2022 OMS DER Survey Results

Public Webinar

Aug 29, 2022

Organization of MISO States

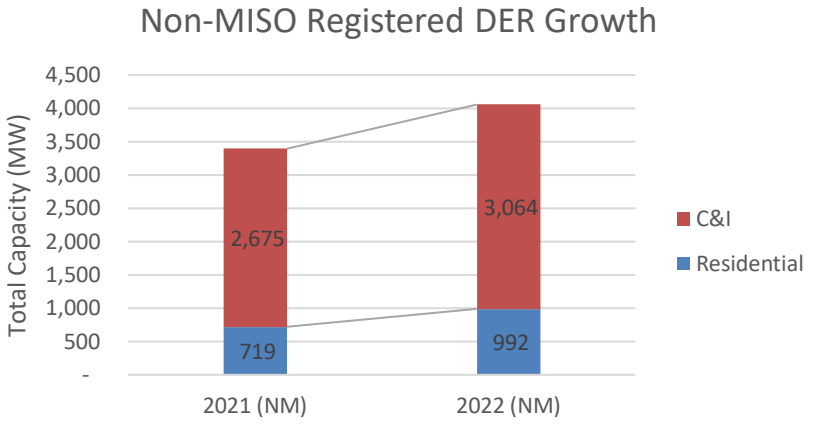
Executive Summary

- This is the fifth year of OMS DER Survey
- This was the second year we requested information on DER that was Registered with MISO (RM)
- DER Growth continues with significant growth in several zones

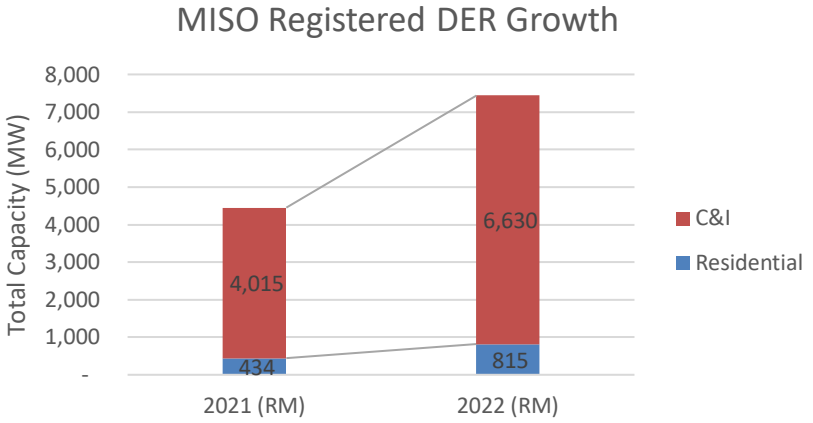
11.5 GW of Total DER Reported

- Over 60% of reported DER is registered with MISO
- Non-MISO DER has a larger portion that is residential
- All categories saw annual growth greater than 30%
  - Residential MISO-Registered DER saw largest increase at 88%
  - Non-MISO C&I DER increased > 1 GW

