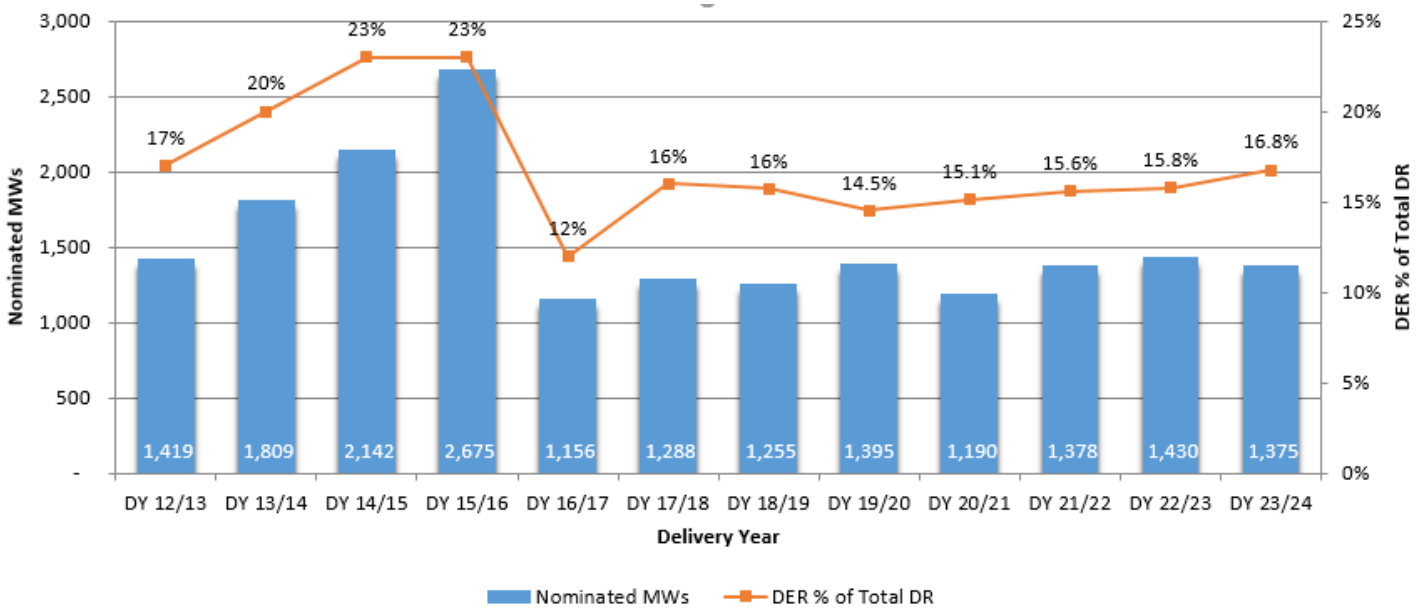
2023 Distributed Energy Resources (DER) that participate in PJM Markets as Demand Response

PJM Demand Side Response Operations

February, 2024

For the purposes of this report PJM will refer to behind the meter devices capable producing electricity in Demand Response as “DR DER”.

Figure 1: Demand Response from DER in Capacity Market



DER participation in the Capacity Market as Demand Response, represented here both in MW volume and as a percentage of overall Demand Response volume, showed steady growth through 15/16 DY and then dropped by close to 50% in16/17 DY. For 23/24 DY the amount of DR DER decreased from previous year by about 55MW and its share of total DR remained similar to previous delivery years.

Observation: Based on discussions with CSPs, PJM believes the drop in 16/17 DY was due to U.S. Court of Appeals for the District of Columbia Circuit issuing a mandate (May 1, 2015) vacating specific RICE NESHAP and NSPS provisions for Emergency Engines with the further guidance released by the EPA on April 15, 2016.

Figure 2: DER Registered Capability in DR Programs (2023 for Economic and 23/24 DY Load Management)

