DER Aggregation Descriptive Characteristics

Scope of Work Paper – The intent is to identify common information around heterogenous and homogeneous DER aggregations that may benefit from standardization and general information requirements

**DER aggregation descriptive characteristics that may benefit from standardization**

* Grid services under Order No. 2222
	+ FERC Order No. 2222, Paragraph 27: Aggregations of new and existing distributed energy resources can provide new cost-effective sources of energy and grid services and enhance competition in wholesale markets as new market participants
* Locational information
	+ 1. Geographic location
			1. Longitude and latitude (conditionally required i.e. offshore wind)
			2. Postal address
			3. Street name and number (conditionally required i.e. land-based facilities)
			4. City (conditionally required i.e. land-based facilities)
			5. State (required)
			6. County
			7. Country (required)
			8. Province (required)
			9. Apartment number
			10. Time zone
			11. PO Box numbers would not be allowed
		2. Grid specific location
			1. Manhole
			2. Utility pole
		3. Zonal information
			1. Load zone
			2. Reserve zone
			3. Dispatch zone
			4. Capacity zone
		4. Market nodal information (p-node)
			1. Hub p-node (aggregation)
			2. LMP node
		5. Electrical nodal information (e-node aka service points)
			1. Would this be the distribution provider’s description or a new description?
			2. Meter information
			3. Phase information
		6. LDC service area
			1. Operating area
			2. City
			3. Neighborhood
			4. Company
		7. Balancing Area
			1. Pseudo-ties
			2. Inter-area ties
			3. Intra-area ties
		8. Project location
			1. Construction site
			2. Land registry book and page number
		9. Price location
			1. LMP nodes/pricing nodes
			2. Distribution pricing node
		10. Service location
			1. Customer account
			2. Service delivery point
		11. Source location
			1. Substation
			2. Circuit
* Operational characteristics of resources comprising aggregation
	+ Nameplate capacity in megawatts of a DER
	+ Capacity of a DER aggregation (facility ratings – minimum or maximum capacity)
	+ Ramp rate/response time
	+ Maximum duration
	+ Minimum run time
	+ Fuel type
	+ Heat rate
	+ Known operational constraints (i.e. analogue to permitting restrictions, environmental restrictions, contractual limit on when individual DER in aggregation can be dispatched)
	+ Time delay to initiate response (start time)
	+ Dispatchable energy resource (yes/no)
	+ Ability/speed to reverse direction (supply vs. demand switching)
	+ Voltage control (yes/no; volt-r)
	+ Transient ability limits
	+ Frequency control
	+ Inertial control
	+ Feeder voltage
	+ Reactive support
	+ Sensitivity to ambient weather conditions
	+ Forecast weather data
	+ Actual weather data
	+ Distribution level data
	+ Interconnection data
	+ Total energy capacity/maximum state of charge (megawatt hours or kilowatt hours)
	+ Telemetry infrastructure to communicate operational characteristics
	+ Metering infrastructure (RMQ metering standards applicability – R. Berdahl)
	+ Efficiency rating
	+ Battery technology
	+ Battery performance over time
	+ Solar panel performance over time
	+ Manufacturer of DER
	+ Types of communication protocols supported
	+ Operating status
	+ Known/planned outages or maintenance
	+ Duration of outage or maintenance
	+ Start/end time of outage or maintenance
	+ Mobility flag
	+ Single phase/three-phase fault indicators
	+ Loss of line faults (transformer configuration)
	+ Weatherization applications
	+ Designated dispatch entity
	+ Joint ownership/JOU operations
	+ Nominal amperage/voltage
	+ (Review NERC materials to be provided by R. Berdahl for additional potential characteristics)
* Number of resources in the aggregation
* Types of resources in the aggregation

**Proposed Information Requirements for DER aggregation for potential inclusion in registry database**

The DER registry is a common repository of information regarding DER aggregators (contact information) and the physical and operational characteristics of individual DER aggregations and contains regulatory, contact, and operational information regarding DERs participating within FERC jurisdictional wholesale markets.

The DER registry could serve as a shared repository of DER information for use by ISOs/RTOs, RERRA (relevant energy retail regulatory authorities), load serving entities, distribution companies, DSOs.