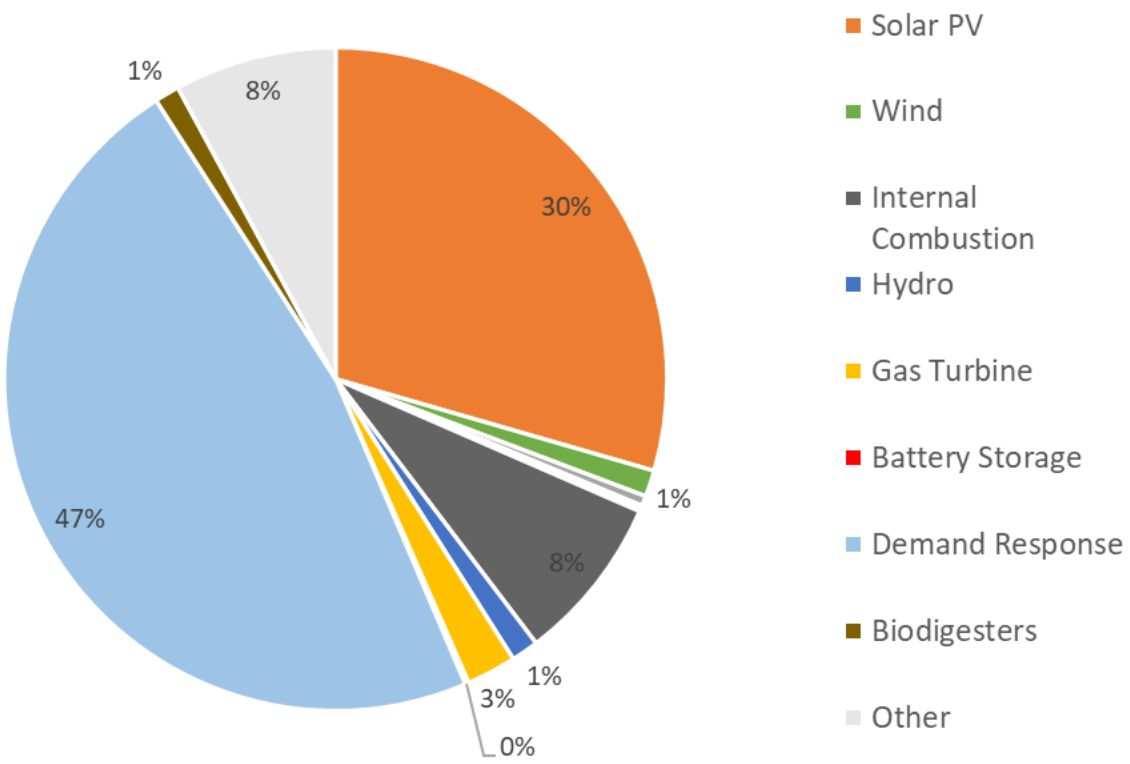
Non-MISO



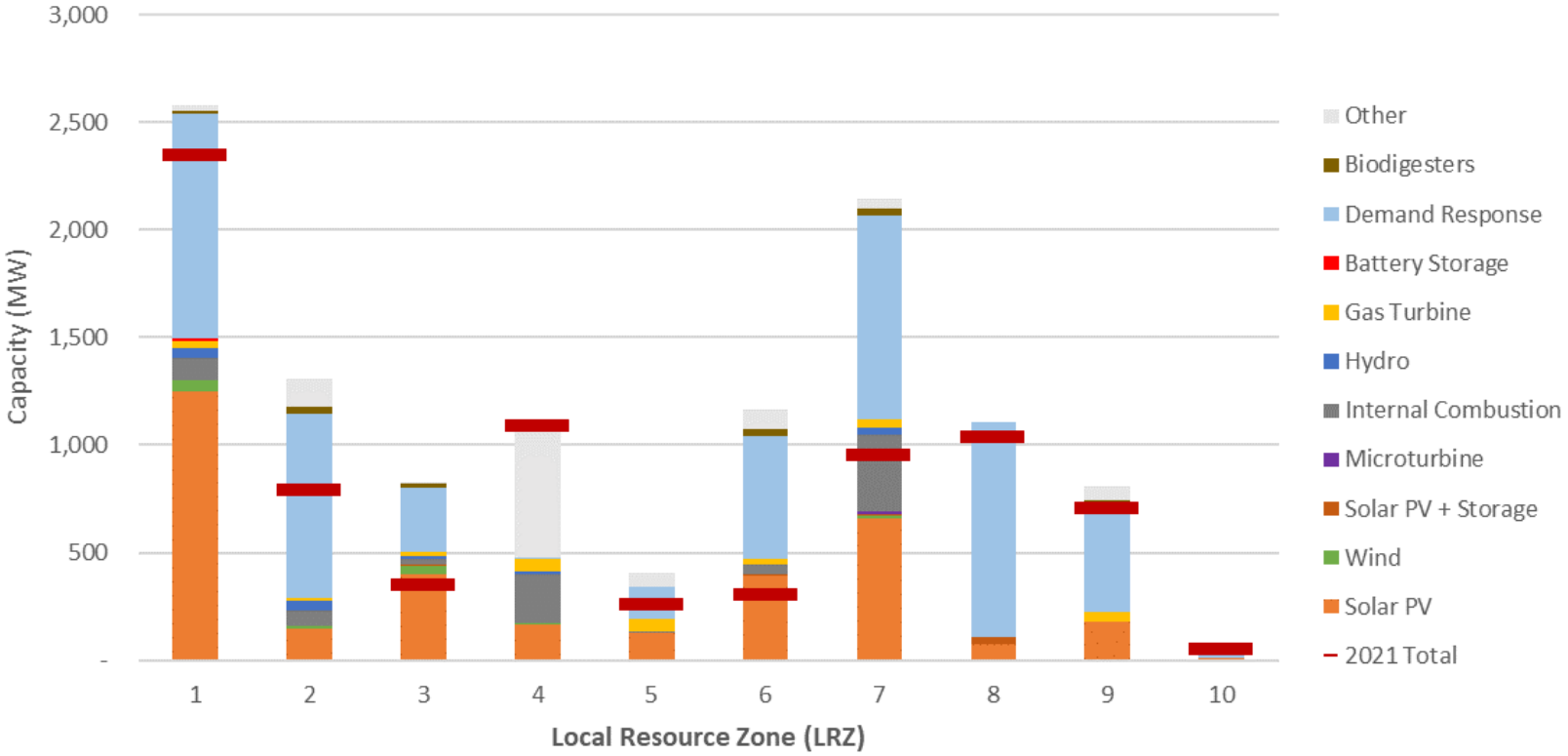
Registered with **MISO**



11.5 GW of DER by Resource Type



Several zones saw large increases this year



NON-MISO REGISTERED DER DATA

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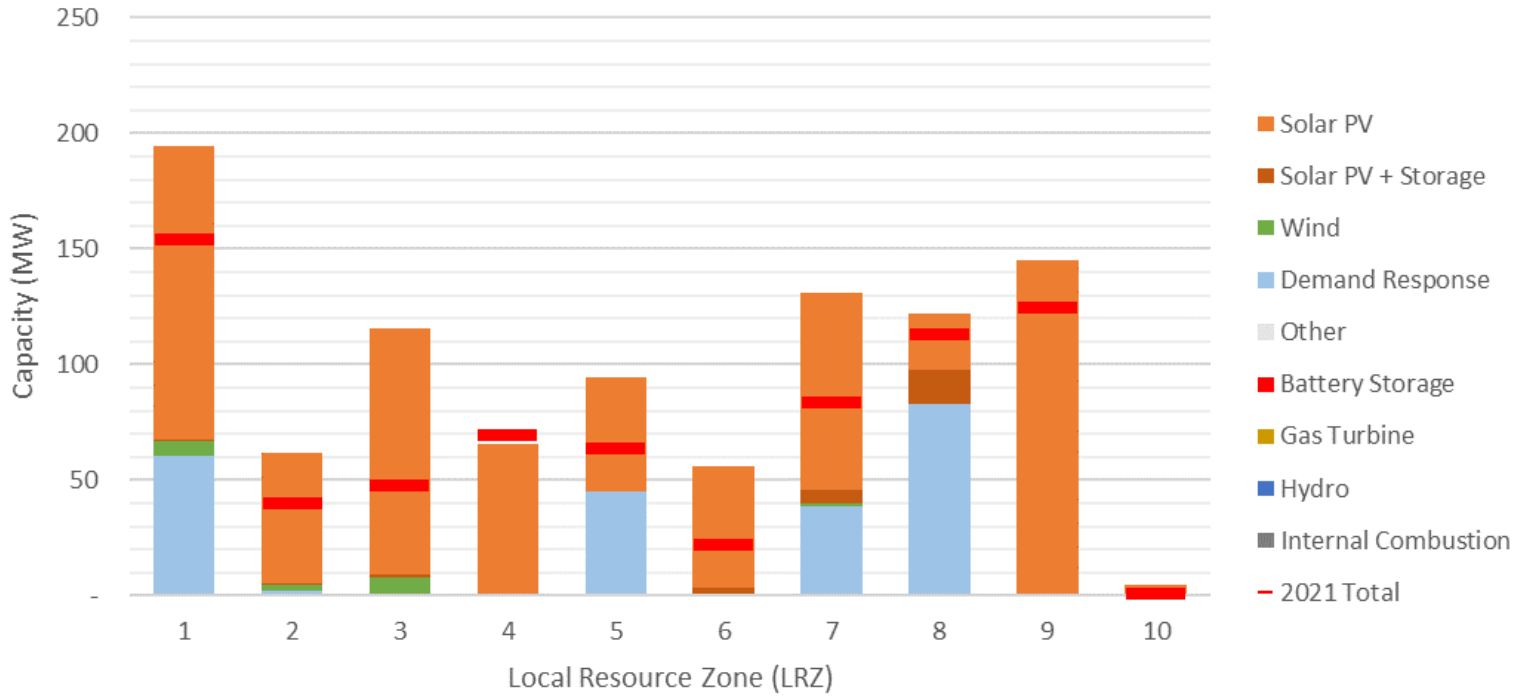
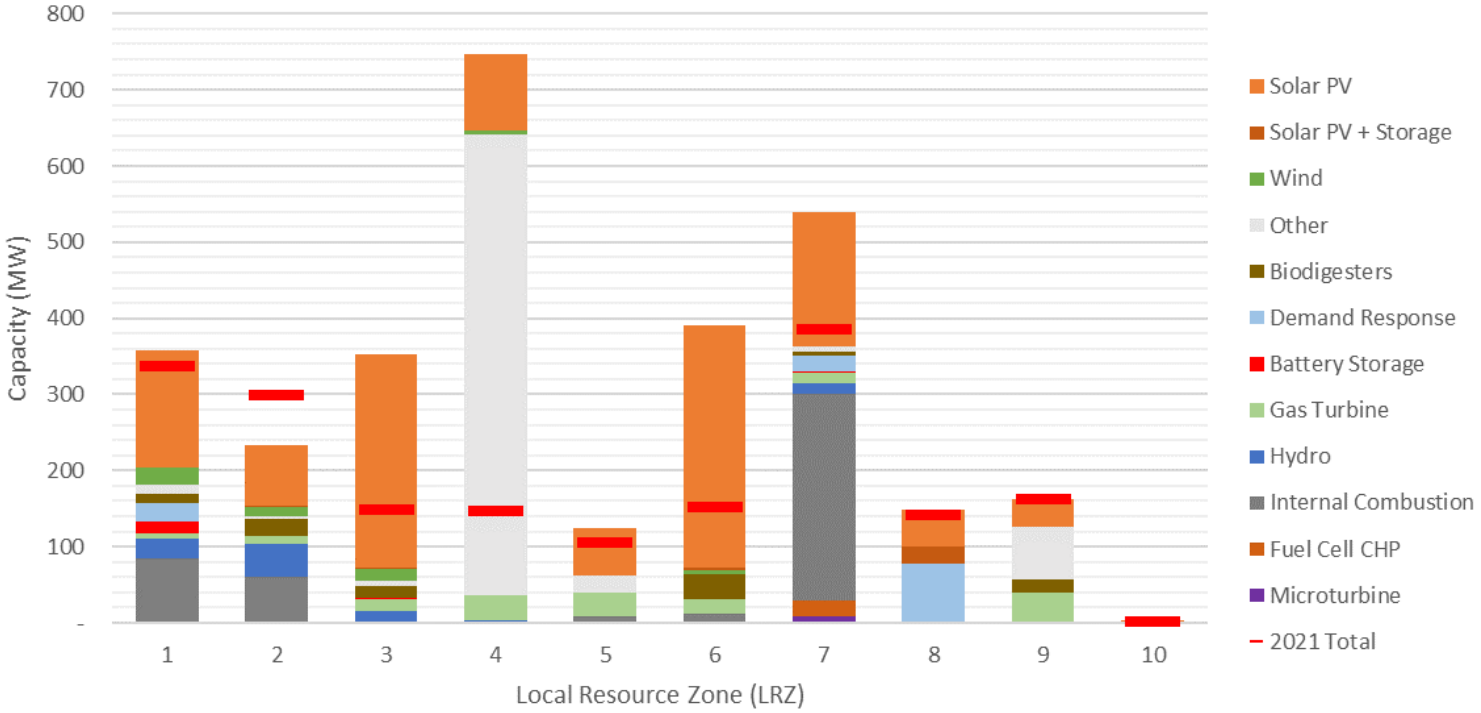


Non-MISO Registered DER: Residential

Large residential solar increases and DR dominate residential DER that is not registered at MISO. Zones 1, 3, 5, 6, and 7 all had over 25 MW increases. Battery and Solar + Storage have begun to show up in several zones.



Non-MISO Registered DER: Non-Residential

There is a much greater variety of resource types in the non-residential customer class. Zone 7 has a large quantity of internal combustion engines that total over 350 MW. Battery storage is present in five LRZs and Storage + PV is present in six.

