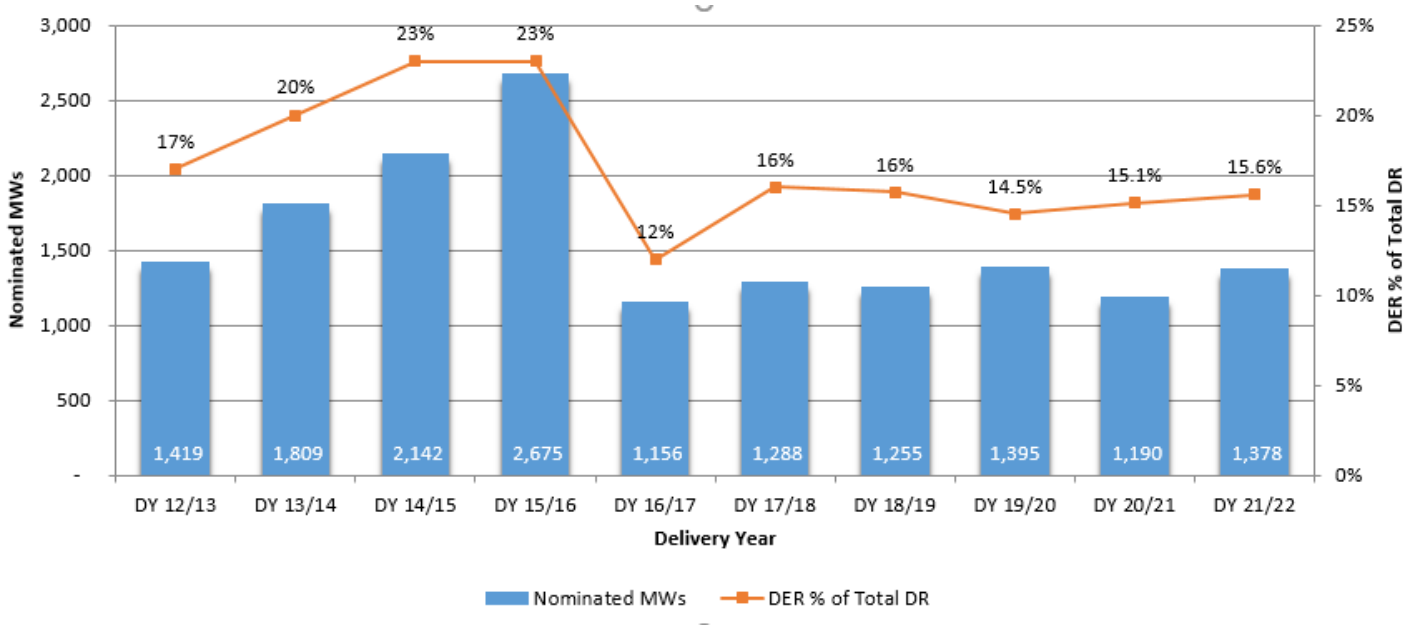
2021 Distributed Energy Resources (DER) that participate in PJM Markets as Demand Response

PJM Demand Side Response Operations

February, 2022

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 21/22 DY the amount of DR DER increased from previous year by about 188MW but its share of total DR remained close to four 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 (2021 for Economic and 21/22 DY Load Management)