A single registration process managed by the ISOs/RTOs could be used to populate the registry data may not be appropriate for some ISOs/RTOs

DER Aggregation-Level Information

* Name of DER aggregator
* Name of market participant representative (performs various market activities i.e. scheduling bids and offers, etc.)
* DER aggregation capacity (in MW)
* Maximum DER aggregation available energy (in MWh)
* Maximum DER aggregation consumption capability (in MWh)
* DER aggregation regulation capability (in MW) (similar to AGC concept)
* Is the DER aggregation homogenous (i.e. one technology type) or heterogenous (i.e. multiple technology types)?
* List of individual registered DERs in the DER aggregation
* Metering
	+ Who owns the metering equipment?
	+ Are the individual behind-the-meter DERs sub-metered?
	+ What are the technical metering specifications?
	+ What information is it collecting and over what time intervals?Who is responsible for reading and telemetering the data?
* Telemetry
	+ Who is responsible for telemetry?
	+ What are the technical telemetry requirements that must be satisfied?

Individual DER-Level Information

* Requirements applicable to every DER in an aggregation
* Name of DER owner
* Geographic location
* Electrical location
* Interconnection information
* Possible operating modes—*e.g.*, peak shaving, emergency power, etc.
* Intended use—*e.g.*, wholesale market, retail market, net metering, demand response, etc.
* Is the DER dispatchable?
* Is the DER autonomous?
* Inverter(s)
	+ - [Note: Should inverter information vary based on resource technology—*e.g.*, solar, wind, storage?]
	+ Metering
		- [Note: Should metering information vary based on resource technology—*e.g.*, solar, wind, storage, DR?]
	+ Telemetry
		- [Note: Should information vary based on resource technology—*e.g.*, solar, wind, storage, DR?]
* Requirements specific to solar DERs
* Solar array information
	+ - Number/capacity of PV cells
		- Azimuth
		- Autotracking capability
		- Obstructions
		- Manufacturer name
		- Model/model number
* Requirements specific to wind DERs
* Turbine information
	+ - Number/capacity of turbines
		- Manufacturer name
		- Model/model number
* Requirements specific to storage DERs
* Storage asset(s)
	+ - Two values: 1) MWh capacity; 2) MW rate of charge/discharge
		- ~~Singular value: inclusion of just MWh capacity to avoid redundancy with more general DER aggregation capacity listed above~~
		- [Note: should we include here all of the requirements from Order No. 841 storage resources?]
* Name of Asset Owner
* Name of Scheduling Coordinator
* Name of Energy Manager
* Nameplate Capacity (in MW)
* Available Energy and Available Storage (in MWh)
* State of Charge
* Maximum State of Charge
* Minimum State of Charge
* Maximum Charge Limit
* Maximum Discharge Limit
* Maximum Charge Rate
* Maximum Discharge Rate
* Minimum Charge Time
* Maximum Charge Time
* Minimum Run Time
* Maximum Run Time
* Discharge Ramp Rate
* Charge Ramp Rate
* Minimum Discharge Limit
* Minimum Charge Limit
* State of Charge Management
* Entity responsible for State of Charge Management
* Maximum Daily Energy Limit
* Maximum Daily Consumption Limit
* Interconnection Rights/Limits
* Megawatt amount of interconnection capacity.
* Nature of rights/limitations—*e.g.*, does the interconnection service render the resource’s output sufficiently deliverable to sell into the capacity market?
* Transmission Charges
* Is the resource subject to them?
* If so, under what conditions and/or dispatch intervals?
* Retail Sales
* Is the resource making retail sales in addition to wholesale sales?
* If so, during which dispatch and settlement intervals?
* Metering
* Who owns the metering equipment?
* What are the technical metering specifications?
* What information is it collecting and over what time intervals?
* Who is responsible for reading and telemetering the data?
* For what purposes is the meter data used: just for RTO/ISO purposes, or also to coordinate operation of the storage asset with a solar or wind resource co-located with the storage asset?
* Telemetry
* Who is responsible for telemetry?
* To whom is the data provided: RTO/ISO, energy manager, scheduling coordinator, asset owner, or a combination of such entities?
* What are the technical telemetry requirements that must be satisfied?
* Requirements specific to Demand Response DERs
* Demand reduction capability
* Dispatchable (yes/no)
* Applicability of net benefits test
* Address1
* Address2
* City
* State/Province
* Zip/Postal Code
* Country
* GPS Coordinates
* Weather Station
* Time Zone Name
* Zone ID
* Zone
* Zone Type
* Electrical Node ID
* Electrical Node Name
* Electrical Node Type
* PNode
* PNode ID
* Competitive Choice Area
* Asset Multiplier