REGISTERED WITH MISO

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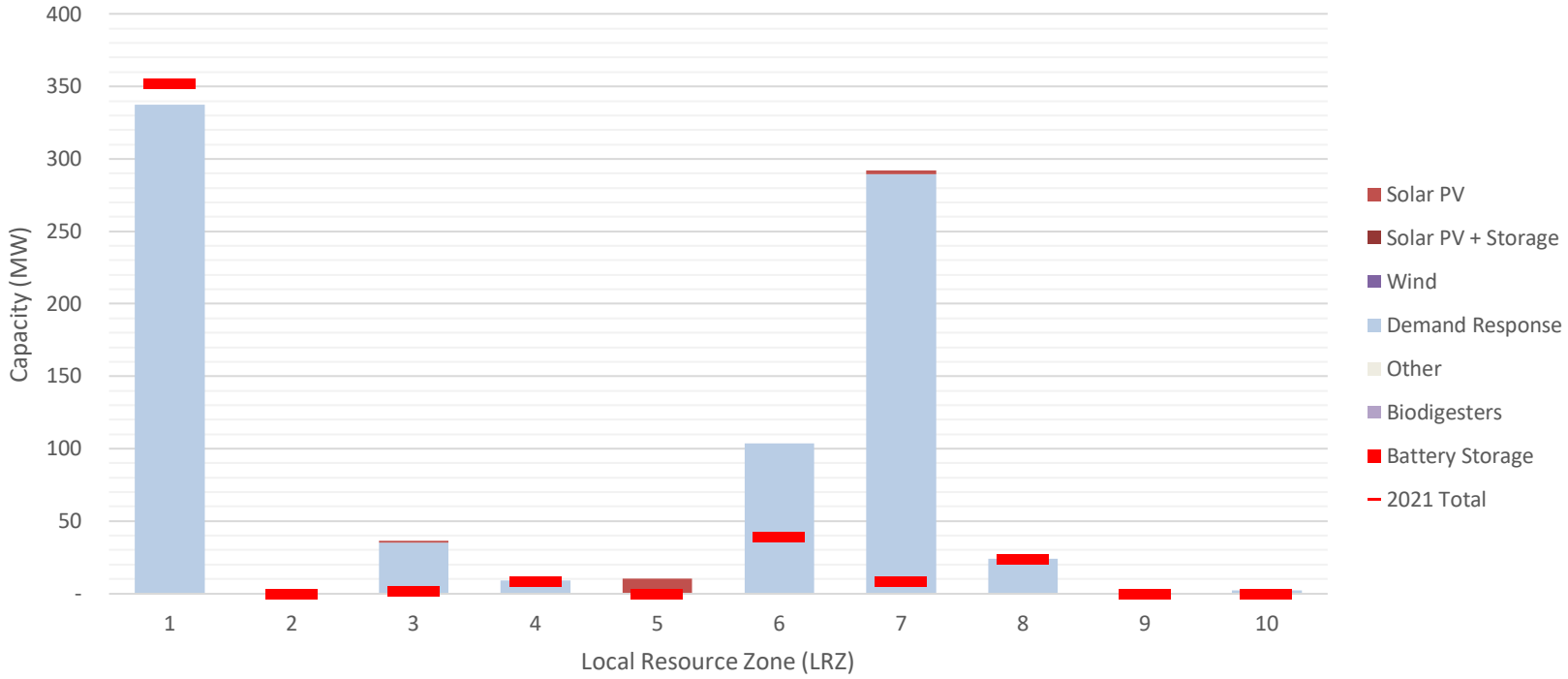
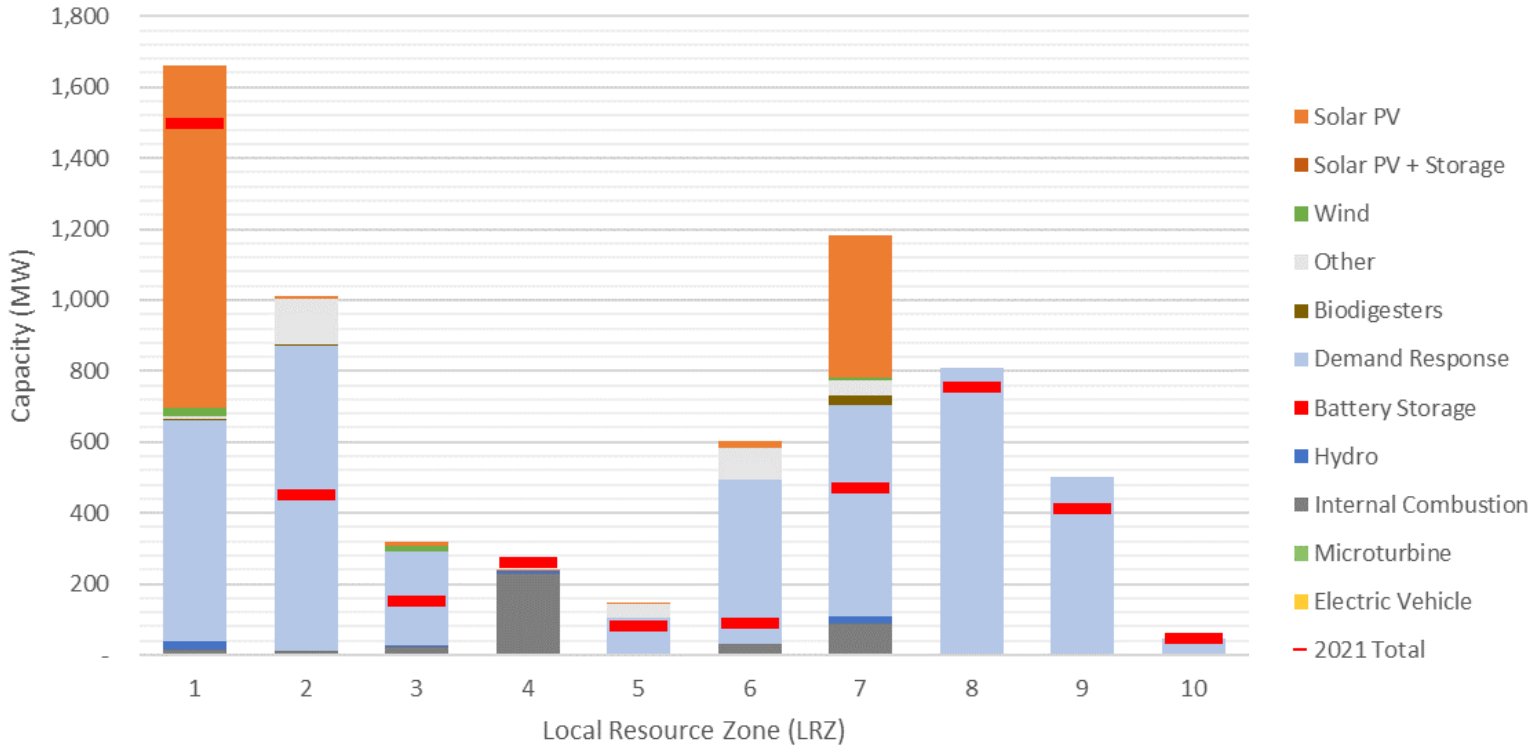


Registered with MISO DER: Residential

Almost all MISO-registered, residential DER is demand response.



Registered with MISO DER: Non-Residential

MISO-registered solar makes up a large portion of DER in zones 1 and 7. Demand Response is the largest resource type in the non-residential category as well. This category's large increase is likely from underreporting in prior years as MISO-reported DER did not show an increase this year.

WRITTEN RESPONSE ANALYSIS

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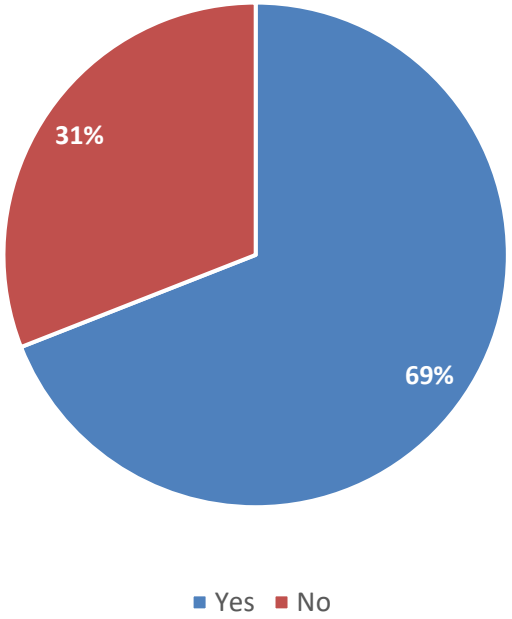
2 - Is your utility considering future investments that will increase awareness or visibility into DER operations?



