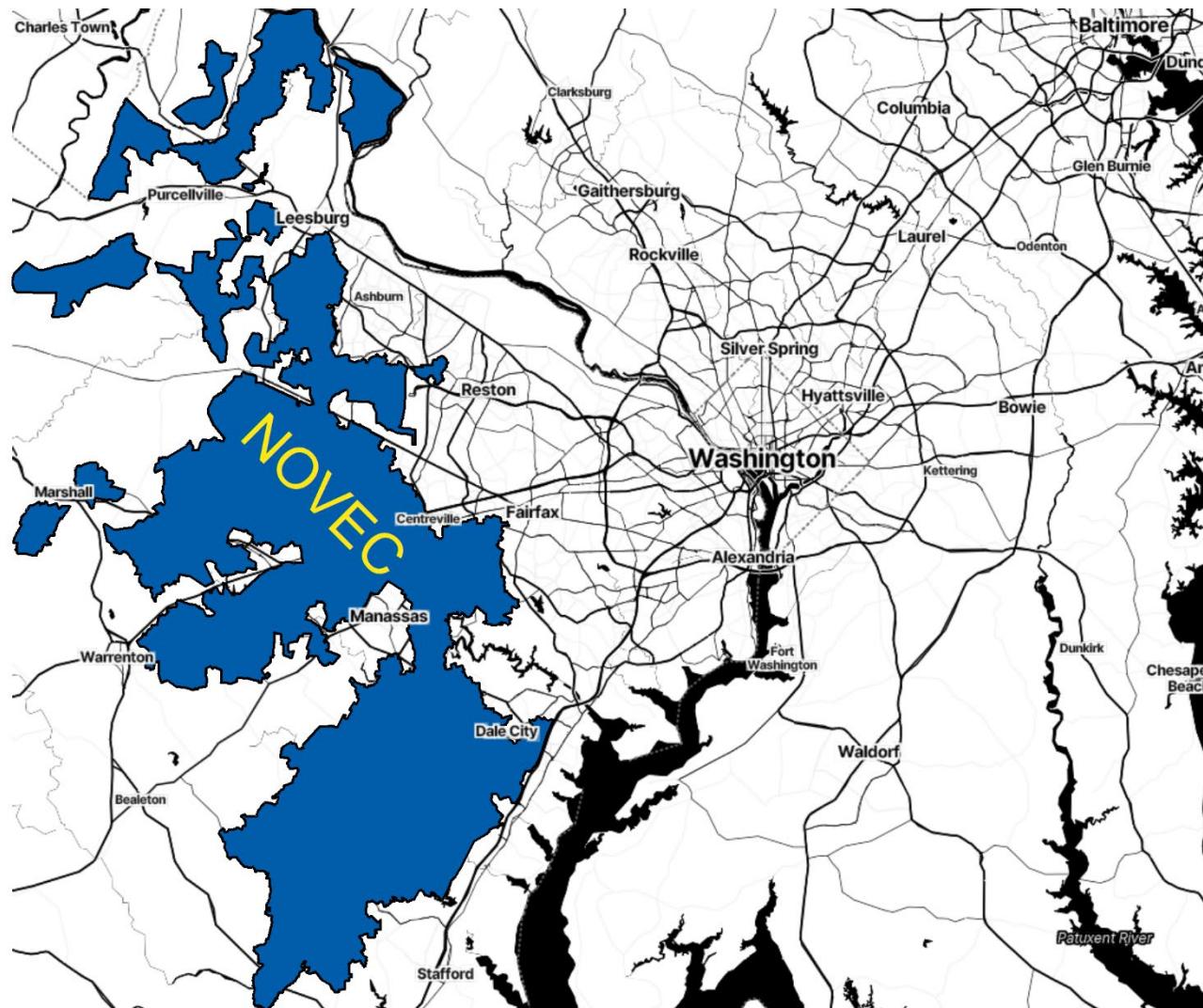




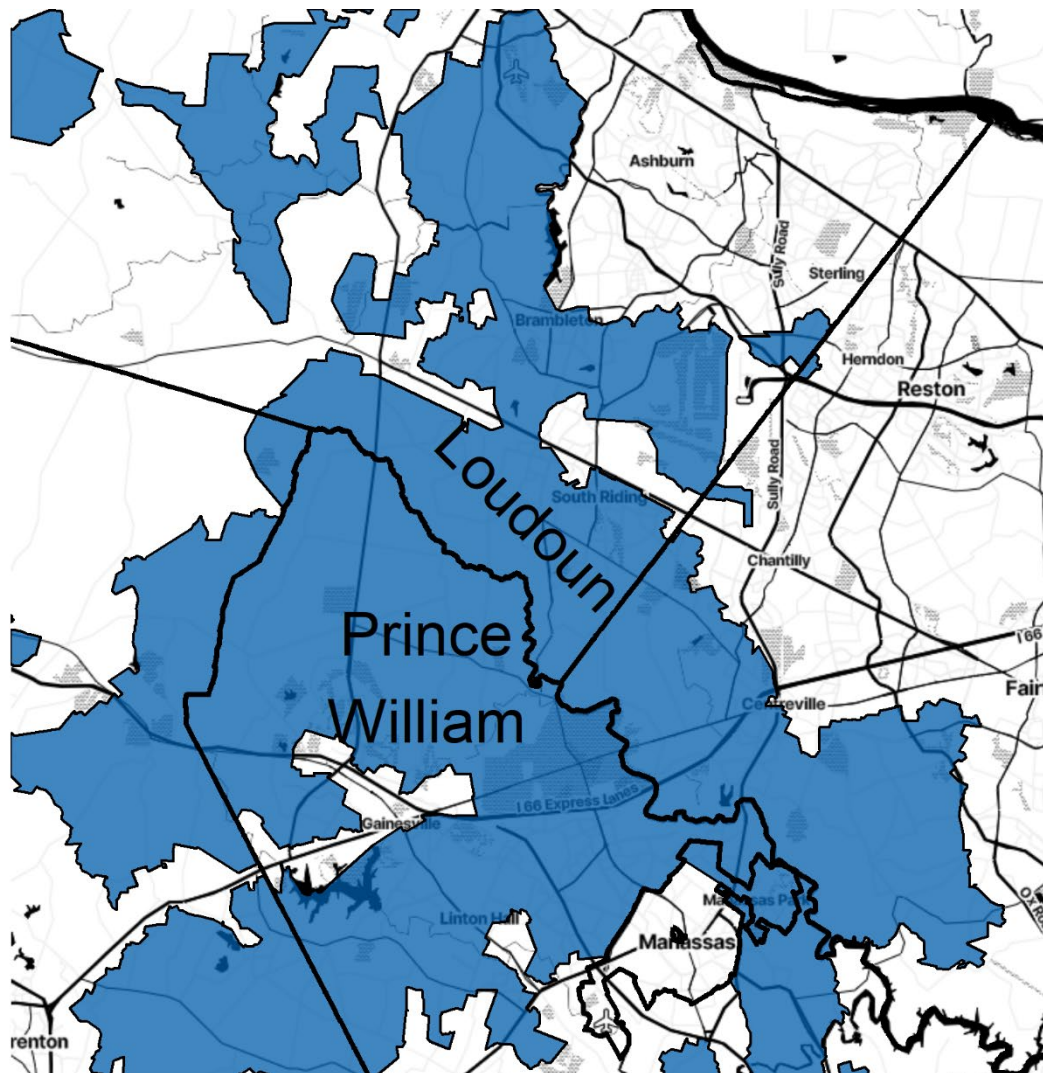
Rapid Growth of Large Data Center Loads

James L. Jones | Northern Virginia Electric Cooperative (NOVEC)
ESIG 2024 Forecasting & Markets Workshop
June 12, 2024

- Rapid growth in data center loads has created new opportunities and challenges for the utility industry
- Agenda:
 1. Background on NOVEC and recent growth
 2. Key challenges for long-term planning
 3. NOVEC's long-term load forecasting process



- NOVEC: Northern Virginia Electric Cooperative
- Service Territory: 651 square miles of primarily suburban/exurban
- Customer Mix: residential, small commercial, critical government facilities, data centers
- Meters: Approx. 180,000 (~275 per square mile)