* NERC Balancing Authority Area
* Connection Type
* Connection Address
* Location Comments
* Contact Type
* Contact Priority
* DUNS Number
* Third Party
* Title
* First Name
* Last Name
* Middle Name
* Contact Method
* Contact Address Data
* Contact Method Priority
* Contact Comments
* Loss Factor Type
* Loss Factor Value
* Connect Voltage
* Grid Connection Comments
* Service Provider ID
* Service Provider Name
* Demand Response Provider
* Demand Response Controlling Entity
* Transmission / Distribution Service Provider ID
* Transmission / Distribution Service Provider Name
* Transmission / Distribution Service Provider Account Number
* Load Serving Entity ID
* Load Serving Entity Name
* Retail Rate ID
* Retail Rate Code
* Retail Rate Name
* Retail Rate Description
* Retail Rate
* Meter Installation Provider ID
* Meter Installation Provider Name
* Meter Authority ID
* Meter Authority Name
* Scheduling Entity ID
* Scheduling Entity Name
* Designated Dispatch Entity ID
* Designated Dispatch Entity Name
* Asset Operator ID
* Asset Operator Name
* Asset Owner ID
* Asset Owner Name
* External Entity Comments
* Meter Configuration
* Parent Meter ID
* Meter ID
* Meter Type
* Meter Manufacturer
* Meter Installation Date
* PT Ratio
* Meter Installer License
* Meter Correction Factors
* Meter Test Criteria
* Meter Test Frequency
* Meter Device QA Plan
* Date of Last Meter Test
* Meter Qualification Date
* Meter Test Results
* VEE Compliance
* Measurement Interval
* ANSI Compliance
* Meter Owner
* Meter Asset Comments
* Meter Model
* Meter Rating
* Meter Multiplier (kH)
* Meter Accuracy Class
* Meter Loss Compensation
* Maximum Error
* Meter Phase
* CT Ratio
* Distributed Generator Type
* Nameplate Rating
* Distributed Generator Fuel Type
* Distributed Generator Permit Type
* Distributed Generator Manufacturer
* Manufactured Date of Distributed Generator
* Installation Date of Distributed Generator
* In-Service Date
* Normal Load Rating
* Distributed Generator Name
* Interconnection Agreement Type
* Interconnection Limits
* Capable of Synchronizing to Grid
* Normal Breaker Status
* Breaker Status During Event
* Wholesale Delivery Point Status
* Private Use Network
* UFR Settings
* Load Resource Control Device
* Device class
* Asset manufacturer
* Asset Model
* Asset Version
* Asset Manufacture Date
* Asset Type
* Distributed Generator Comments
* Program ID
* Program Name
* Market
* Market Product
* Effective Enrollment Date
* Enrollment Status
* Resource Type
* Resource Qualification Test Date
* Enrollment End Date
* Requalification Test Date
* Lead Time
* Day Ahead Flag
* Real Time Flag
* Self-Schedule Flag
* Response Time
* Response Method Type
* Response Method ID
* Response Method Name
* Response Method Value
* Verified Capability
* Verified Capability Factor
* Performance Evaluation Method Type Code
* Performance Evaluation Method
* Market Enrollment Comments
* Requirements specific to Energy Efficiency DERs
	+ The approach is intended for measures where either performance factors (such as lighting wattage) or operational factors (such as operating hours) can be measured on a spot or short-term basis during baseline establishment and post-installation periods, or for measures for which a measured proxy variable, in combination with well-established algorithms and/or stipulated factors, can provide an accurate estimate of the Demand Reduction Value.
	+ The evaluation of whole-building or facility level metered data may be completed using techniques ranging from billing comparisons to multivariate regression analysis.
	+ Operational simulations can be used for industrial processes that take into account the specifics of the process addressed by the energy efficiency actions.
	+ Characterizing baseline and post-installation conditions may involve metering performance and operating factors both before and after the retrofit. Long-term whole-building energy use data may be used to calibrate the simulations.
	+ ALTERNATIVE ACCEPTABLE M&V METHODOLOGIES
	+ ENERGY EFFICIENCY VALUE CALCULATION VARIABLES
	+ MEASUREMENT AND MONITORING PARAMETERS AND VARIABLES REQUIREMENTS
		- heating ventilating and air conditioning (HVAC) equipment, HVAC controls, building envelopes, interior/exterior lighting, major electric consuming equipment and weather sensitive loads
	+ MONITORING FREQUENCY AND DURATION
	+ The EERP shall classify all data that have passed validation and used in the Demand Reduction Value calculations as (i) actual data, (ii) estimated data or (iii) missing data. The data classification shall be stored along with the data values in the data retention and management system prescribed by the System Operator.
* Requirements specific to microgrids
	+ Peak load
	+ TBD – need subject matter expertise