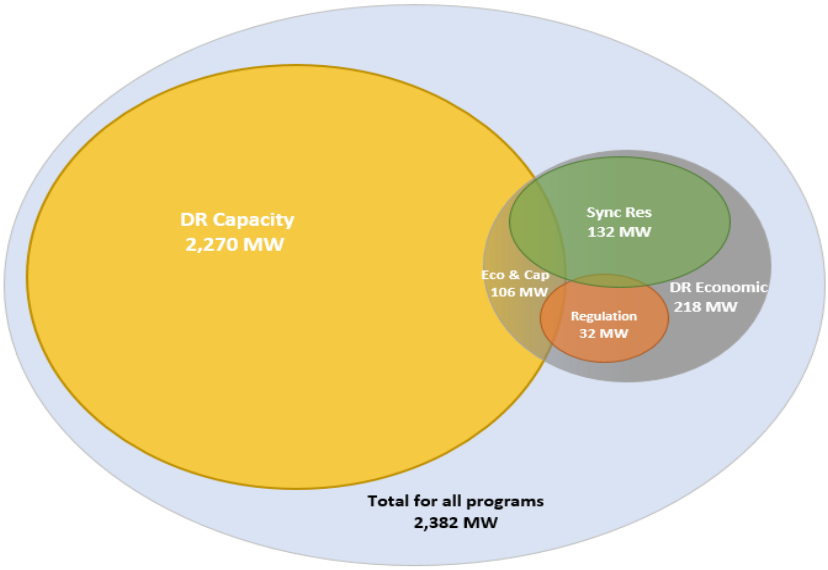
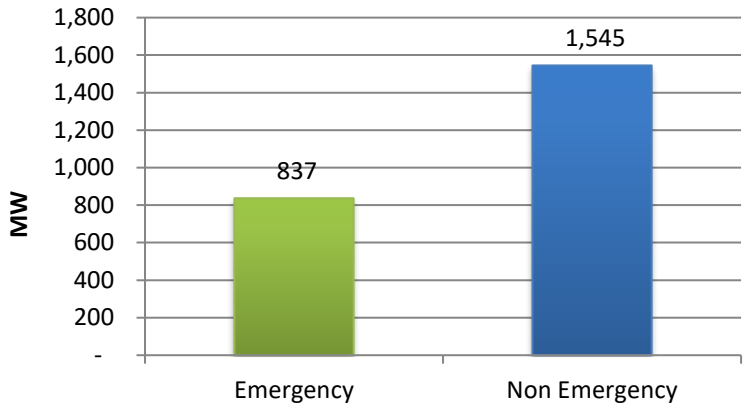


Figure 2 shows assigned for load reduction MW capability for DERs registered in Demand Response programs. Of 2,270 MWs registered in capacity market, only 106 MWs also participate as Economic DR in the Energy and Ancillary Service wholesale markets. 112 MWs of capability are registered as Economic DR only. This brings total DR DER capability to 2,382 MWs. 75% of DERs participating as Economic DR have been certified to provide ancillary services.