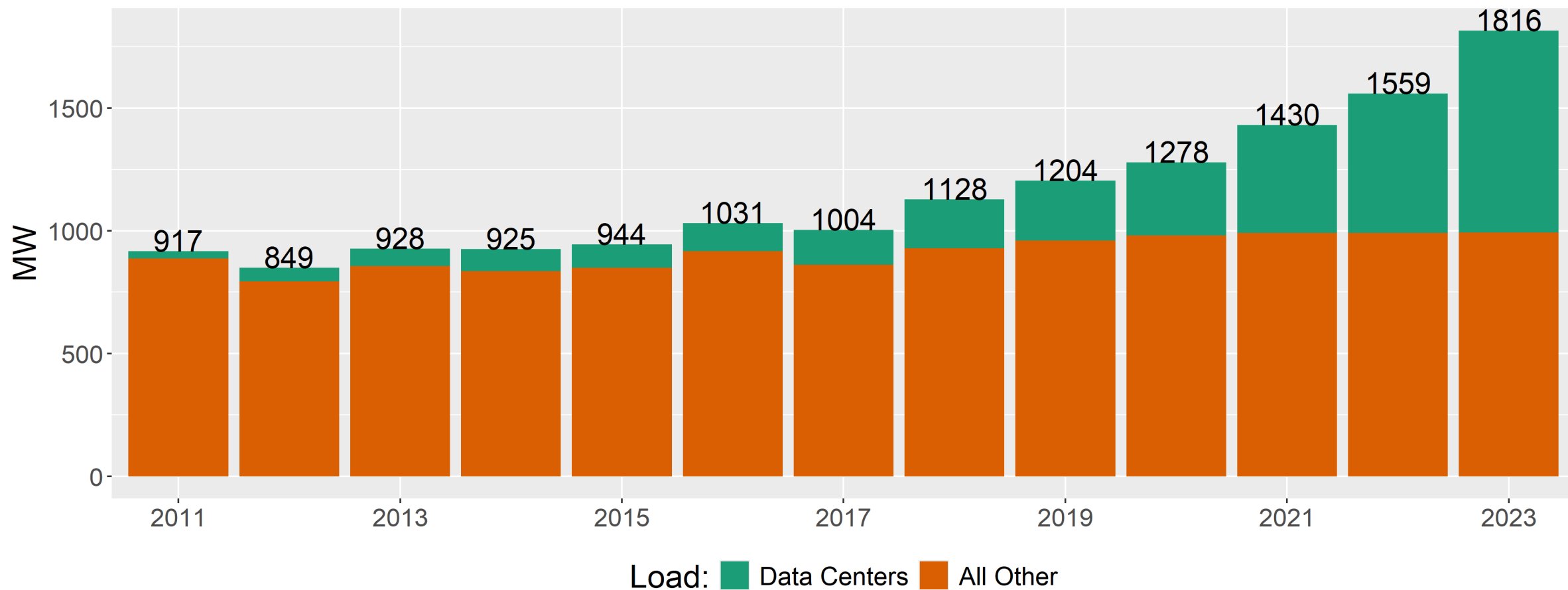


- NOVEC serves 50+ data centers with approx. load of 900 MW
- Contribution:
 - Energy: 63% (Jun. 23-May 24)
 - Summer Peak: 45% (Sep. 23)
 - Winter Peak: 51% (Jan. 24)
- Key hotspots: Loudoun and Prince William