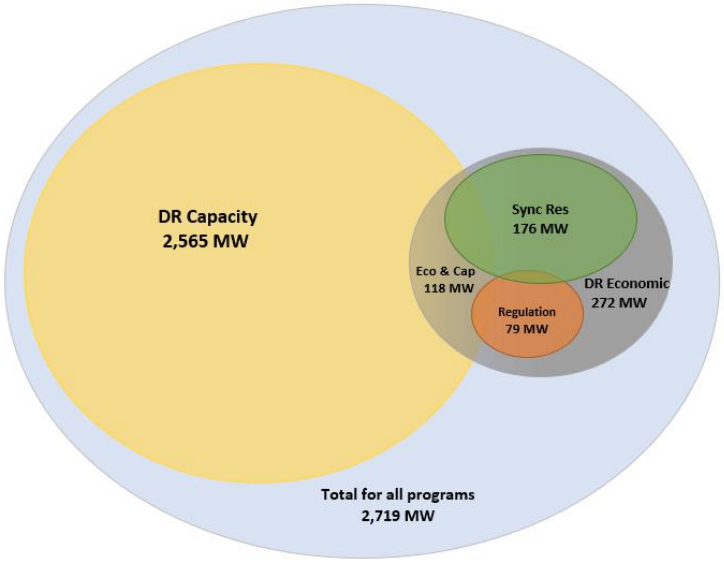
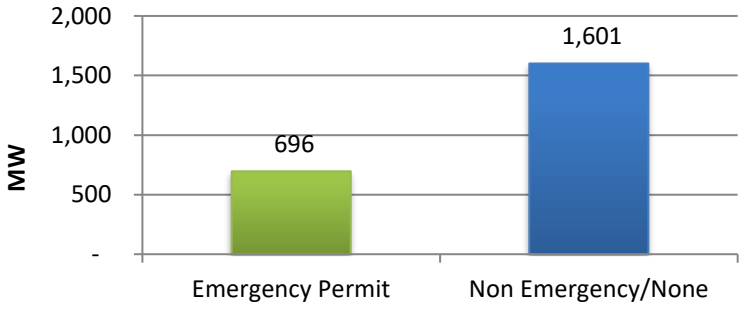


Figure 2 shows assigned for load reduction MW capability for DERs registered in Demand Response programs. Of 2,565 MWs registered in capacity market, only 118 MWs also participate as Economic DR in the Energy and Ancillary Service wholesale markets. 272 MWs of capability are registered as Economic DR only. This brings total DR DER capability to 2,719 MWs. 84% of DERs participating as Economic DR have been certified to provide ancillary services.

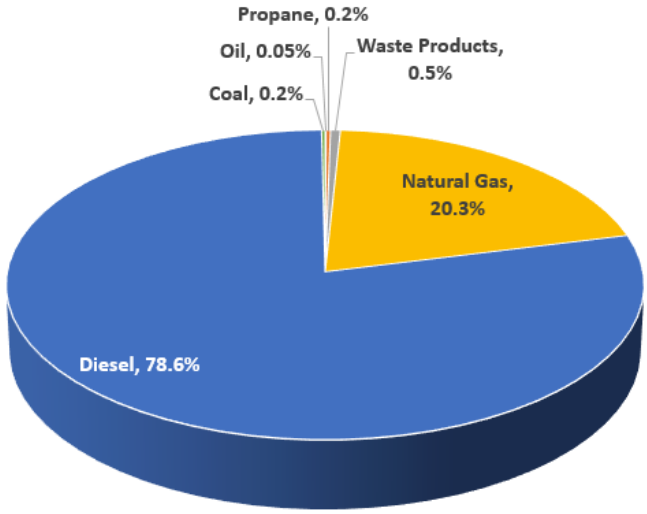
Notes: Values are CSP reported max output MWs assigned to reduce load in DR programs (real nameplate capability is higher and described in this report). These DER max output values may exceed nominated MWs for capacity resources because, in some cases, only partial capability may be offered. DER capability for economic registrations is captured as of 1/2024.

Figure 3: DER registered DR capability by generator permit type



Emergency generators account for approximately one third of total DER with generators registered capability (2,297MWs). Generators with emergency permit can only operate during emergency conditions. Even if they have extra capability beyond their load they cannot use it unless they upgrade machine and/or upgrade emergency permit to non-emergency permit.

Figure 4: DR Registered generator MWs by fuel mix (2023 for Economic and 23/24 DY Load Management)



Fuel mix for behind the meter generation that participates in DR predominantly consists of diesel (78.6%) and natural gas (20.3%) which make up a combined 99% of the total fuel types. This is consistent with the previous year. Batteries are excluded from this chart.