Yes

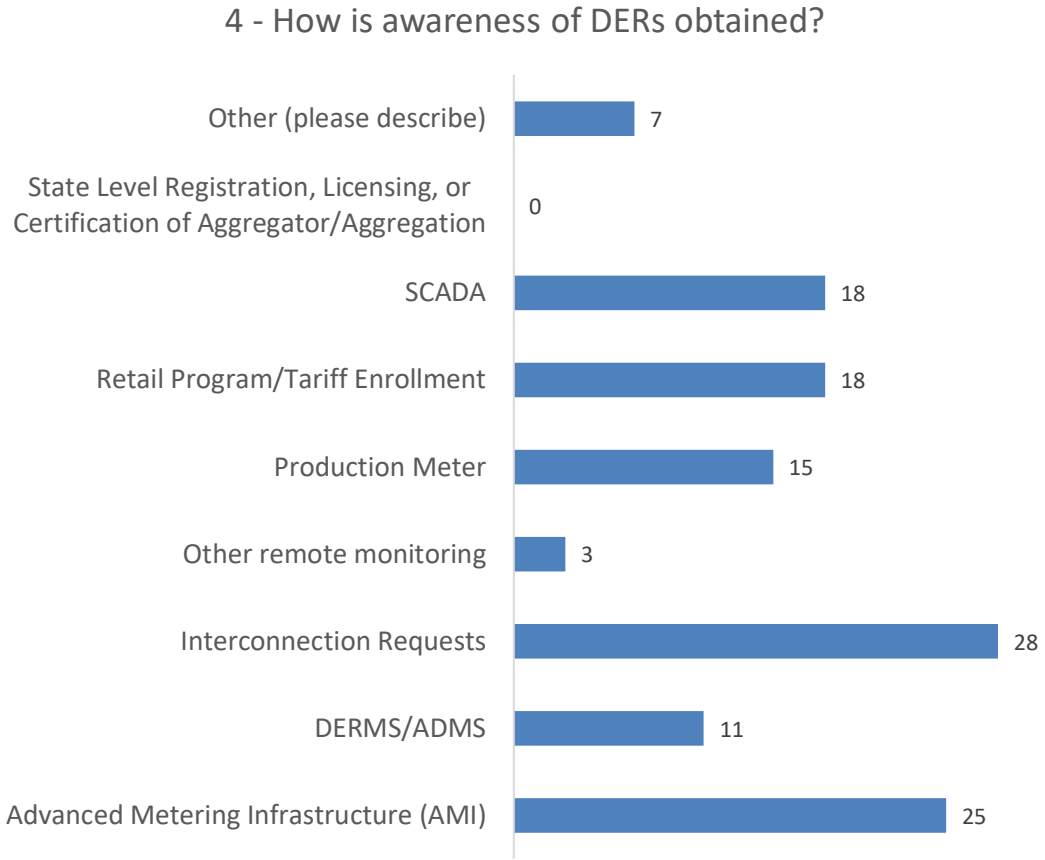
- Some only via interconnection requirements
  - Stronger telemetry requirements for larger installations
  - Some require production meters for all new solar installs
- AMI and SCADA
  - SCADA for larger installations, threshold is typically 0.5-1MW
- ADMS/DERMS
  - Some in the process of deploying, others considering scale/scope as DER penetration increases

No

- Nothing planned in next 3-5 years
- AMI deployment in early stages
- If required by FERC/state regulator, will make necessary changes
- N/A we use a wholesale power provider

Comparison to 2021

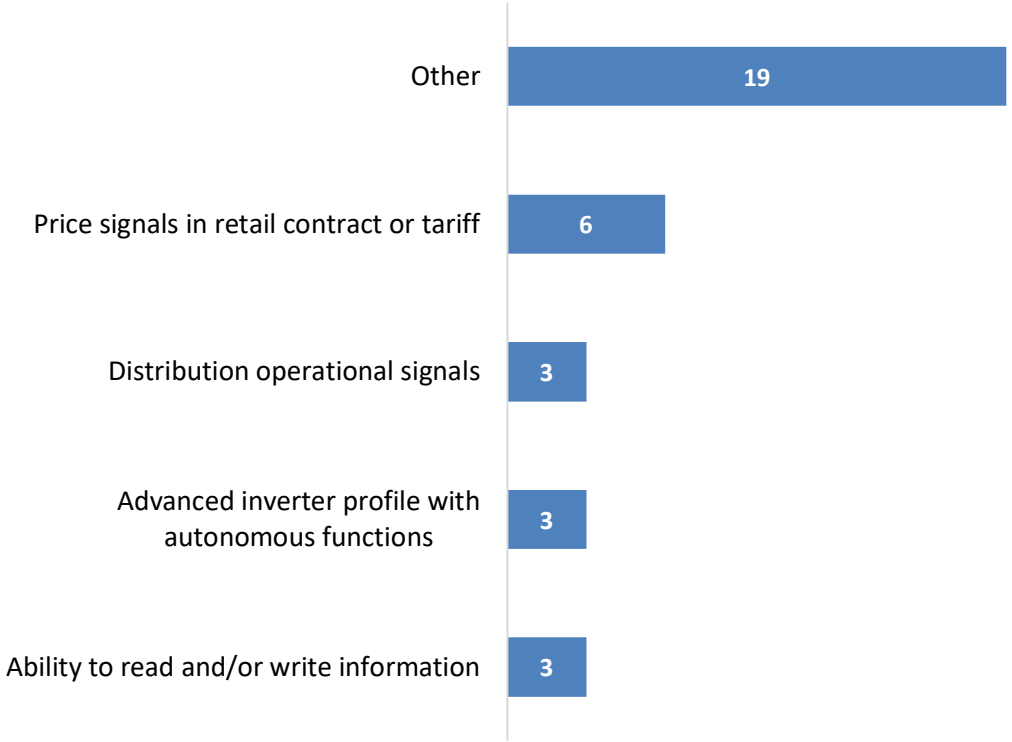
- Highly variable, dependent on respondent
- AMI and interconnection requests continue to be the largest category, followed closely by program enrollment, SCADA, and production meters
  - From narrative responses, perhaps an increased interest in production meters with some respondents now requiring them on new installations
- DERMS/ADMS only deployed in some footprints, with others waiting to see more DER penetration but see this as a future state.