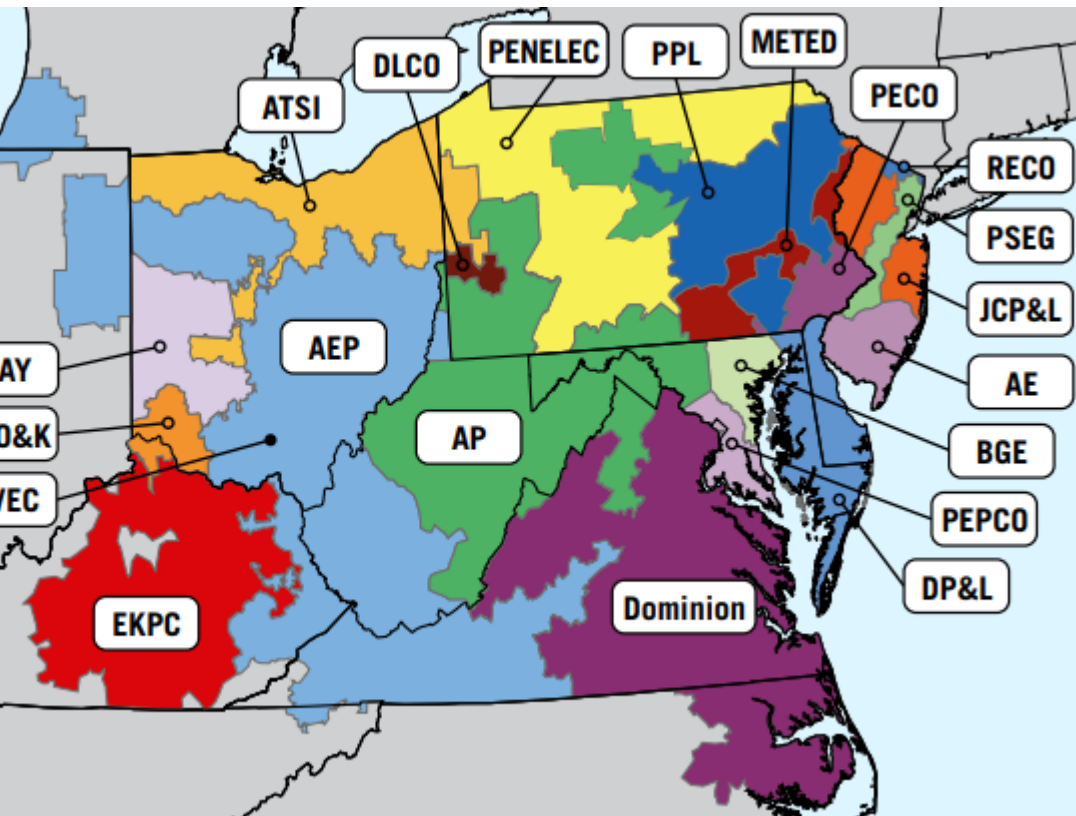
Rapid Load Growth for NOVEC

NOVEC System Summer Peak Load | 2011-2023 Actual

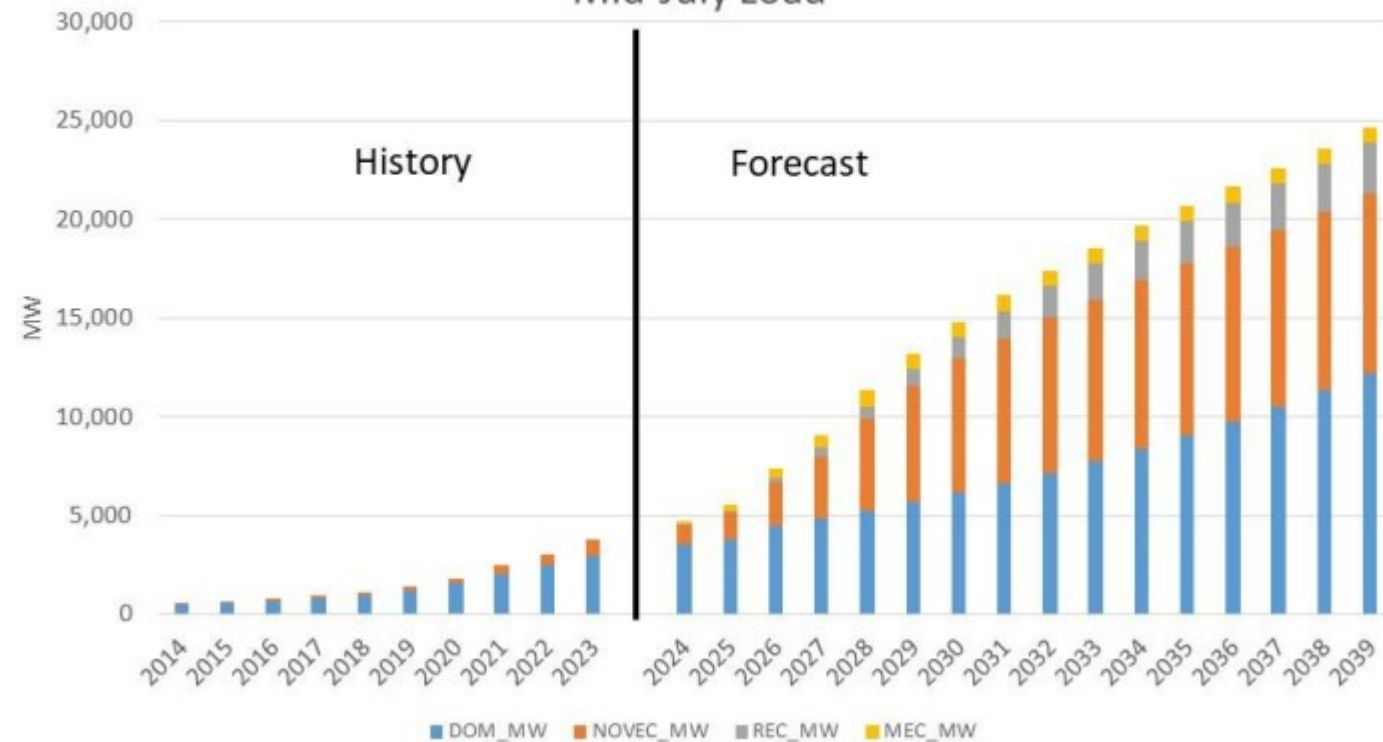


Source: NOVEC

PJM Transmission Zones



Dominion Zone Total Data Center Historical and Forecasted Mid-July Load



Source: PJM 2024 Load Forecast – Load Forecast Supplement

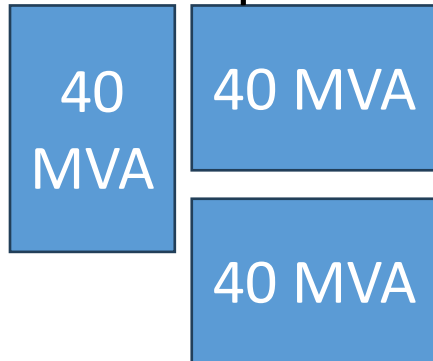
- Northern Virginia has limited local generation, transmission is critical
- An accurate load forecast is key to prevent over or under building
- Major Milestones:
 - Summer 2022 – transmission constraints announced in Eastern Loudoun County
 - Dec 2023 – PJM approves \$5 billion in network upgrades
 - ▶ Currently, transmission costs are borne by all rate payers
- The planning and forecasting process now receives intense scrutiny
- **The load forecast must be sound and defensible**

- Key terms:
- Contracted capacity – nameplate capacity of the building's electric service
- Metered demand – building's actual usage
- Utilization rate – metered demand as a percentage of contracted capacity