Figure 5: DR Registered generator count by engine type (2023 for Economic and 23/24 DY for Load Management)

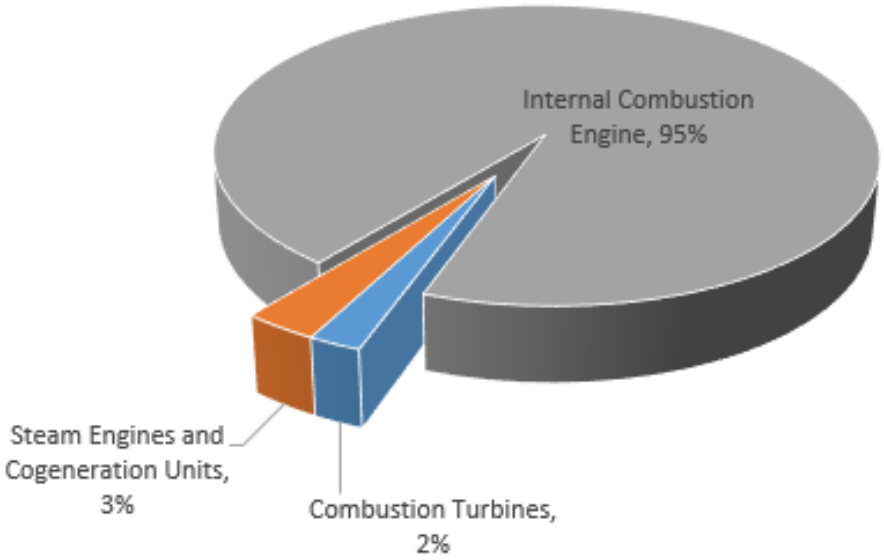
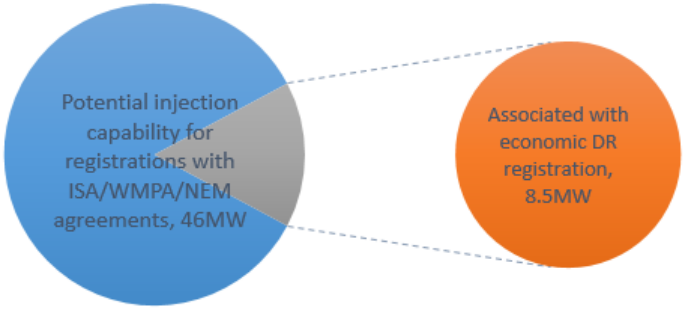


Figure 6: 2023 DR DER Potential injection capability MW



Out of total 3,012MW nameplate capability only 291MW are associated with those that have an agreement to inject. Potential DR DER injection capability is calculated as an excess MW capability of the generator/battery nameplate over the location's average load reading (available to PJM) and totals 46MW (16% of 291MW). From that 8.5MW of the injection capability come from generators/batteries that associated with economic DR registrations.

Majority of locations with behind the meter generator or battery do not have any agreement to export excess energy onto the grid. As of time of this report there are only less than 5 locations that have a wholesale agreement (WMPA/ISA) and 37 locations that have other retail level agreement to inject energy onto the grid.

Note: Calculated amounts come from CSP reported values.

Figure 7: Batteries vs Generators DR registered MW capability

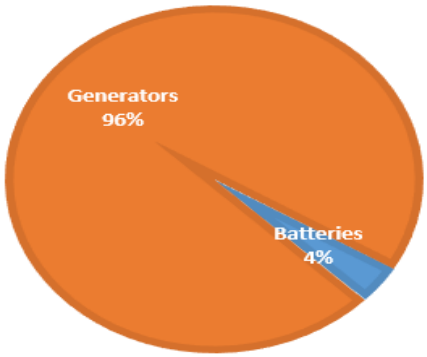
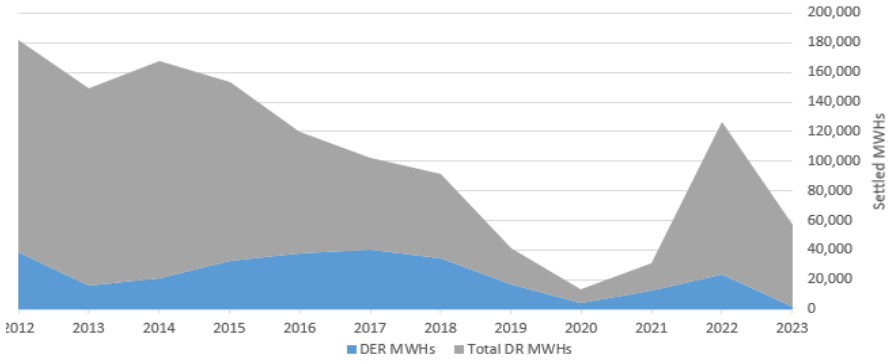