Key Takeaways

- Highly variable, dependent on respondent
- Price signals via tariffs continue to be largest category of the selectable responses
  - Various tariffs mentioned that price a price signal either via MISO LMPs or formula-based pricing
- 'Other' category
  - Restrictions on exporting to the Transmission system
  - Telecommunications protocol to limit production
  - Direct Transfer Trip schemes for larger DERs
  - Remote start/stop DERs which are on interruptible rates

5 - Types of Interoperability
(i.e., Communication with DERs)

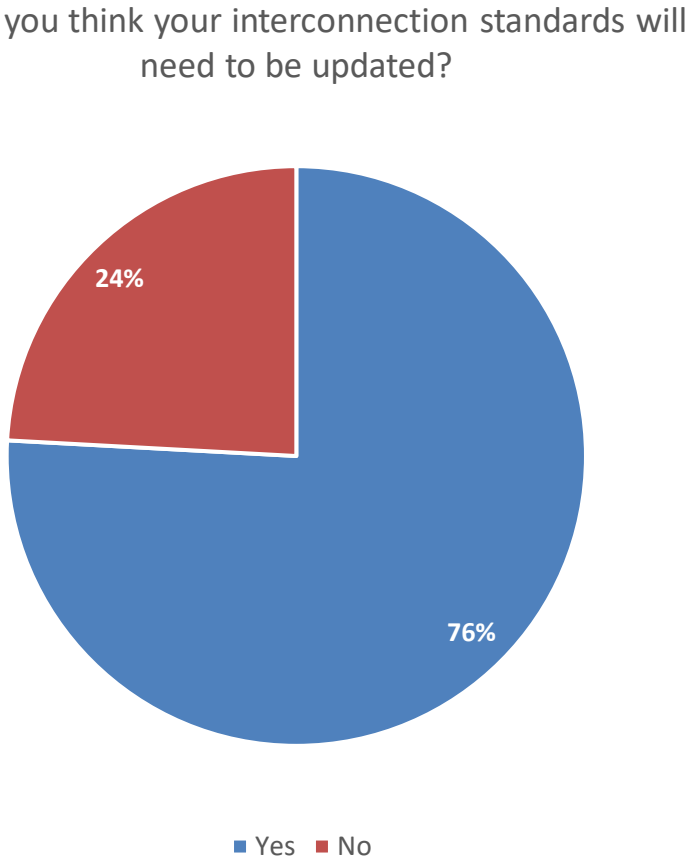


There's a lot of activity in interconnection

Most "No" respondents were already compliant with IEEE1547-2018.

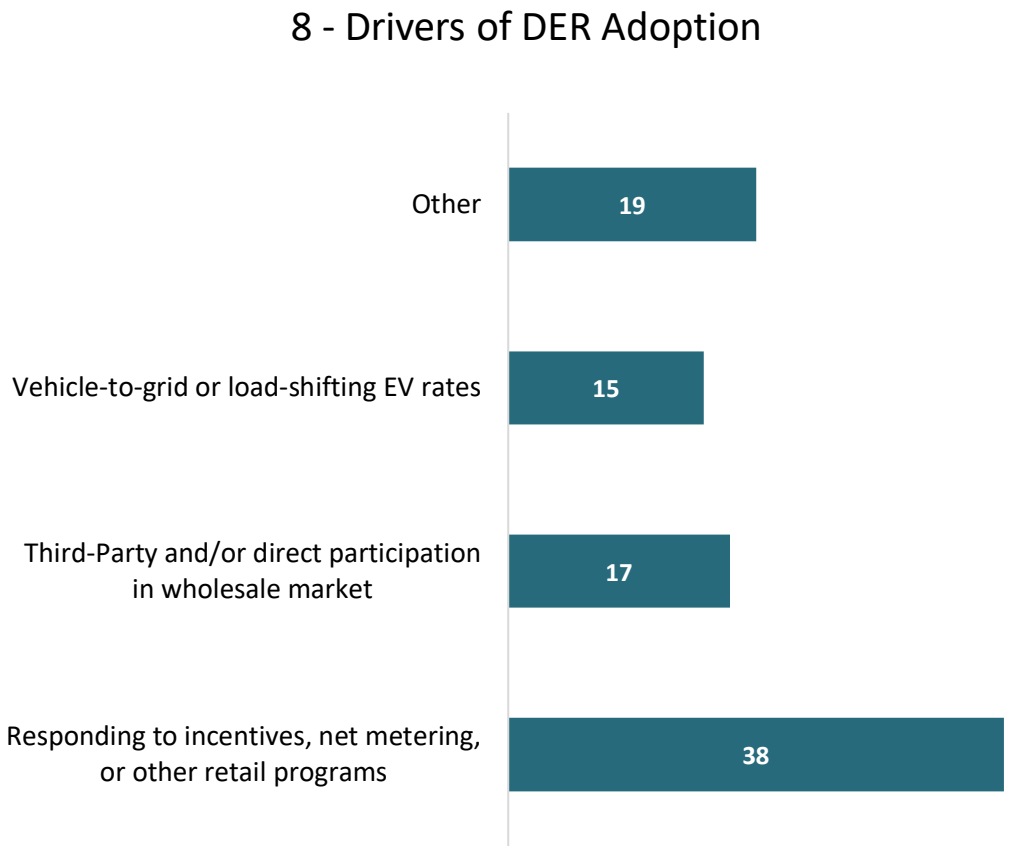
Those looking to update interconnection standards cited many reasons:

- Compliance with Order 841/2222
- To meet customer needs
- Big changes in DER tech and ops
- To ensure application processing and information are fair, timely, and balanced
- To introduce more visibility and systematic reviews due to the growth of DERs and their ability to operate in aggregate.
- Need new standards to review aggregations
- To detail how the utility will work with MISO or TO regarding transmission analyses



Key Takeaways

- 'Other'
  - Corporate renewable targets
  - Increased customer interest driven by developer advertisements, easy financing, environmental concerns, and sustainability goals
  - Technological developments, including energy storage
  - Downward trend of solar PV prices and development of solar + storage solutions
  - Interest in microgrids for backup generator functionality