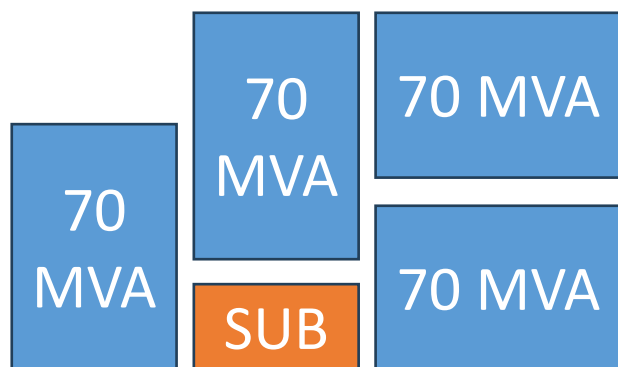
Building



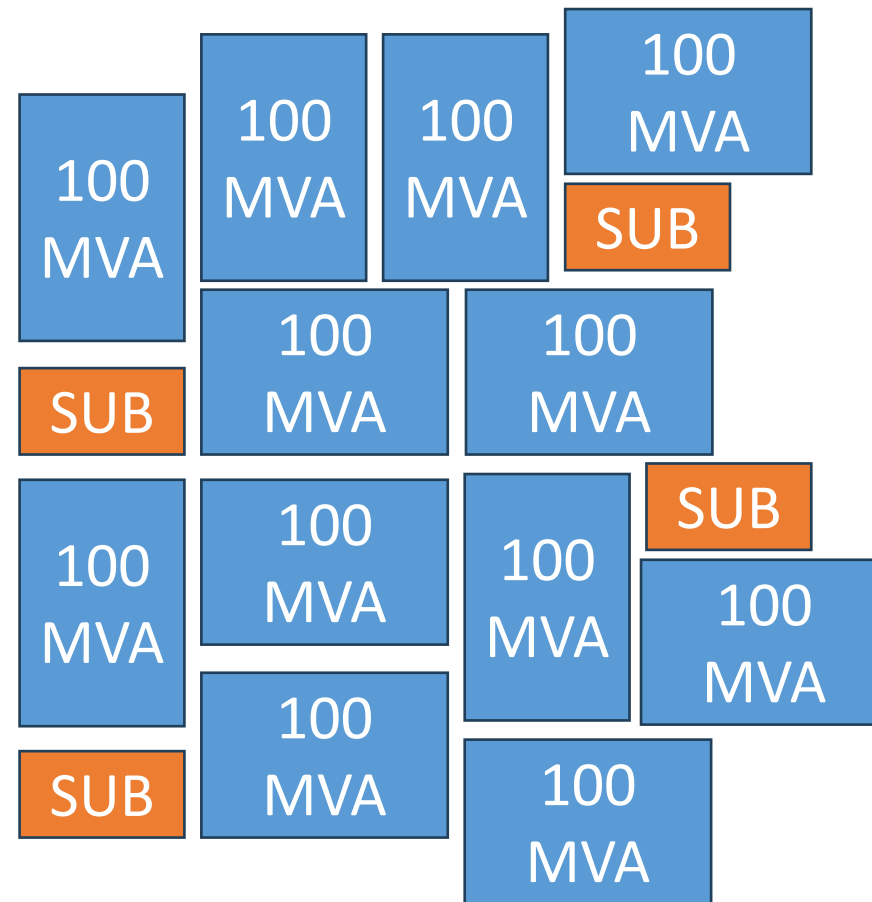
Campus



Campus + Dedicated Substation



Mega-Campus + Multiple Dedicated Substations



- Two phases:
 1. Ramping – load increases over time while building is filled out
 2. Maturity – building is fully constructed, load remains relatively stable over time
- Key features:
 - Daily/weekly/annual seasonal patterns
 - Weather sensitivity (cooling only)
 - Very high load factor
- Heterogeneity: every customer, campus, and building is unique

- NOVEC utilizes a bottom-up forecasting approach for data centers
 - Forecast load on individual buildings
 - Aggregate building loads to campus, substation, region, system
- Phase one: identify all data centers in NOVEC service territory
- Phase two: produce metered load forecast for each building

- NOVEC identifies all current and upcoming data center projects within our service territory
- Includes: active, under construction, or planned projects highly likely to be successfully developed
- NOVEC's analysis includes:
 - Collecting a detailed site plan
 - Identifying the electric infrastructure that will serve each project

- NOVEC generates a metered load forecast for each building identified in the planning phase
- Econometric models were developed and are used by NOVEC staff to predict building-level utilization rates (metered demand/contracted capacity) conditional on:
 - Calendar factors (day of week/day of year)
 - Weather factors (cooling degree days)
 - Past behavior at the customer, campus, and/or building-level when available
- Building-level forecasts are aggregated to campus/substation/region/system as needed