Use Case Data Usage Description

Registration for the resource from the ISO/RTO perspective

* Locational information
	+ 1. Geographic location
			1. Longitude and latitude (conditionally required i.e. offshore wind)
			2. ~~Postal address~~
			3. Street name and number (conditionally required i.e. land-based facilities)
			4. City (conditionally required i.e. land-based facilities)
			5. State (required)
			6. County
			7. Country (required)
			8. Province (required)
			9. Apartment number
			10. ~~Time zone~~
			11. ~~PO Box numbers would not be allowed~~
		2. ~~Grid specific location~~
			1. ~~Manhole~~
			2. ~~Utility pole~~
		3. Zonal information
			1. Load zone
			2. ~~Reserve zone~~
			3. ~~Dispatch zone~~
			4. ~~Capacity zone~~
		4. Market nodal information (p-node)
			1. ~~Hub p-node (aggregation)~~
			2. ~~LMP node~~
		5. Electrical nodal information (e-node aka service points)
			1. Would this be the distribution provider’s description or a new description?
			2. Meter information
			3. Phase information
			4. Substation
			5. Circuit
			6. further details needed from SME
		6. Distribution Utility and/or Energy Authority (distribution provider)
			1. ~~Operating area~~
			2. ~~City~~
			3. ~~Neighborhood~~
		7. Balancing Area (need SME input, concerned about double counting)
			1. Pseudo-ties
			2. Inter-area ties
			3. Intra-area ties
		8. ~~Project location~~
			1. ~~Construction site~~
			2. ~~Land registry book and page number~~
		9. ~~Price location~~
			1. ~~LMP nodes/pricing nodes~~
			2. ~~Distribution pricing node~~
		10. Service location
			1. Customer account
			2. Service delivery point
		11. ~~Source location~~
			1. ~~Substation~~
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* Operational characteristics of resources comprising aggregation
	+ Nameplate capacity in megawatts of a DER (could be fractional for kWh)
	+ ~~Capacity of a DER aggregation (facility ratings – minimum or maximum capacity)~~
	+ Ramp rate
	+ Response time
	+ Maximum run time
	+ Minimum run time
	+ DER type
	+ Heat rate – need more input, possibly market monitoring
	+ ~~Known operational constraints (i.e. analogue to permitting restrictions, environmental restrictions, contractual limit on when individual DER in aggregation can be dispatched)~~
	+ ~~Time delay to initiate response (start time)~~
	+ Dispatchable energy resource (yes/no)
	+ Ability to reverse direction (supply vs. demand switching)
	+ Voltage control (yes/no; volt-r) – see NERC guidance
	+ Transient ability limits – need SME input
	+ Frequency control – see NERC guidance
	+ Inertial control – need SME input
	+ Feeder voltage – need SME input
	+ Reactive support – need SME input
	+ ~~Sensitivity to ambient weather conditions~~
	+ ~~Forecast weather data~~
	+ ~~Actual weather data~~
	+ ~~Distribution level data~~
	+ ~~Interconnection data~~
	+ Total energy capacity/maximum state of charge (megawatt hours or kilowatt hours)
	+ Telemetry infrastructure to communicate operational characteristics
	+ Metering infrastructure (RMQ metering standards applicability – R. Berdahl)
	+ Efficiency rating
	+ Battery technology
	+ Battery performance over time
	+ Solar panel performance over time
	+ Manufacturer of DER
	+ Types of communication protocols supported
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	+ Known/planned outages or maintenance
	+ Duration of outage or maintenance
	+ Start/end time of outage or maintenance
	+ Mobility flag
	+ Single phase/three-phase fault indicators
	+ Loss of line faults (transformer configuration)
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