9 - Transmission System Impacts

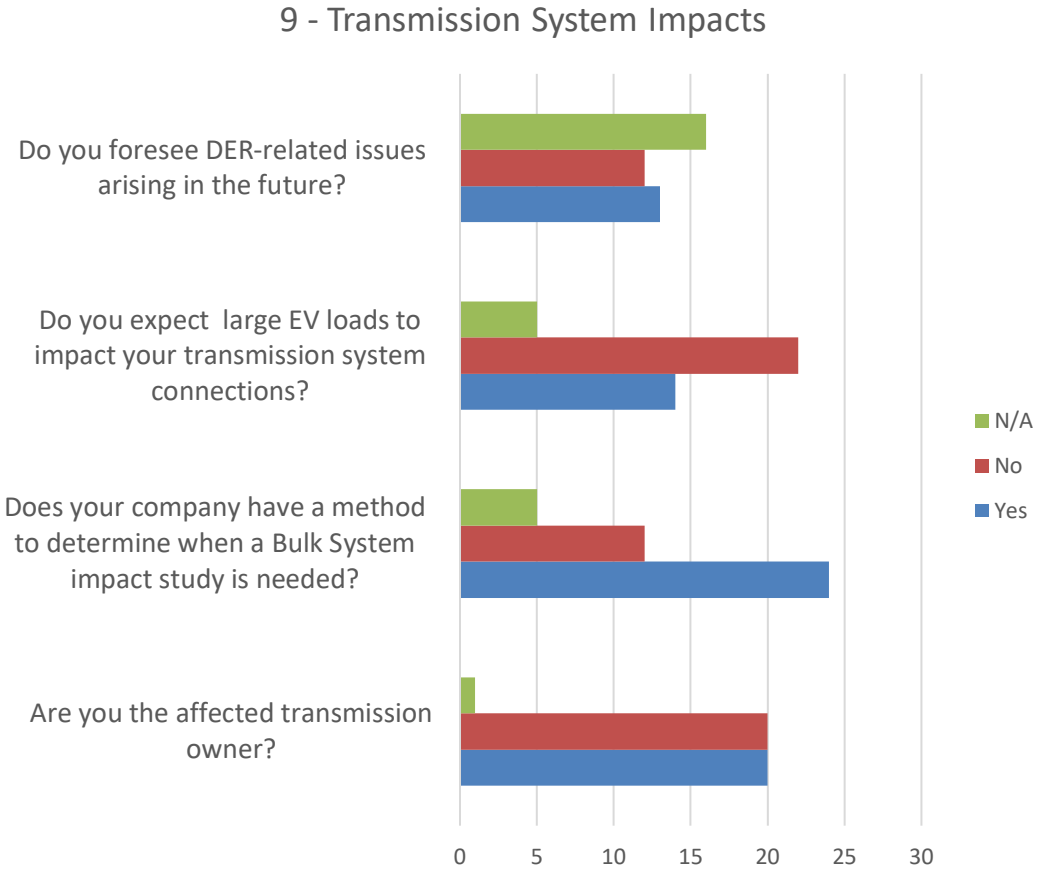
Some indicated DER penetration is not high enough to result in transmission (T) system impacts (no backflow yet)

Others have seen isolated T impacts and have flagged those facilities for TO review based on threshold criteria

- Backflow onto T system, increased need for reactive power, variance in load forecast, safety associated with T system faults

EV impacts

- Envision future concerns about charging ramp rates and substation/wires upgrades needed to accommodate large EV sites or fast-charge stations



9 - Transmission System Impacts (cont'd)

- Future needs
  - Enhanced coordination between D operator and T operator
  - Need to determine cost impacts of D/T system upgrades and assign them appropriately
  - Increased need for accurate DER load forecasts and visibility into DER operations (a concern around 40% penetration)
  - Need for protective relaying to incorporate a direct transfer trip signal to pull DERs offline during T system faults

Forecasting DER

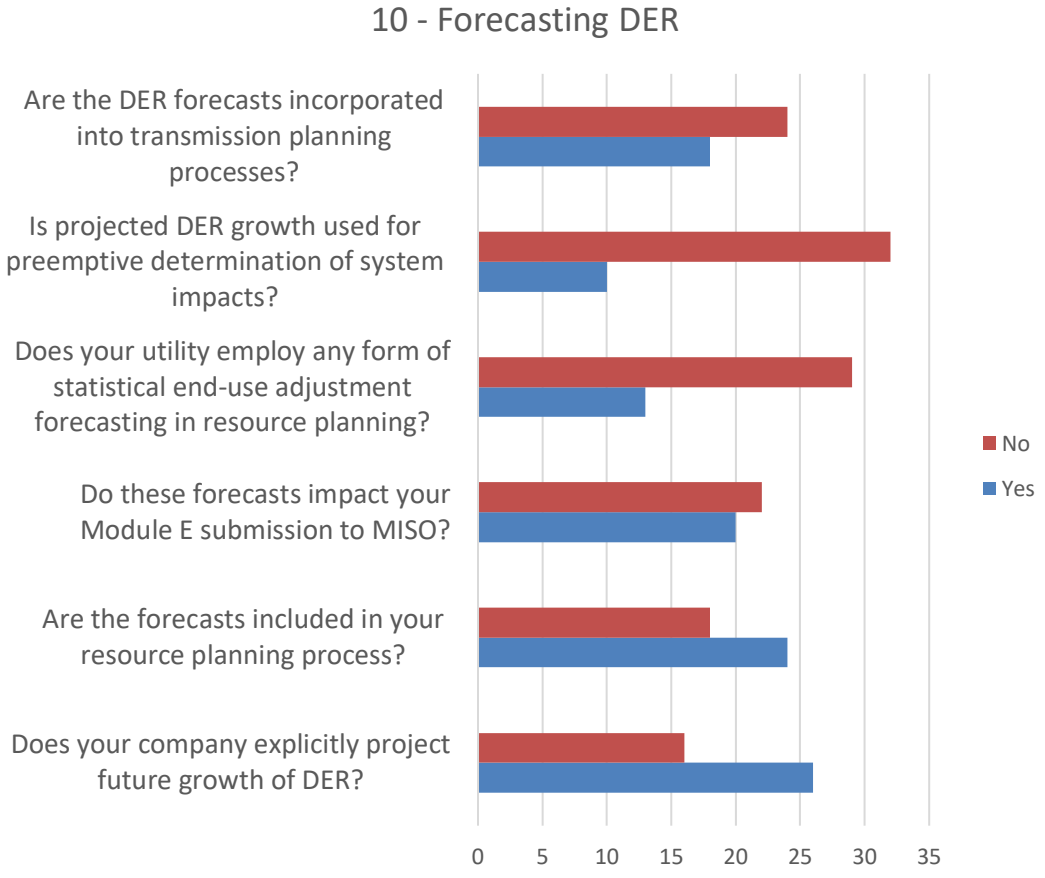
To the extent the utility has visibility, forecast is included in Module E submission

- Have visibility into, and typically *do* forecast: DR and utility owned DERs
- Some do not explicitly forecast customer owned DER unless there is a known, large DER installation

Otherwise, captured as peak load reduction and netted from base load forecast

- Non-forecasted DER impacts are captured by historical demand data and feed into forward-looking load projections

Some utilize statistical end-use adjustment forecasting to support their annual forecasting and provide inputs for resource planning purposes.