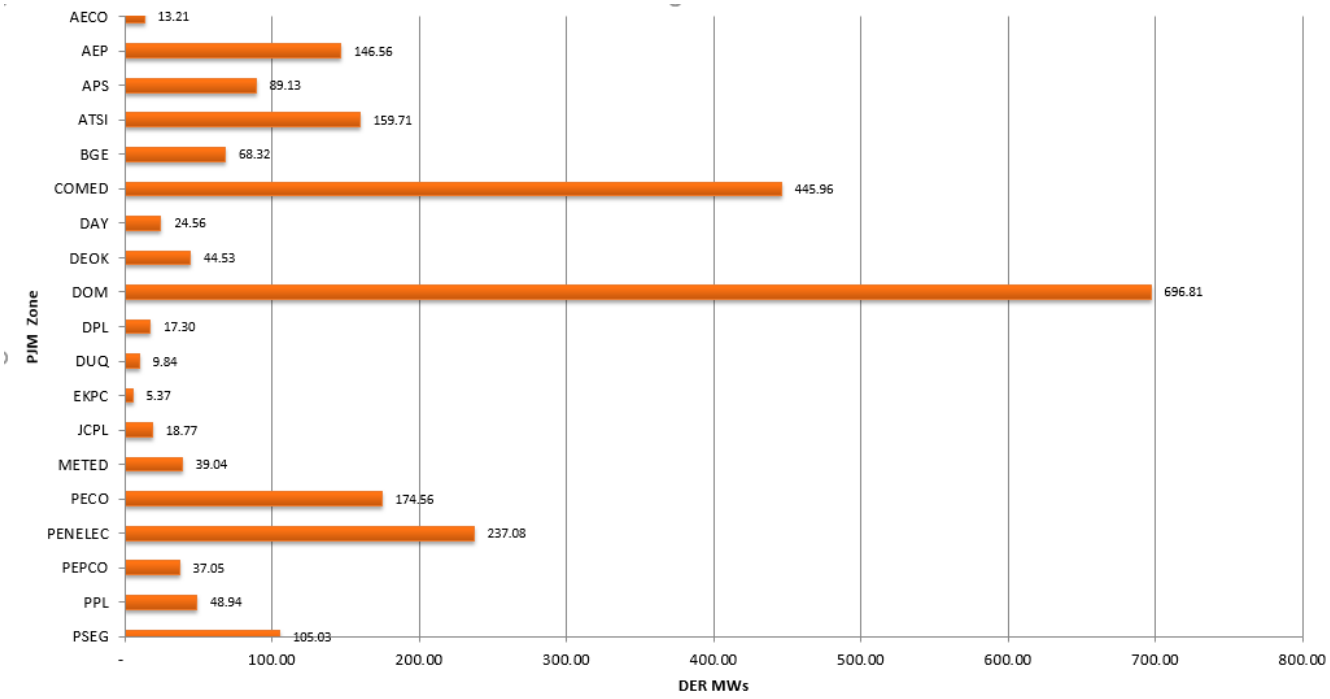
Notes: Values are CSP reported max output MWs assigned to reduce load in DR programs (real nameplate capability is higher and described in this report). These DER max output values may exceed nominated MWs for capacity resources because, in some cases, only partial capability may be offered. DER capability for economic registrations is captured as of 1/2022.

Figure 3: DER capability by generator permit type



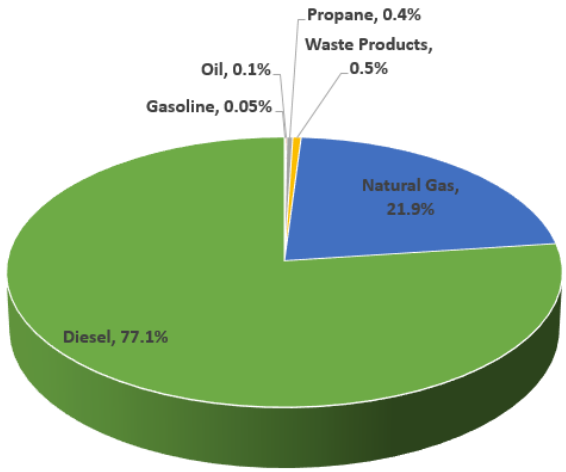
Emergency generators account for approximately 35% of total DER registered capability (2,382MWs). Generators with emergency permit can only operate during emergency conditions. Even if they have extra capability beyond their load they cannot use it unless they upgrade machine and/or upgrade emergency permit to non-emergency permit.

Figure 4: DR DER Registered MW Capability by Zone



Note: Values are CSP reported MWs for load reduction purposes by DR DER. Locations that participate in both Load Management and Economic are included only once.

Figure 5: DR DER Registered MW in DR Programs (2021 for Economic and 21/22 DY Load Management) by Fuel Mix



Fuel mix for behind the meter generation that participates in DR predominantly consists of diesel (77%) and natural gas (22%) 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 6: DR Registered generator count by engine type (2021 for Economic and 21/22 DY for Load Management)