Near-term Forecast

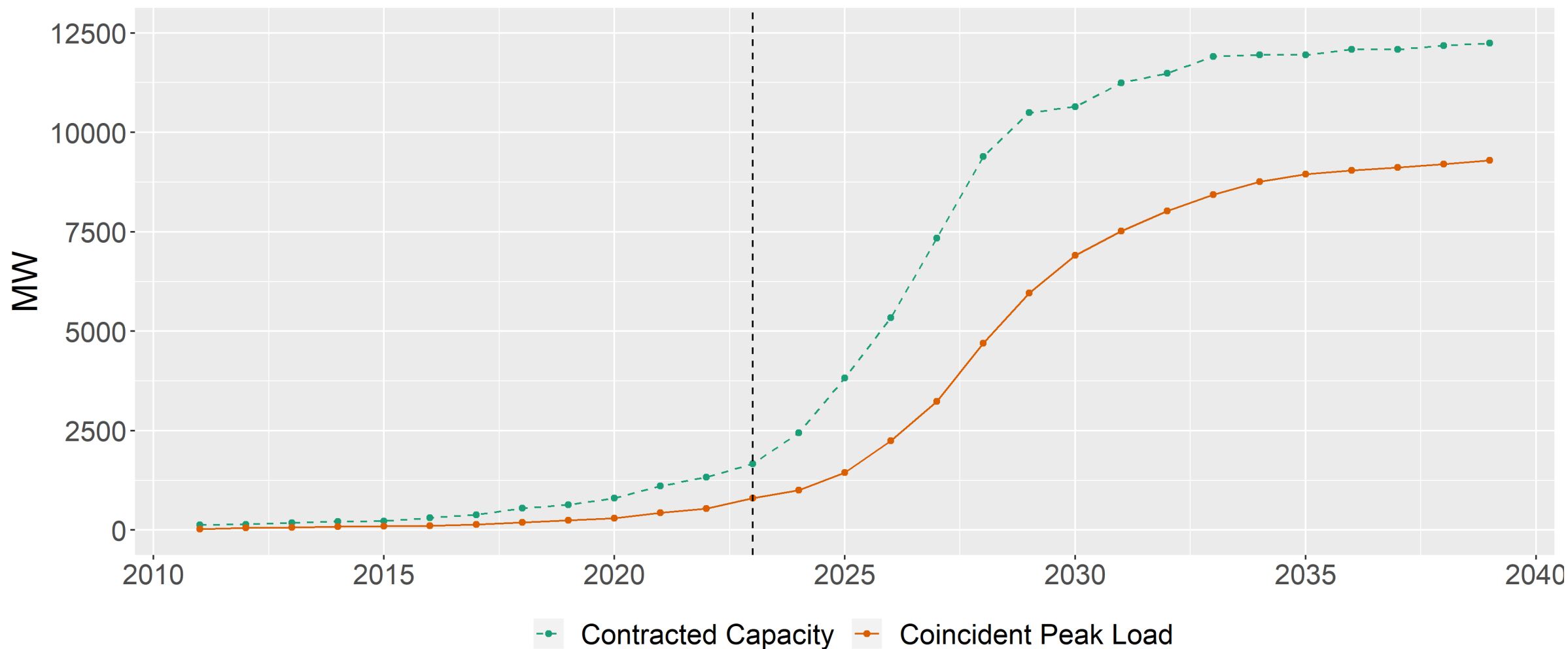
August 2023 Forecast Vintage

	Actual					Forecast				
	Jul 2019	Jul 2020	Jul 2021	Jul 2022	Jul 2023	Jul 2024	Jul 2025	Jul 2026	Jul 2027	Jul 2028
Data Centers (#)	24	29	34	38	47	63	84	106	130	159
Yr-Yr Change	3	5	5	4	9	16	21	22	24	29
Contracted Capacity (MVA)	636	799	1,114	1,333	1,675	2,456	3,830	5,348	7,345	9,399
Yr-Yr Change	88	163	315	219	342	781	1,374	1,518	1,997	2,054
Coincident Peak Load (MW)	243	298	432	545	808	1,000	1,449	2,247	3,239	4,696
Yr-Yr Change	54	55	134	113	263	192	449	798	992	1,457



Long-term Forecast

August 2023 Forecast Vintage



- Data centers are the main drivers of growth for NOVEC and the broader DOM transmission zone
- Rapid load growth has created tremendous challenges, especially for the transmission system
- A sound, defensible load forecast plays a critical role in navigating these challenges