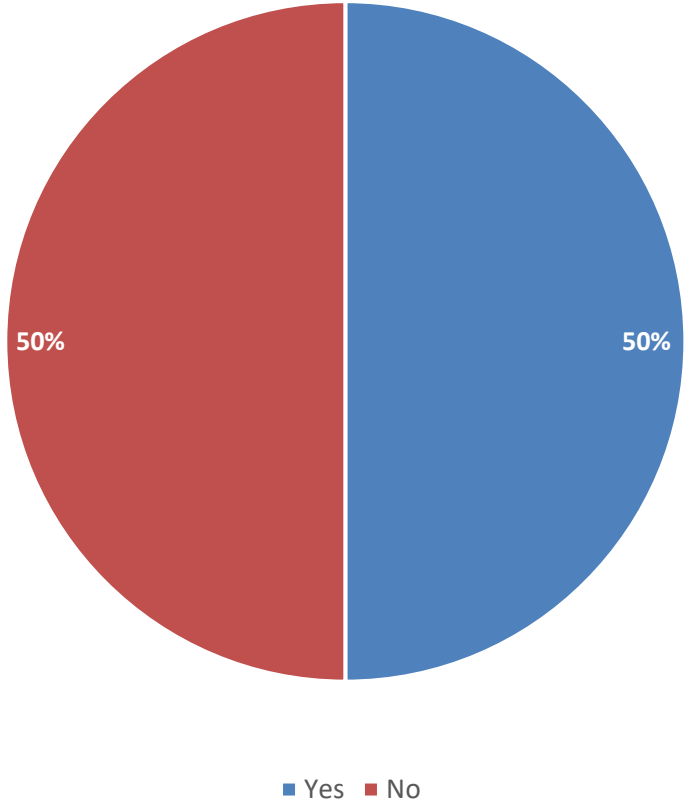
Is your utility contemplating changes in light of FERC Order 2222?

Yes:

- Interconnection agreement changes
- Operational coordination needs
- Customer care, billing, & registration
- Guidelines around planning, operations, dispatch, and metering
- Increasing visibility at DER aggregations

No:

- Not at this time, but monitoring
- Very low penetration of DERs
- Small utility opt-out



APPENDIX

Organization of MISO States

Comparison to Past Surveys

Customer Class	2018	2019	2020	2021 (NM)	2021 (RM)	2021 Total	2022 (NM)	2022 (RM)	2022 Total
Residential MW	456	411	528	719	434	1,154	992	815	1,807
Non-Res MW	2,124	3,387	3,845	2,675	4,015	6,090	3,064	6,630	9,694
Total MW	2,581	3,797	4,373	3,394	4,449	7,243	4,056	7,445	11,500

All Data

DER Type	Installations			Capacity (MW)		
	Residential	Non-Res	Total	Residential	Non-Res	Total
Solar PV	87,300	15,042	102,342	730	2,674	3,404
Wind	1,003	463	1,466	18	109	127
Solar PV + Storage	3,309	98	3,407	27	30	57
Wind + Storage	1	-	1	0	-	0
Electric Vehicle	3,677	3,137	6,814	0	4	4
Microturbine	-	4	4	-	9	9
Fuel Cell CHP	-	2	2	-	21	21
Fuel Cell Electric	-	1	1	-	0	0
Internal Combustion	-	393	393	-	842	842
Hydro	3	88	91	0	152	152
Gas Turbine	-	46	46	-	278	278
Battery Storage	40	16	56	1	19	20
Demand Response	775,371	316,515	1,091,886	1,030	4,389	5,419
Biodigesters	-	88	88	-	138	138
Other	17	77	94	0	1,030	1,030
Totals	870,721	335,970	1,206,691	1,807	9,694	11,500

Non-MISO Registered DER Data

DER Type	Installations			Capacity (MW)		
	Residential	Non-Res	Total	Residential	Non-Res	Total
Solar PV	86,974	13,993	100,967	716	1,260	1,976
Wind	1,003	451	1,454	18	59	78
Solar PV + Storage	3,309	98	3,407	27	30	57
Wind + Storage	1	-	1	0	-	0
Electric Vehicle	3,677	3,137	6,814	0	4	4
Microturbine	-	4	4	-	9	9
Fuel Cell CHP	-	2	2	-	21	21
Fuel Cell Electric	-	-	-	-	-	-
Internal Combustion	-	305	305	-	442	442
Hydro	3	56	59	0	99	99
Gas Turbine	-	36	36	-	170	170
Battery Storage	40	16	56	1	19	20
Demand Response	140,695	1,809	142,504	229	123	353
Biodigesters	-	81	81	-	106	106
Other	17	47	64	0	723	723
Totals	235,719	20,035	255,754	992	3,064	4,056

MISO Registered DER Data

DER Type	Installations			Capacity (MW)		
	Residential	Non-Res	Total	Residential	Non-Res	Total
Solar PV	326	1,049	1,375	14	1,413	1,428
Wind	-	12	12	-	50	50
Solar PV + Storage	-	-	-	-	-	-
Wind + Storage	-	-	-	-	-	-
Electric Vehicle	-	-	-	-	-	-
Microturbine	-	-	-	-	-	-
Fuel Cell CHP	-	-	-	-	-	-
Fuel Cell Electric	-	1	1	-	0	0
Internal Combustion	-	88	88	-	400	400
Hydro	-	32	32	-	53	53
Gas Turbine	-	10	10	-	108	108
Battery Storage	-	-	-	-	-	-
Demand Response	634,676	314,706	949,382	801	4,265	5,066
Biodigesters	-	7	7	-	33	33
Other	-	30	30	-	307	307
Totals	635,002	315,935	950,937	815	6,630	7,445