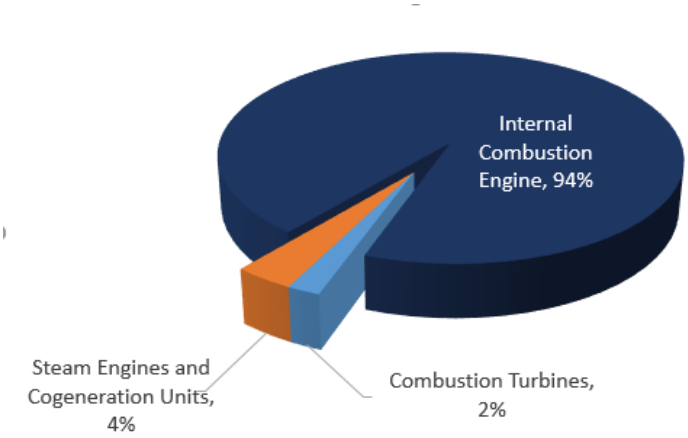
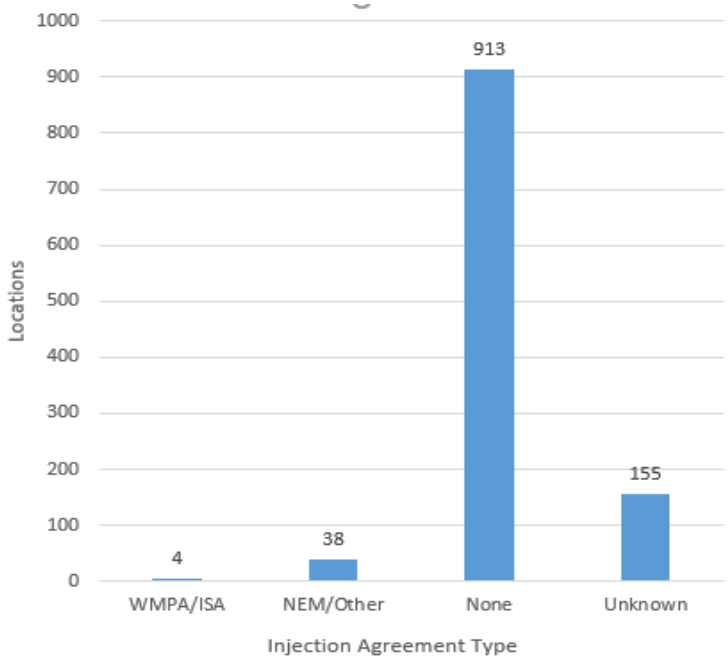


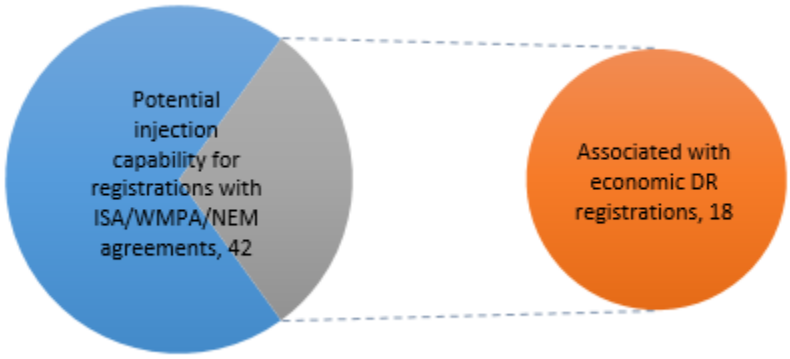
Figure 7: DR DER Registered Locations by interconnection agreement type



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 4 locations that have a wholesale agreement (WMPA/ISA) and 38 locations that have other retail level agreement to inject energy onto the grid[1].

[1] There are 155 locations with unknown agreement status because the locations were input into the system before the option was added.

Figure 8: 2021 DR DER Potential injection capability MW



Potential DR DER injection capability is calculated as an excess MW capability of the generator/battery nameplate over the location's highest load and totals 42MW (1% of 3,257MW total nameplate capability) for registrations that have locations with interconnection agreement (retail or wholesale). From that 18MW of the injection capability come from generators/batteries that associated with economic DR registrations.