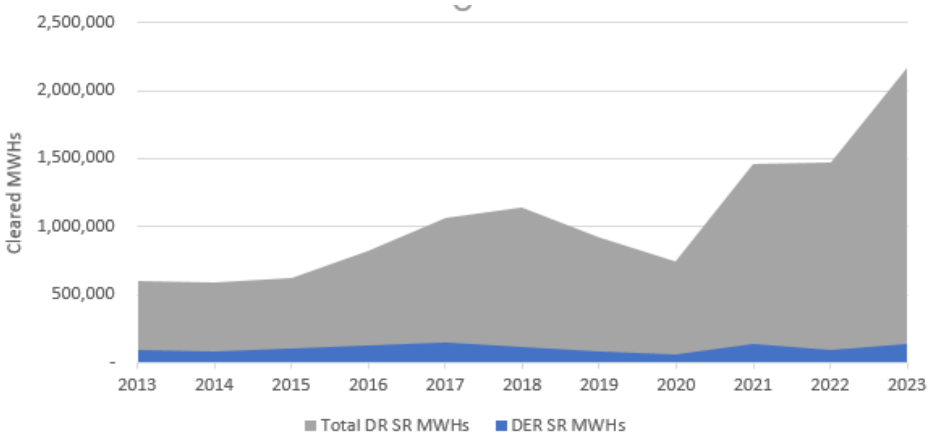
Figure 8: PJM Demand Response Economic Energy Settled MWhs Trend



DR DER participation in Economic Energy market in 2023 decreased from the last year by 50%. At the same time, the share of DER participating as Demand Response decreased from 23% in 2022 to 3% in 2023.

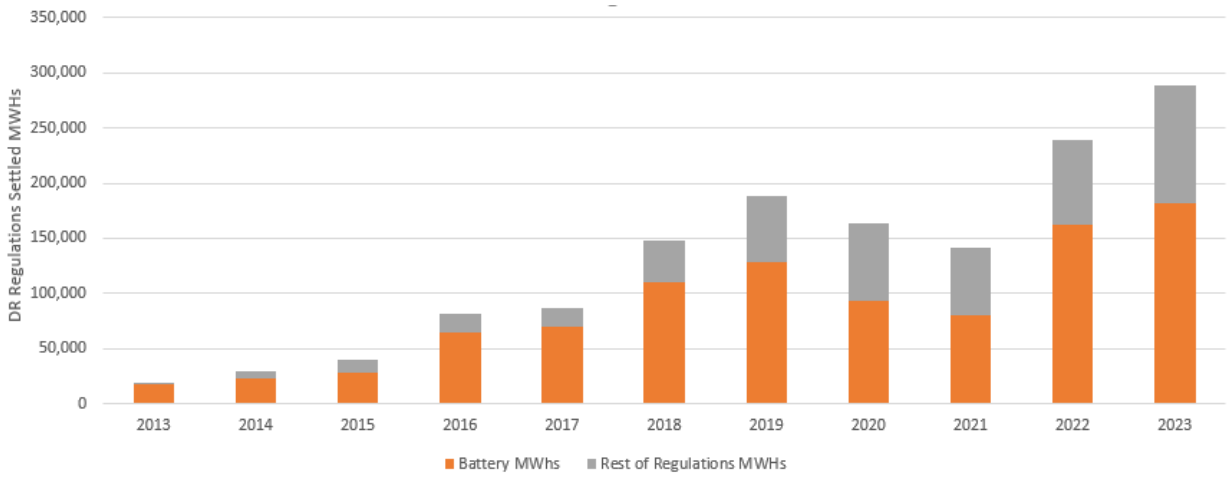
*Note: 2023 settled MWHs number may increase slightly when all settlements for events in December get confirmed. The final number will be reflected in 2024 DER report.

Figure 9: PJM Demand Response Synchronized Reserves Cleared MWHs Trend



DR Synchronized Reserves cleared MWHs increased by 50% from 2022. DER share of Total DR in 2023 remained approximately the same (6%).

Figure 10: PJM Demand Response Regulation Settled MWhs trend for DER



Behind the meter battery storage participation in DR regulation market increased in 2023. Batteries share of total DR increased by 12% from 2022. Electrical water heaters contribution (rest of regulation) also increased from 2022 numbers.

Figure 11: 2023 DR DER Regulation MW participation

DERs cleared volume in regulation market was at about 96% of the tested capability. Cleared capability is calculated as a sum of the highest amount cleared for each resource during 2023.