Note: Calculated amounts come from CSP reported values

Figure 9: Batteries vs Generators DR registered MW capability

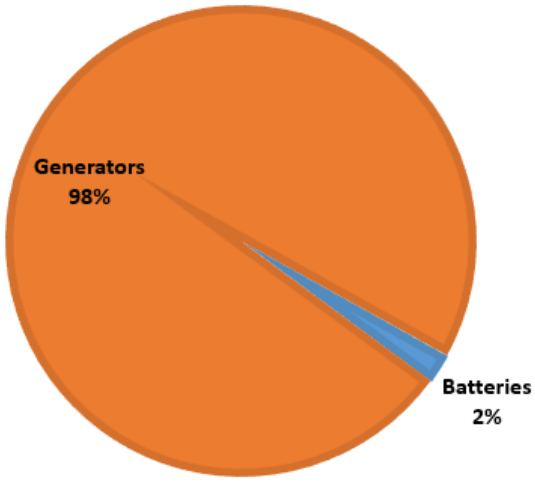
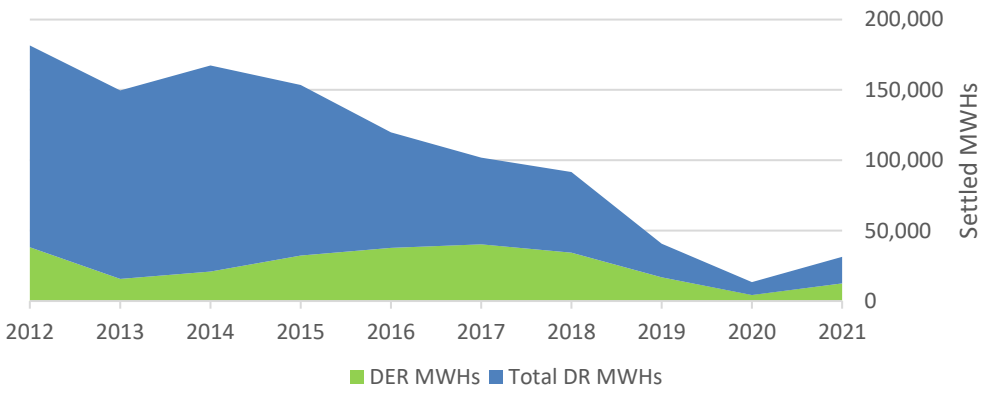


Figure 10: PJM Demand Response Economic Energy Settled MWhs Trend



DR DER participation in Economic Energy market in 2021 recovered from the last year but still remained lower than pre pandemic level. At the same time, the share of DER participating as Demand Response increased from 45% in 2020 to 70% in 2021.

*Note: 2021 settled MWHs number may increase slightly when all settlements for events in December get confirmed. The final number will be reflected in 2022 DER report.

Figure 11: PJM Demand Response Synchronized Reserves Cleared MWHs Trend

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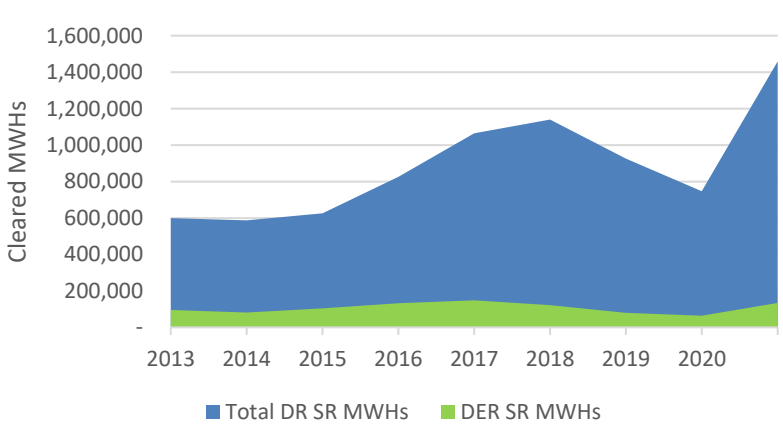
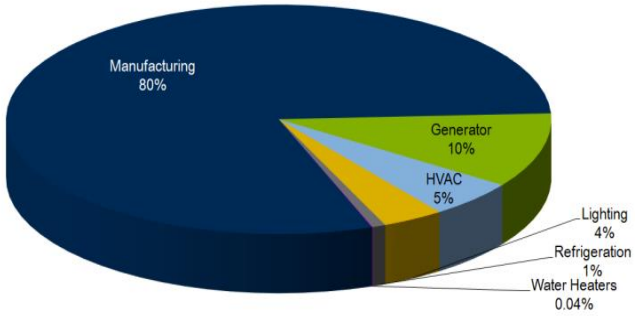


DR Synchronized Reserves cleared MWhs increased significantly from 2020. DER share of Total DR in 2021 remained unchanged from the previous 2 years and comprised 9%.

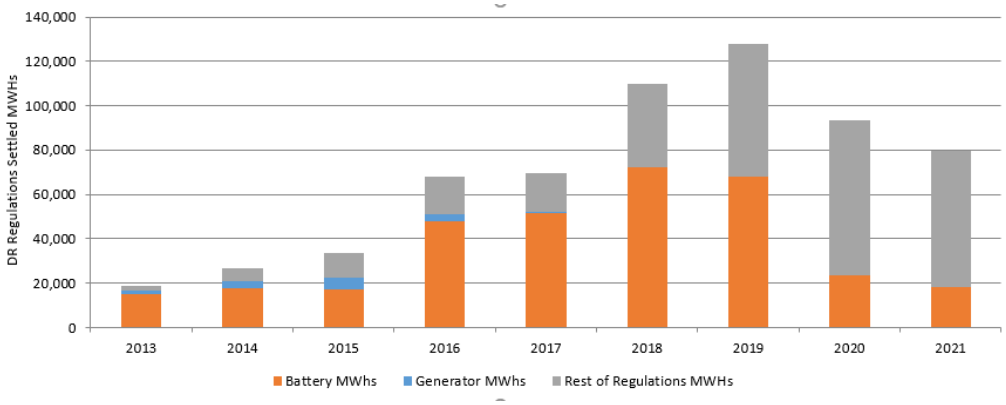
Note: PJM finding are based on extrapolation of DR capability by load reduction method submitted by curtailment service providers. PJM does not know what load reduction method was deployed in any given event.

Figure 12: 2020 PJM Demand Response Confirmed Synchronized Reserve Registrations Load Reduction Methods



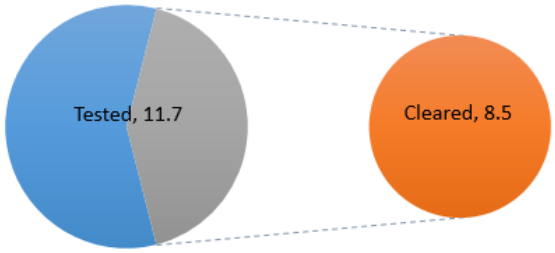
Behind the meter generators represent only 10% of total Synchronized Reserves participating as Demand Response while the load reduction from the manufacturing process leads with 80%. This is consistent with the last year.

Figure 13: PJM Demand Response Regulation Settled MWhs trend for DER



Behind the meter battery storage participation in DR regulation market decreased in 2021 by 12% from 2020. Batteries share of total DR provided remained consistent with the last year and has decreased by 50% from 2019 due to a large battery that left the market. Electrical water heaters contribution (rest of regulation) remained consistent with 2020 numbers.

Figure 14: 2020 DR DER Regulation MW participation



DERs cleared volume in regulation market was at about 73% of the tested capability. Cleared capability is calculated as a sum of the highest amount cleared for each resource during 2021.